Nonroad Evaporative Emission Rates

United States
Environmental Protection
Agency

Nonroad Evaporative Emission Rates

NR-012d

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

United States
Environmental Protection
Agency

EPA-420-R-10-021
NR-012d
July 2010

Nonroad Evaporative Emission Rates

Report No. NR-012d

July 2010

Assessment and Standards Division
EPA, Office of Transportation and Air Quality

Purpose

This report documents the basic evaporative emission assumptions and calculations used in EPA's final NONROAD2008a emissions model. The types of evaporative emissions covered in this report include diurnal, tank permeation, hose permeation, hot soak, and running losses. Separate reports address displacement and spillage from refueling (NR-013b) and crankcase emissions (NR-010f). Relative to the December 2005 version of this report, this version has been updated to incorporate the standards in the 2008 final rulemaking affecting small nonroad SI engines and equipment, as well as marine SI engines and vessels. [1] It also describes updates to some of the pre-control emission rates, as well as the new ability of NONROAD2008a to specifically model the effects of ethanol blends on fuel tank and hose permeation losses.

Introduction

Evaporative emissions refer to hydrocarbons released into the atmosphere when gasoline, or other volatile fuels, evaporate from equipment. The types of evaporative emissions are defined below, along with a discussion of the changes since the draft NONROAD2004 model:

- <u>diurnal</u>: These emissions are due to temperature changes throughout the day. As the day gets warmer, the fuel in the tank heats up and begins to evaporate. Diurnal emissions were included in draft NONROAD2004, but the methodology has been updated for final NONROAD2005. In addition, final NONROAD2005 includes diffusion losses (vapor exiting an orifice regardless of changes in temperature) as part of diurnal emissions. NONROAD2008a incorporates diurnal controls for marine SI engines, places limits on diffusion losses for small SI engines, and no longer models diffusion losses for handheld engines.

- <u>permeation</u>: These emissions are due to fuel that works its way through the material used in the fuel system. The outer surfaces of these materials are exposed to ambient air, so the gasoline molecules permeate through these fuel-system components and are emitted directly into the air. Permeation is most common through plastic fuel tanks and rubber hoses. Fuel and tank permeation were not included in draft NONROAD2004, but have been developed for final NONROAD2005 in conjunction with rulemaking development for spark-ignition (SI) engines. NONROAD2008a incorporates hose and fuel permeation controls for small SI and marine SI engines, updates some pre-control emission factors for hose permeation, and includes updated hose lengths for outboard boats.

- hot soak: These emissions are due to residual heat from the equipment just after the engine is shut off. There were placeholders for this emission type in draft NONROAD2004, which were set to null (zero) values. Final NONROAD2005 has estimates for hot soak emissions. There have been no changes for NONROAD2008a.

- running loss: These emissions are similar to diurnal except the heating is caused by engine operation. Like hot soak, there were placeholders for this emission type in draft NONROAD2004, which were set to null (zero) values. Final NONROAD2005 has estimates for running loss emissions, including controls for large SI engines. NONROAD2008a includes running loss controls for small SI nonhandheld equipment.

- displacement: These emissions are the vapors displaced from the fuel tank when the tank is refueled. These emissions are included in both draft NONROAD2004 and all subsequent versions, including NONROAD2008a. They are discussed in another technical report (NR-013b).

- spillage: This refers to fuel spilled during refueling events. Like displacement, these emissions are included in both draft NONROAD2004 and all subsequent versions, including NONROAD2008a. They are discussed in another technical report (NR-013b).

- crankcase: These are vapors released from the crankcase of an engine. These emissions are included in both draft NONROAD2004 and all subsequent versions, including NONROAD2008a. They are discussed in another technical report (NR-010f).

- resting loss: Resting losses occur when the equipment is not being used. The ambient temperature is either stable or declining during a resting loss event. These losses are mainly due to permeation and diffusion emissions. There were placeholders for this emission type in draft NONROAD2004, which were set to null (zero) values. Final NONROAD2005 and NONROAD2008a do not have a separate entry for resting loss emissions, since they are already included as part of the permeation and diurnal emissions.

Equipment fueled with compressed natural gas (CNG), liquified petroleum gas (LPG), and diesel fuel are assumed to have no significant evaporative emissions. As a result, all evaporative emissions calculated by the model are from gasoline-fueled equipment.

Evaporative Emission Standards

In addition to estimating emissions from uncontrolled engines, the NONROAD model is designed to account for the effect of federal emissions standards. NONROAD will not cover California emission standards or proposed federal standards that are not yet final. NONROAD2008a accounts for evaporative standards established under the following regulations:

- "Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based)." This rule establishes evaporative standards for large spark-ignition engines greater than 25 horsepower (hp) and recreational vehicles. Recreational vehicles include snowmobiles, all-terrain vehicles, and offroad motorcycles. [2]

- "Control of Emissions From Nonroad Spark-Ignition Engines and Equipment." This rule establishes evaporative standards for small spark-ignition engines less than or equal to 25 hp and marine SI engines. [1]

The emission standards with the affected model years for each category are summarized in Table 1.

Table 1. Nonroad SI Engine Evaporative Emission Standards[a]

Engine Category[b]			Model Years[c]	HC Emission Standards by Evap Type[d]				
				Diurnal	Tank Permeation	Hose Permeation	Hot Soak	Running Loss
Small SI	Nonhandheld	Class I	2009-2011			15g/m^2/day		
			2012+	[e]	1.5 g/m^2/day	15g/m^2/day		90% reduction
		Class II	2009-2010			15g/m^2/day		
			2011+	[e]	1.5 g/m^2/day	15g/m^2/day		80% reduction
	Handheld (Classes III, IV, & V)		2009-2011	[e]	1.5 g/m^2/day[f]			
			2012+	[e]	1.5 g/m^2/day[f]	15g/m^2/day[f]		
Marine SI	Personal Watercraft (PWC) and Portable Tanks		2009			15g/m^2/day		
			2010	0.4 g/gal/day		15g/m^2/day		
			2011+	0.4 g/gal/day	1.5 g/m^2/day	15g/m^2/day		
	Other Installed Tanks		2009-2010			15g/m^2/day		
			2011	0.4 g/gal/day		15g/m^2/day		
			2012+	0.4 g/gal/day	1.5 g/m^2/day	15g/m^2/day		
Large SI >25 hp			2004-2006				90% reduction	
			2007+	90% reduction			90% reduction	90% reduction
Recreational Vehicles			2008+		1.5 g/m^2/day	15g/m^2/day		

[a] The evaporative standards apply to gasoline-fueled equipment. Equipment fueled with compressed natural gas (CNG), liquefied petroleum gas (LPG), and diesel fuel are assumed to have no significant evaporative emissions.
[b] Recreational vehicles include snowmobiles, all-terrain vehicles, and offroad motorcycles. For the marine SI category, portable tanks are used by outboard engines ≤25hp. Other installed tanks are assigned to outboard engines >25hp and all inboard/sterndrive engines.
[c] In some instances, the standards are phased-in over time. The rulemakings should be consulted for details. The nonhandheld hose permeation standard begins in the 2009 model year (MY), but is modeled with a 95% phase-in beginning in 2008, based on manufacturers' use of low permeation hoses in that timeframe.
[d] Standards for the large SI gasoline category and running loss emission source are expressed as a percent reduction from uncontrolled engines. The permeation standards must be met at specified temperatures, using gasoline with 10 percent ethanol (E10).
[e] Although there are no diurnal emission control standards for small SI engines, control of diffusion emissions is modeled beginning with the 2012 MY for Class I and the 2011 MY for Class II nonhandheld engines. NONROAD2008a also assumes no diffusion emissions for handheld equipment.
[f] No permeation control is modeled for handheld equipment used in cold weather applications (i.e., chainsaws).

Evaporative technology types have been used beginning with NONROAD2005 to define unique sets of standards. These technology types are specified for each SCC, hp category, and model year. The evaporative technology types take the following form:

```
 12345678
E00000000
```

where:
E: Evap tech type
1: Diurnal
2: Tank permeation
3: Hose permeation
4: Hot soak
5: Displacement
6: Spillage
7: Running loss
8: Resting loss (not used)

and Value:
0: Base
1: Control Level 1
N: Control Level N

For example, the base case (pre-control) technology type is E00000000. For a model year containing the first tier of both diurnal and running loss controls, the corresponding technology type would be E10000010. There is only one tier of evaporative controls, so the control value is 1 for most technology types; however, it has been necessary to add technology types with control values of 2 and 3 in some cases as a way to account for standard phase-in schedules.

The resulting technology distributions by SCC, hp category, and model year are provided in Appendix A, Table A1.

Diurnal Emissions

Methodology and Baseline Diurnal Estimates

For diurnal emission estimates, the Wade equations [3,4,5] are used to calculate grams of hydrocarbons emitted per day. The Wade equations are well established and are also used in the MOBILE model. The Wade equations are provided in Appendix B. These equations require the following inputs: percent tank fill, percent headspace, tank size, Reid Vapor Pressure (RVP) of the fuel, the minimum temperature (Tmin), and the maximum temperature (Tmax). The percent headspace assumed and hard coded in the model is 15 percent. The percent tank fill assumed and hard coded in the model is 50 percent. The tank sizes are provided in the spillage input file.

Documentation of the tank sizes used in the NONROAD model is provided in the technical report for refueling emissions. [6] RVP, Tmin, and Tmax are user inputs.

With this approach, diurnal emissions during the winter could be overestimated, especially using non-weathered fuel RVPs. To account for this, winter diurnal emissions are adjusted by including a minimum temperature of 40°F, below which diurnal emissions are set to zero. The model checks both Tmin and Tmax to see if either one is below 40°F. If both are below 40°F, then diurnal emissions are zero. If just Tmin is below 40°F, but Tmax is above 40°F, Tmin is adjusted to 40°F. For example, if Tmin is 20°F and Tmax is 50°F, the model calculates diurnal emissions for just the 40°F to 50°F range.

For on-highway applications, a correction of 0.78 is applied based on a comparison of automotive test results to the theoretical Wade equations. Based on nonroad data, this correction appears to be appropriate for nonroad applications as well. Appendix C provides a comparison of nonroad test data to the theoretical Wade equations. As a result, a correction of 0.78 is applied for all gasoline equipment. This correction factor is hard coded in the model.

We also account for diffusion losses in the baseline diurnal emissions for tanks that have open vents directly to the atmosphere. Diffusion refers to the rate at which hydrocarbon molecules flow out of a small orifice in the fuel tank due to molecular motion in the fuel tank. This rate is equivalent to the rate at which the hydrocarbon molecules would collide with a wall area equal to the size of the hole and will occur at constant, or even decreasing, temperatures.

For fuel tanks that have a sealed system with pressure relief (i.e., personal water craft) we would not expect to see diffusion losses. In addition, data presented in Appendix C show that, when the fuel tank is vented through a long hose, diffusion is minimal. This is probably due to additional molecular collisions created by the hose. For this reason, we do not model diffusion losses for systems that have a long vent hose (i.e., installed marine fuel tanks). We also do not model diffusion losses for recreational equipment. Finally, we believe that handheld equipment are all produced with either sealed fuel tanks or slosh/spill resistant fuel caps. Therefore, for NONROAD2008a, we do not include diffusion emissions for handheld equipment.

We model diffusion losses for large SI equipment, small SI nonhandheld equipment, and portable marine fuel tanks which have open orifices that vent directly to the atmosphere. For marine equipment, outboards less than or equal to 25 hp are considered to have portable fuel tanks in NONROAD2008a. In these applications, the vents are typically in the fuel cap. To model these losses, we draw on diurnal emissions data for a fuel tank with and without a vent line. Based on these data, we see about 40-50% higher emissions over a diurnal test for a tank with a small vent directly to the atmosphere than for a tank that is vented through a hose. In our modeling, we use a correction factor of 1.46. The data and derivation of this correction factor is provided in Appendix C. This correction factor or multiplier is contained in the evdiu.emf input file.

Additional diurnal adjustments are applied for recreational marine equipment. These include: 1) temperature swing adjustments, 2) a 50 percent baseline reduction for boats with portable plastic tanks, and 3) a 70 percent baseline reduction for personal watercraft to account for the presence of 1 psi pressure relief valves. Each adjustment is discussed below.

For recreational marine equipment, fuel temperature swings are generally not as large as the associated ambient temperature swings. This is especially true for boats stored in the water. Recreational marine equipment can be classified as boats with installed plastic or metal tanks which are stored on trailers, boats with installed plastic or metal tanks which are stored in the water, and boats with portable plastic tanks. For boats with installed plastic or metal tanks which are stored on trailers, the diurnal temperature swing is reduced by 50 percent, resulting in revised Tmin and Tmax values that are then used to calculate diurnal emissions. For boats with installed plastic or metal tanks that are stored in the water, the diurnal temperature swing is reduced by 80 percent. For boats with portable plastic tanks, we treat portable tanks as exposed to ambient air; as a result, there is no temperature swing adjustment. The data used to derive these estimates are presented in Appendix C. These temperature swing adjustments are hard coded within the model. The fractions of equipment falling into each category by SCC and hp are provided in the spillage.emf input file. We treat the smallest installed tanks as being on trailer boats and the largest tanks as being on boats stored in the water. For sizes in between, we use a linear interpolation of the fraction of boats stored in the water. Based on this analysis, 5 percent of personal watercraft and 35 percent of boats with installed fuel tanks are stored in the water.

An example of how the model calculates revised Tmin and Tmax values to account for a reduced temperature swing is provided here for illustration. Example: For Tmin =60°F and Tmax = 84°F, calculate revised values given a 50 percent temperature swing reduction.

1) Temperature swing = (84°F-60°F) = 24°F
2) New temperature swing with 50% reduction = 0.5x24°F = 12°F
3) Average diurnal temperature = (84°F+60°F)/2 = 72°F
4) The new temperature swing is applied to the average diurnal temperature to calculate revised Tmin and Tmax values.

Revised Tmin = 72°F-6°F = 66°F; Revised Tmax = 72°F+6°F = 78°F

Most, if not all, recreational marine portable fuel tanks have valves that the user can close when the boat is not in use. For the purpose of modeling, we estimate these valves are closed half the time based on the assumption that user behavior is highly variable. Therefore, for outboards ≤ 25hp, which have portable fuel tanks, an additional diurnal adjustment of 0.50 is applied. This correction factor or multiplier is contained in the evdiu.emf input file.

Personal watercraft (PWC) have sealed systems with pressure relief valves that range from 0.5 to 4.0 psi. These tanks are modeled as having a 1 psi pressure relief valve, and only emit vapor when the pressure calculated by the Wade equations exceeds 1 psi. To account for this, a simplified additional diurnal adjustment of 0.30 is applied for PWC, which is based on a comparison of estimated annual diurnal emissions with and without the relief valves, using regional daily RVP values. The data used as the basis for this estimate is provided in Appendix C. This correction factor or multiplier is also contained in the evdiu.emf input file. The use of a single correction factor is a limitation, in that seasonal changes in temperature and fuel RVP are not reflected. On an annual basis, however, the difference should be minimal.

Installed fuel tanks are vented to the atmosphere through a hose running from the tank to the outside of the hull. In NONROAD, installed fuel tanks are considered to be used in outboards > 25 hp and all inboard engines. No additional baseline diurnal adjustments beyond those discussed above are applied for installed fuel tanks.

Deterioration factors for diurnal emissions are contained in the evdiu.det input file. There is no deterioration applied to diurnal emissions in NONROAD2005, so the deterioration factor is 1.

Diurnal Controls

Diurnal control (i.e., 90% reduction) is applied for large SI gasoline equipment, beginning in the 2007 model year (MY). Controlled large SI gasoline equipment will be primarily pressurized to 3.5 psi. Therefore, the diffusion should be zero and diurnal emissions minimal. To model diurnal control, a diurnal adjustment (multiplier) of 0.10 is applied for these equipment.

Although there are no diurnal emission requirements for small nonroad SI equipment, a limit was placed on diffusion emissions, beginning with the 2012 MY for Class I and the 2011 MY for Class II nonhandheld engines. This reduces the diurnal multiplier from 1.46 to 1.0 for these engines. Note that we do not include diffusion emissions for handheld equipment (i.e., the multiplier is 1.0 for all years).

For marine SI engines, we model portable fuel tanks as having 90 percent lower diurnal emissions than an open vent system to account for use of automatic seals beginning with the 2010 MY. Also, we set the diffusion multiplier to 1.0 because the tanks would be sealed. Presumably, the diurnal temperature cycles would build some pressure in the fuel tank causing hydrocarbons to be released when the tank is opened. Therefore, we do not model these tanks as having zero diurnal emissions. For PWC, we use the baseline scenario of sealed systems with a 1.0 psi pressure relief valve. For installed fuel tanks, we model a 60 percent reduction starting in the 2011 MY to account for the use of carbon canisters in the fuel line with passive purge. [7] As in the baseline, no diffusion is modeled for PWC and installed fuel tanks.

These control adjustments, along with the baseline adjustments described above for diffusion losses, recreational marine equipment with portable fuel tanks, and PWC, are applied via the evdiu.emf emission factor input file. The evdiu.emf emission factor input file is provided in Appendix A, Table A2. The portion of the spillage file which contains the tank capacities is provided in Appendix A, Table A3.

The only fuel correction factor for diurnal emissions in the NONROAD model is for RVP. The effect of ethanol fuels on diurnal breathing loss emissions must be estimated with the RVP input. In areas with no RVP waiver, no adjustment is required to the RVP inputs. In areas where ethanol receives a 1 psi waiver, areas must estimate the fraction of market fraction of ethanol use, and input a weighted average RVP. For example, in an area with a 1 psi waiver where the market fraction of ethanol is 25% and the RVP of the base gasoline without ethanol is 7.8 RVP, the inputted weighted average RVP should be 0.25* (7.8+1) + 0.75 * (7.8) = 8.05. There is no additional RVP adjustment in the model for commingling or fuel weathering effects.

Diurnal Sample Calculation

A sample calculation is provided for recreational marine inboard engines. Calendar year 2011 is chosen, which is also the first model year for which diurnal controls apply for this category. To account for the mix of pre-control and control engines in 2011, diurnal calculations are performed separately for the pre-2011 MY and the 2011 MY engines present in the 2011 calendar year. These are then summed to obtain total diurnal emissions for 2011.

User Inputs:
SCC: 22820100055 (4-stroke inboard rec marine)
MaxHP: 175
RVP: 8 psi
Tmin: 60°F
Tmax: 84°F
Calendar year: 2011

Model Inputs:
Percent tank fill: 50% (spillage.emf)
Tank size: 49.92495 gal (spillage.emf)
Portable plastic fraction: 0.000 (spillage.emf)
Installed plastic trailer fraction: 0.469 (spillage.emf)
Installed plastic water fraction: 0.201 (spillage.emf)
Installed metal trailer fraction: 0.231 (spillage.emf)
Installed metal water fraction: 0.099 (spillage.emf)
DF: 1 (evdiu.det)
Wade equation multipliers: 1.0 for pre-2011 MY engines; 0.4 for 2011 MY engines (evdiu.emf)
Engine population: 308,139 pre-2011 MY engines; 17,391 2011 MY engines (from by-model-year output file)

Calculations:

1) The diurnal temperature swing is reduced by 50% for the fraction of tanks installed in vessels stored out of the water. The diurnal temperature swing is reduced by 80% for installed tanks in vessels stored in the water. Calculate new Tmin and Tmax values for 50% and 80% temperature swing reductions.

   Diurnal avg T = (60°F +84°F)/2 = 72°F

Temperature swing = (84°F -60°F) = 24°F

New temperature swing with 50% reduction = 0.5*24°F =12°F
New Tmin = 72°F -6°F = 66°F; New Tmax = 72°F +6°F = 78°F

New temperature swing with 80% reduction = 0.2*24°F =4.8°F
New Tmin = 72°F -2.4°F = 69.6°F; New Tmax = 72°F +2.4°F = 74.4°F

2) Using the Wade equations in Appendix B, along with the new Tmin and Tmax from 1),
   Diurnal EF with 50% temp swing reduction = 19.645 g/day
   Diurnal EF with 80% temp swing reduction = 7.731 g/day

3) Apply 0.78 correction factor and appropriate Wade equation multiplier.
   Pre-2011 MY engines:
   Adjusted diurnal EF with 50% temp swing reduction = 19.645*0.78*1.0 = 15.323 g/day
   Adjusted diurnal EF with 80% temp swing reduction = 7.731*0.78 *1.0 = 6.030 g/day
   2011 MY engines:
   Adjusted diurnal EF with 50% temp swing reduction = 19.645*0.78*0.4 = 6.129 g/day
   Adjusted diurnal EF with 80% temp swing reduction = 7.731*0.78 *0.4 = 2.412 g/day

4) Calculate weighted diurnal g/day emissions
   Pre-2011: (0.469*15.323)+(0.201*6.030)+(0.231*15.323)+(0.099*6.030) = 12.535 g/day
   2011 MY: (0.469*6.129)+(0.201*2.412)+(0.231*6.129)+(0.099*2.412) = 5.014 g/day

5) Calculate tons/day
   Pre-2011 MY: (12.535 g/day)*(308,139)*(1b/453.6g)*(ton/2000 lb) = 4.258 tons/day
   2011 MY: (5.014 g/day)*(17,391)*(1b/453.6g)*(ton/2000 lb) = 0.096 tons/day
   Total: 4.258 tons/day + 0.096 tons/day = 4.354 tons/day

6) Calculate tons/year
   2011 is not a leap year, so it has 365 days.
   Total: 4.354 tons/day * 365 days/year = 1,589 tons/year

Tank Permeation

Fuel tank permeation is estimated with the following general equation:

Tank permeation (g/day) = tank permeation emission factor (g/m^2/day)*fuel tank inside surface area (m^2)*TCF*(1-metal fraction)*DF

where:
TCF = temperature correction factor
DF = deterioration factor

The TCF is calculated using the average temperature for the scenario. Thus, the inputs needed to estimate tank permeation emissions are the tank permeation emission factor, the surface area of the fuel tank, the average ambient temperature, the tank metal fraction, and the deterioration factor.

Metal tanks are assumed to have zero permeation, so the metal fraction is not included in the calculation of emissions.

The model has the capability of including deterioration, but no deterioration is assumed for tank permeation (i.e., all DFs equal to 1.0). The DFs are contained in the evtank.det file.

The spillage.emf input file contains tank capacities in gallons. As a result, it was necessary to develop a relationship to convert tank capacity (gallons) to surface area (m^2) in order to apply the above equation. Both EPA and ARB measured the fuel tank surface areas of a number of different fuel tanks of various volumes from different applications. These data are provided in Appendix D. A hyperbolic expression was developed to fit through the volume and surface area data. This expression, which is hard coded in the model, is shown below:

surface area (m^2) = 0.15*SQRT((((gal+2)^2)/4)-1)

This equation is used with the fuel tank capacities in the spillage.emf file to estimate fuel tank surface area by equipment type.

Because permeation is very sensitive to temperature, we used Arrhenius' relationship [8] to adjust the emission factors by temperature, where the constants were determined by relating the equation to the known properties of materials used in fuel tanks and hoses. Generally, permeation roughly doubles with every 10°C increase in temperature for materials used in fuel systems, such as high density polyethylene (HDPE) and nitrile rubber.

The temperature adjustment is applied from the average temperature for the scenario. Since the emission factors are based on a temperature of 85°F, the temperature adjustment therefore reduces emissions by 50% with each 10°C reduction from 85°F. The temperature adjustment is calculated using the following equation:

Tank TCF = 3.788519E-2*exp(3.850818E-2*Tavg)

where Tavg = average temperature, °F

The equation is a curve fit to the equation: TCF = 0.5*exp((29.4°C - X°C)/10). The temperature adjustment is hard coded in the model.

NONROAD2008a also has the ability to model the effects of ethanol-gasoline blends on both tank and hose permeation emissions. To do this, emission factors using gasoline (E0) and a

10 percent ethanol blend (E10) are required. The ratios of E10 to E0 emission factors are input to equations that predict permeation emissions for ethanol volume percents specified by the user. These equations are hard coded in the model. A section describing this methodology in more detail, along with a sample calculation for an ethanol blend fuel, are provided following the hose permeation section.

The sections immediately below discuss the tank permeation emission factors (on gasoline and E10) and tank metal fractions used for each of the following nonroad categories: small SI, large SI, recreational marine, and recreational equipment. A sample calculation for gasoline is then presented. The evtank.emf emission factor input file is provided in Appendix A, Table A6. The metal fractions are in the spillage.emf file, provided in Appendix A, Table A3.

Small SI Tank Permeation

Fuel tank permeation rates were developed by CARB and EPA for a number of different uncontrolled tanks for both handheld and nonhandheld equipment. The data and results for gasoline are shown in Appendix E. The data for E10 can be found in documentation for the 2008 rulemaking. [7,9] Based on a review of the data, it is reasonable to break the tanks into three categories, HDPE tanks below 0.25 gallons, HDPE tanks above 0.25 gallons, and nylon handheld fuel tanks. The average baseline tank permeation emission factors are shown below:

Table 2. Small SI Tank Permeation Baseline Emission Factors at 29°C (g/m^2/day)

Tank Type	Gasoline (E0)	E10	E10/E0
Metal tanks	0	0	0
Nylon handheld fuel tanks*	1.25	2.5	2.0
Small SI HDPE <0.25 gallons	6.5	7.2	1.1
Small SI HDPE ≥0.25 gallons	9.7	10.7	1.1

* Nylon is used in equipment with structurally-integrated fuel tanks, which are primarily chainsaws. The nylon EFs are therefore assigned to chainsaws in the model.

In previous versions of NONROAD, nylon handheld fuel tanks were modeled by applying an adjustment to the HDPE emission factors to account for the nylon fraction of the tanks. These adjustments are no longer used in NONROAD2008a; instead, the nylon-specific emission factors in Table 2 are used.

There is a small SI tank permeation standard of 1.5 g/m^2/day. The implementation schedule is dependent on the engine subcategory. We believe that fuel tanks using alternative materials to meet the 1.5 g/m^2/day standard on 10 percent ethanol fuel will typically permeate at least 50 percent less when gasoline is used. Therefore, we model permeation from fuel tanks meeting the standard to be 0.75 g/gal/day at 29°C on gasoline. The exception is that no permeation control is modeled for chainsaws, since they are used in cold weather applications. The small SI control tank permeation emission factors used in the model are shown in Table 3.

Table 3. Small SI Tank Permeation Control Emission Factors at 29°C ($g/m^2/day$)

Tank Type	Gasoline (E0)	E10	E10/E0
Metal tanks	0	0	0
Nylon handheld fuel tanks (chainsaws)	1.25	2.5	2.0
Small SI HDPE <0.25 gallons	0.75	1.5	2.0
Small SI HDPE ≥0.25 gallons	0.75	1.5	2.0

The resulting gasoline baseline and control emission factors are contained in the evtank input file. The E10/E0 adjustment factors for the baseline emission factors are contained in the spillage.emf file and provided in Appendix A, Table A5. The E10/E0 adjustment factor of 2.0 for the control emission factors is hard coded in the model.

The tank metal fractions are based on sales data and conversations with manufacturers. Metal fractions are 0.2 for Class 1, 0.1 for Class 2, and 0.0 for Classes 3-5. Class 1 are nonhandheld engines <225cc, which corresponds to 3-6hp. Class 2 are nonhandheld engines >=225cc, which corresponds to 6-25hp. Class 3 are handheld engines <20cc, which corresponds to 0-1hp. The descriptions of Classes 4 and 5 are provided above. The tank metal fractions are contained in the spillage.emf file.

Large SI Tank Permeation

Most of the large SI engines run on LPG and have metal tanks. For the remaining gasoline-fueled engines, the majority of these also have metal tanks. There are a few examples of applications with plastic tanks (e.g., concrete saws, utility vehicles), but these represent a small fraction of the total. For modeling purposes, all large SI equipment are assumed to have metal tanks, so there are no tank permeation emissions from large SI gasoline equipment in NONROAD2008a.

Recreational Marine Tank Permeation

Fuel tanks may be constructed in several ways. Portable fuel tanks and some small, higher production-volume, installed tanks are generally blow-molded using high-density polyethylene (HDPE). Installed plastic marine fuel tanks are often produced in many shapes and sizes to fit the needs of specific boat designs. These fuel tanks are generally rotationally-molded out of cross-link polyethylene.

Separate baseline emission factors were developed for HDPE and cross-link tanks used in recreational marine vessels. These emission factors are provided in Table 4 below. The data and derivation of the E0 emission factors is provided in Appendix E. The data for E10 can be found in documentation for the 2008 rulemaking. [7,9]

Table 4. Recreational Marine Tank Permeation Baseline Emission Factors at 29°C (g/m^2/day)

Tank Type	Gasoline (E0)	E10	E10/E0
Metal tanks	0	0	0
HDPE plastic tanks	9.9	10.9	1.1
Cross-link plastic tanks	8.0	8.8	1.1

These emission factors were then assigned to each SCC and hp category. Outboard engines <=25hp, PWC, and inboard/sterndrive engines <=16hp were assigned the HDPE emission factor. Outboard engines >25hp and inboard/sterndrive engines >16hp were assigned the crosslink emission factor.

A standard of 1.5 g/m^2/day is applied, beginning in the 2011 model year for PWC and outboard engines ≤25 hp and the 2012 model year for outboard engines >25 hp and all inboard/sterndrive engines. Similarly to small SI, we model permeation from fuel tanks subject to control to be 0.75 g/gal/day at 29°C on gasoline. The recreational marine control tank permeation emission factors used in the model are shown in Table 5.

Table 5. Recreational Marine Tank Permeation Control Emission Factors at 29°C (g/m^2/day)

Tank Type	Gasoline (E0)	E10	E10/E0
Metal tanks	0	0	0
HDPE plastic tanks	0.75	1.5	2.0
Cross-link plastic tanks	0.75	1.5	2.0

The resulting gasoline baseline and control emission factors are contained in the evtank input file. The E10/E0 adjustment factors for the baseline emission factors are contained in the spillage.emf file. The E10/E0 adjustment factor of 2.0 for the control emission factors is hard coded in the model.

The metal fraction is zero for outboards <=25hp and all PWC. The metal fraction for outboards >25hp and all inboard/sterndrive engines is 0.33.

Recreational Equipment Tank Permeation

A baseline emission factor of 9.7 g/m^2/day is used for all recreational equipment. This is the same emission factor used for small SI equipment with tanks equal or greater than 0.25 gallon. A standard of 1.5 g/m^2/day is applied, beginning in the 2008 model year. In NONROAD, a control emission factor of 0.75 g/m2/day is used for the 2008 and later model years. This is based on a 50 percent compliance margin to account for E10 fuel effects. The model does not yet account for any ethanol blend permeation effects for this category.

Recreational equipment are assumed to have no metal tanks (i.e., metal fraction = 0.0).

Tank Permeation Sample Calculation

A sample calculation is provided for small SI equipment operated on gasoline.

User Inputs: SCC: 2265006015 (4-stroke air compressors)
MaxHP: 6
Tavg: 75°F
Calendar year: 2005

Model Inputs: EF: 9.7 g/m^2/day at 85°F (evtank.emf)
Tank size: 1.1 gal (spillage.emf)
Tank metal fraction: 0.2 (spillage.emf)
DF: 1 (evtank.det)
Engine population in 2005: 65,329 (model output)

Calculations:

1) Calculate surface area (m^2).
Surface area = 0.15*SQRT((((1.1+2)^2)/4)-1) = 0.178 m^2

2) Calculate tons/day, without temperature adjustment
The metal fraction (0.20) would have no tank permeation emissions.
(9.7 g/m2/day)*(0.178 m^2)*(65,329)*(lb/453.6g)*(ton/2000 lb)*(1-0.2)*(1) = 0.10 tons/day

3) Calculate temperature adjustment (50% lower with each 10°C reduction from 85°F)
The temperature adjustment is applied from the average temperature for the scenario (75°F)
Tank TCF °F = 3.788519E-2*exp(3.850818E-2*75°F) = 0.68

4) Apply temperature adjustment
(0.10 tons/day)*(0.68) = 0.068 tons/day

5) Calculate tons/year
2005 is not a leap year, so it has 365 days.
Total: 0.068 tons/day * 365 days/year = 25 tons/year

Hose Permeation

Fuel hose includes all fuel and vapor lines. Fuel hose permeation is estimated with the following general equation:

Hose permeation (g/day) = hose permeation emission factor (g/m^2/day)*fuel hose surface area (m^2)*TCF*(1-metal fraction)*DF

where:
Fuel hose surface area (m^2) = π * hose length (m) * inside hose diameter (m)
TCF = temperature correction factor
DF = deterioration factor

The TCF is calculated using the average temperature for the scenario. Thus, the inputs needed to estimate hose permeation emissions are the hose permeation emission factor, the hose length, the hose diameter, the average ambient temperature, the hose metal fraction, and the deterioration factor.

Metal fuel lines are assumed to have zero permeation, so the metal fraction is not included in the calculation of emissions. Metal fuel lines are used in large SI equipment.

The model has the capability of including deterioration, but no deterioration is assumed for hose permeation (i.e., all DFs equal to 1.0). DFs for all equipment except recreational marine vessels are contained in the evhose.det file. DFs for rec marine fill neck, supply/return and vent line hose types (also equal to 1.0) are contained in the evneck.det, evsupret.det, and evvent.det files, respectively.

As mentioned in the discussion of fuel tank permeation, permeation is very sensitive to temperature. Generally, permeation roughly doubles with every 10°C increase in temperature. The temperature adjustment is applied from the average temperature for the scenario. Since the emission factors are based on a temperature of 73°F, the temperature adjustment reduces emissions by 50% with each 10°C reduction from 73°F. The temperature adjustment is calculated using the following equation:

Hose TCF = 6.013899E-2*exp(3.850818E-2*Tavg)

where Tavg = average temperature, °F

The equation is a curve fit to the equation: TCF = 0.5*exp((23°C - X°C)/10). The temperature adjustment is hard coded in the model.

Fuel hose dimensions were estimated for every piece of equipment. For NONROAD2008a, hose lengths for outboard boats with installed fuel systems were updated based on data supplied by a boat builder. The hose lengths and diameters by SCC and hp category are contained in the spillage.emf input file and provided in Appendix A, Table A4.

The emission factors are provided in Appendix A, Table A7. The metal fraction inputs are provided in Appendix A, Table A4.

The sections below discuss the hose permeation emission factors and hose characteristics used for each of the following nonroad categories: small SI, large SI, recreational marine, and recreational equipment.

Small SI Hose Permeation

Because permeation is a function of surface area and because hose lengths and inner diameters are defining parameters, hose permeation rates are based on $g/m^2/day$. The hose permeation emission factors in NONROAD2008a incorporate a more complete set of data than those in NONROAD2005. In addition, distinctions are now made between permeation rates for liquid fuel versus fuel vapor exposure and between permeation rates for gasoline versus ethanol-blend fuels. Based on data presented in the 2008 rulemaking documentation [7,9], we estimate non-handheld fuel hose permeation rates of 122 $g/m^2/day$ on gasoline and 222 $g/m^2/day$ on E10. For handheld equipment, hose permeation rates of 140 $g/m^2/day$ on gasoline and 255 $g/m^2/day$ on E10 were estimated. A summary of the baseline small SI hose permeation emission factors in the model is provided in Table 6 below.

Table 6. Small SI Hose Permeation Baseline Emission Factors at 23°C ($g/m^2/day$)

Hose Type	Gasoline (E0)	E10	E10/E0
Handheld equipment fuel hose	140	255	1.82
Non-handheld equipment fuel hose	122	222	1.82

Small SI equipment are subject to a 15 $g/m^2/day$ hose permeation standard. The phase-in schedule is dependent on the engine subcategory. The fuel hose test procedures are based on Fuel CE10 (Fuel C with 10 percent ethanol) as a test fuel. Based on the same data referenced above, we would expect in-use emissions on gasoline-based E10 to be about half of the measured level on Fuel CE10. In addition, we believe that hose designed to meet the final 15 $g/m^2/day$ standard on E10 will permeate at least 50 percent less when gasoline is used. Therefore, we model permeation from hoses designed to meet 15 $g/m^2/day$ on Fuel CE10 to be 3.75 $g/m^2/day$ on gasoline at 23°C. No emission reductions are modeled for hose on handheld equipment used in cold weather applications (i.e., chainsaws). A summary of the control emission factors is given in Table 7.

Table 7. Small SI Hose Permeation Control Emission Factors at 23°C ($g/m^2/day$)

Hose Type	Gasoline (E0)	E10	E10/E0
Handheld chainsaw	140	255	1.82
Handheld other	3.75	7.5	2.00
Non-handheld equipment fuel hose	3.75	7.5	2.00

Hose lengths are based on industry data. We use an inner diameter of 1/8 inch for hose on handheld equipment and ¼ inch for non-handheld equipment.

There are no metal hoses for small SI equipment, so the metal fraction is zero.

Large SI Hose Permeation

Most of the fuel lines for gasoline-fueled large SI equipment consist of metal lines connected by plastic sections for corners and bends. Engines meeting the large SI evaporative standards starting in the 2007 model year are expected to have near zero fuel line emissions, given the stringency of the standards. For modeling purposes, all large SI equipment are assumed to have metal fuel lines, so there are no hose permeation emissions from large SI gasoline equipment in NONROAD2008a.

Recreational Marine Hose Permeation

For the recreational marine category, hose permeation is the sum of emissions from three hose types: supply/return, fill neck, and vent line. Therefore, emission factors, hose lengths, and hose diameters are required for each hose type. There are separate emission factor input files for each hose type.

The majority of marine fuel hoses are constructed primarily of nitrile rubber with a chloroprene cover for abrasion and flame resistance. Fuel hose for portable marine fuel tanks (used in outboard engines ≤25 hp) is not subject to any established recommended practice. For this reason, we consider fuel hose used on portable marine fuel tanks to be equivalent to the hose used in small SI applications. The supply hose for each portable marine fuel tank is modeled to include a primer bulb with the same permeation rate as the hose.

For SD/I vessels, Coast Guard requirements in 33 CFR 183 (which reference SAE J1527) are that fuel hose for boats with gasoline engines meet the Class 1, Type A requirements which specify a maximum permeation rate of 100 g/m^2/day at 23°C. [10] Accordingly, these vessels have fuel hose with lower permeation. Rather than using the recommended permeation rate limits for this hose, which was done for the previous version of the model, we now base the baseline permeation emission factors on data using gasoline with ethanol, which is more representative of in-use fuels. [7]

For other vessels with installed fuel tanks (i.e., PWC and outboard engines >25 hp), the baseline permeation emission factors are based on test data on marine hose not certified to Coast Guard Class I requirements.

Fuel fill neck hoses are subject to a less stringent permeation standard (300 g/m^2/day at 23°C) under the Coast Guard specifications because they are not normally continuously in contact with fuel (Class 2). However, fill neck hose is not usually exposed to liquid fuel. Therefore, we used vapor line data to estimate both fill neck and vent line permeation rates.

A summary of the recreational marine hose permeation baseline emission rates is provided in Table 8 and Table 9 below.

Table 8. Recreational Marine Supply/Return Hose Baseline Permeation Emission Rates at 23°C*

Category	Equipment Description	SCC	HP	g/m²/day		
				Gasoline (E0)	E10	E10/E0
Portable	2-Str Outboard	2282005010	<=25	122	222	1.82
Installed	2-Str Outboard	2282005010	>25	42	125	2.98
Installed	4-Str Inboard/ Sterndrive	2282010005	All	22	40	1.82
PWC	2-Str Personal Watercraft	2282005015	All	42	125	2.98

*The gasoline EFs are contained in the supret.emf input file. The E10/E0 adjustment factors are contained in the spillage.emf input file.

Table 9. Recreational Marine Fill Neck and Vent Line Hose Baseline Permeation Emission Rates at 23°C*

Category	Equipment Description	SCC	HP	g/m²/day		
				Gasoline (E0)	E10	E10/E0
Portable	2-Str Outboard	2282005010	<=25	0	0	0
Installed	2-Str Outboard	2282005010	>25	2.5	4.9	1.96
Installed	4-Str Inboard/ Sterndrive	2282010005	All	2.5	4.9	1.96
PWC	2-Str Personal Watercraft	2282005015	All	2.5	4.9	1.96

*The fill neck gasoline EFs are contained in the evneck.emf input file. The vent line gasoline EFs are contained in the event.emf input file. The E10/E0 adjustment factors are contained in the spillage.emf input file. These hose types are not subject to control, so these EFs are used for all model years.

Recreational marine engines are subject to a 15 g/m^2/day standard beginning in 2009. Similarly to small SI engines, we model permeation from supply/return hoses designed to meet 15 g/m^2/day on Fuel CE10 to be 3.75 g/m^2/day on gasoline at 23°C. Fill neck and vent hose containing vapor rather than liquid fuel are not subject to the final standards. No emission reductions are modeled for these hose types.

A summary of the supply/return hose permeation control emission rates is provided in Table 10.

Table 10. Recreational Marine Supply/Return Hose Control Permeation Emission Rates at 23°C*

Category	Equipment Description	SCC	HP	g/m²/day		
				Gasoline (E0)	E10	E10/E0
Portable	2-Str Outboard	2282005010	<=25	3.75	7.5	2.00
Installed	2-Str Outboard	2282005010	>25	3.75	7.5	2.00
Installed	4-Str Inboard/ Sterndrive	2282010005	All	3.75	7.5	2.00
PWC	2-Str Personal Watercraft	2282005015	All	3.75	7.5	2.00

*The gasoline EFs are contained in the supret.emf input file. The E10/E0 adjustment factors are hard coded in the model.

Hose lengths and diameters by hose type are contained in the spillage input file. Our estimates of hose lengths are based on discussions with and comments from boat builders. In addition, the vent line lengths in NONROAD2005 were divided by two to account for a vapor gradient throughout the fuel line caused by diurnal breathing and diffusion. This factor has been removed in lieu of the new emission factors for vent lines based on vapor exposure.

Fuel lines connected to a portable fuel tank are also generally fitted with a primer bulb, also typically constructed from nitrile rubber. To account for primer bulb emissions, the primer bulb hose surface area ($0.012177 m^2 = \pi * 0.1525 m$ (length) * 0.0254 m (inside diameter)) was added to the supply/return hose surface area for portable equipment. This was done in the model by adjusting the supply/return length for portable equipment from 1.83m to 2.44m.

Recreational Equipment Hose Permeation

We consider fuel hose on recreational equipment to be constructed similar to SAI J30 R7 hose, which has a permeation requirement of 550 g/m^2/day at 23°C. Considering that fuel hose is likely constructed to be below this requirement, a baseline emission factor of 450 g/m^2/day is used for all recreational equipment. A standard of 15 g/m^2/day is applied, beginning in the 2008 model year. In NONROAD, a control emission factor of 7.5 g/m^2/day is used for the 2008 and later model years. This is based on a 50 percent compliance margin to account for E10 fuel effects.

Recreational equipment are assumed to have no metal hoses (i.e., metal fraction = 0.0).

Hose Permeation Sample Calculation

A sample calculation is provided for recreational marine inboard engines using gasoline.

User Inputs: SCC: 2282010005 (4-stroke inboard rec marine)
MaxHP: 175
Tavg: 75°F
Calendar year: 2005

Model Inputs: Fill neck EF: 2.5 g/m^2/day at 73°F (evneck.emf)
Supply/return EF: 22 g/m^2/day at 73°F (supret.emf)
Vent line EF: 2.5 g/m^2/day at 73°F (evvent.emf)
Fill neck length: 1.83000 m (spillage.emf)
Fill neck diameter: 0.038100 m (spillage.emf)
Supply/return length: 1.83000 m (spillage.emf)
Supply/return diameter: 0.009525 m (spillage.emf)
Vent length: 2.44000 m (spillage.emf)

Vent diameter: 0.015875 m (spillage.emf)
Fill neck DF: 1 (evneck.det)
Supply/return DF: 1 (evsupret.det)
Vent DF: 1 (evvent.det)
Engine population: 311,583 (model output)

Calculations:

1) Calculate surface area for each type of hose (π*diameter*length)
   Fill neck: (3.14)*(0.038100)*(1.83000) = 0.2189 m^2
   Supply/return: (3.14)*(0.009525)*(1.83000) = 0.0547 m^2
   Vent: (3.14)*(0.015875)*(2.44000) = 0.1216 m^2

2) Calculate total g/day for the three hose types
(2.5 g/m^2/day*0.2189 m^2)+(22 g/m^2/day*0.0547 m^2)+(2.5 g/m^2/day*0.1216) = 2.05 g/day

3) Calculate tons/day, without temperature adjustment
(2.05 g/day)*(311,583)*(lb/453.6g)*(ton/2000 lb) = 0.70 tons/day

4) Calculate temperature adjustment (should be 50% lower with each 10°C reduction from 73°F) The temperature adjustment is applied from the average temperature for the scenario (75°F).
TCF = 0.06013899*exp(0.03850818*Tavg) = 0.06013899*exp(0.03850818*75) = 1.08

5) Apply temperature adjustment
(0.70 tons/day)*(1.08) = 0.76 tons/day

6) Calculate tons/year
2005 is not a leap year, so it has 365 days.
Total: 0.76 tons/day * 365 days/year = 278 tons/year

Modeling of Ethanol Blend Effects on Fuel Tank and Hose Permeation Emissions

Due to the increasing use of gasoline-ethanol blends, and the effects of such blends on permeation emissions, NONROAD2008a has been modified to be able to estimate these effects for small gasoline-fueled equipment and recreational boats. This section describes the methodology and presents an example calculation of tank permeation emissions when an ethanol blend fuel is used.

Graphical User Interface (GUI)/Option File Changes

Two new input fields have been added to the option file and GUI to allow users to specify ethanol blend market share and volume percent ethanol in the blend. Note that these new inputs are used to model the effects of ethanol blends on permeation emissions only. Other evaporative sources are not affected in the model by the use of ethanol blends. In addition, the model does not have the ability to model the effects of other oxygenate blends on permeation emissions.

The effect of oxygenate blends (ethanol or otherwise) on exhaust emissions is modeled by specifying the oxygen weight percent input in the option file/GUI. If this input is not consistent with the new ethanol blend fields, the GUI/output file will provide a warning. The GUI prompt will also provide a suggested oxygen weight percent input that is consistent with the ethanol blend inputs specified. This prompt/warning can be ignored, however, and the model will still run. This may be necessary in some cases. For example, if an MTBE blend is modeled, the oxygen weight percent input would reflect this, but the volume percent ethanol and market share inputs would be set to zero, since the model does not have the ability to model the effects of MTBE blends on permeation emissions.

Ethanol Blend Default Values

In the absence of local information regarding ethanol blend market shares and volume percents, Appendix F contains suggested nationwide average fuel properties. [11]

Modeling the Nonlinear Nature of the Permeation Effect

Based on the limited available test data it appears that the effect of alcohol-gasoline blends on permeation is nonlinear, tending to increase permeation at lower alcohol concentrations up to about 20% ethanol, but then decreasing permeation at higher alcohol concentrations. [12]

Starting with the gasoline (E0) and 10% ethanol (E10) emission factors described above, a simple exponential curve was selected to connect the zero and 10% points continuing up to the 20% ethanol level. Then to get a nonlinear decreasing curve above 20% a simple decreasing exponential curve was used. Since effects above 85% are especially uncertain, and no such fuels are foreseen for use in nonroad equipment, the effect above 85% was set equal to the E85 effect. [9] The equations used are shown below.

Hose and Tank Permeation for 0 - 20% ethanol volume percent:

Permeation EF = GasEF + GasEF * (E10fac - 1) * [(EthVfrac / 0.10) ^ 0.4]

Hose and Tank Permeation for ethanol volume percent greater than 20%:

Permeation EF = GasEF * { 1 + (E10fac - 1) * [(20 / 10) ^ 0.4] }
* { 1 - [(MIN(EthVfrac, 0.85) - 0.20) / 0.80] ^ (1 / 0.4) }

where:

Permeation EF = Permeation emission factor for modeled fuel (grams per meter^2 per day)

GasEF = Gasoline hose permeation emission factor from input EF data files (grams per meter^2 per day)

E10fac = permeation emission adjustment factor for E10 relative to gasoline, from input EF data file (spillage.emf), (unitless)

EthVfrac = Volume fraction ethanol in the fuel being modeled. E10 = 0.10

0.4 = exponent chosen to yield a reasonable shape of curve.

The E10 adjustment factors are contained in the spillage file and provided in Appendix A, Table A5.

Note that all ethanol blends currently modeled with NONROAD or NMIM are less than or equal to E10, so no parts of this curve above E10 are used yet. If/when nonroad equipment starts being designed for operation on blends greater than E10, there may be other hose or tank material changes that require revisiting this analysis.

Market Share Effect

The effect of market share is modeled based on the proportion of ethanol blend use in the market being modeled. In most areas the ethanol blend market share is either zero or 100%, but in areas where it is between those two market shares, or when doing a nationwide model run, the effect is calculated as a simple proportion.

Sample Calculation of Permeation Emissions with Ethanol Blends

A sample calculation of tank permeation emissions with a 9.3 percent ethanol blend is provided for small SI equipment. This is the same equipment type used previously to illustrate the calculation of tank permeation emissions with gasoline.

User Inputs:
- SCC: 2265006015 (4-stroke air compressors)
- MaxHP: 6
- Tavg: 75°F
- Calendar year: 2005
- Ethanol blend market percent: 90.0
- Ethanol blend volume percent: 9.3

Model Inputs:
- Gasoline EF: 9.7 g/m^2/day at 85°F (evtank.emf)
- E10 permeation adjustment factor: 1.100 (spillage.emf)
- Tank size: 1.1 gal (spillage.emf)
- Tank metal fraction: 0.2 (spillage.emf)
- DF: 1 (evtank.det)

Engine population in 2005: 65,329 (model output)

Calculations:

1) Calculate tank permeation EF for 9.3 ethanol volume percent.
   Permeation EF = GasEF + GasEF * (E10fac – 1) * [(EthVfrac/0.10)^0.4]
   E9.3 EF = 9.7 + 9.7 * (1.1 – 1) * [(0.093/0.10)^0.4] = 10.64 g/m^2/day

2) Calculate composite tank permeation EF, accounting for ethanol market share.
   (10.64 * 0.900) + [9.7 * (1-0.900)] = 10.55 g/m^2/day

3) Calculate surface area (m^2).
   Surface area = 0.15*SQRT((((1.1+2)^2)/4)-1) = 0.178 m^2

4) Calculate tons/day, without temperature adjustment
   The metal fraction (0.20) would have no tank permeation emissions.

(10.55 g/m2/day)*(0.178 m^2)*(65,329)*(lb/453.6g)*(ton/2000 lb)*(1-0.2)*(1) = 0.108 tons/day

5) Calculate temperature adjustment (50% lower with each 10°C reduction from 85°F)
   The temperature adjustment is applied from the average temperature for the scenario (75°F)
   Tank TCF °F = 3.788519E-2*exp(3.850818E-2*75°F) = 0.68

6) Apply temperature adjustment
   (0.108 tons/day)*(0.68) = 0.074 tons/day

7) Calculate tons/year
   2005 is not a leap year, so it has 365 days.
   Total: 0.074 tons/day * 365 days/year = 27 tons/year

Running Loss Emissions

The running loss inventory is estimated by multiplying the running loss emission rates in g/hr by the total activity in hours for each equipment type. Running loss emissions are not dependent on ambient temperature, so no temperature adjustment is necessary.

The model has the capability of including running loss deterioration, but no deterioration is assumed for running loss emissions (i.e., all DFs equal to 1.0). The DFs are contained in the evrunls.det file.

Small SI Running Loss

Running loss baseline emission rates are available for several small SI applications, which are provided in Table 11 below. Although the ATVs and forklifts are not considered to be small SI equipment, these data can be used as surrogates for equipment that were not tested. The source and derivation of these emission factors are provided in Appendix G. These emission factors are then mapped/assigned to all the SCCs in NONROAD. The mapping of emission factors to SCCs is also described in Appendix G.

Table 11. Small SI Running Loss Baseline Emission Factors

Application	HC [g/hour]
ATV	11.30
Forklift	4.61
Riding Mower	2.86
Trimmer/Edger	0.58
Lawnmower	3.34
Generator/Pressure Washer	14.23

Running loss control requirements for nonhandheld engines take effect in the 2012 model year for Class I engines and the 2011 model year for Class II engines. For Class I engines, we believe that the final running loss control requirement will be met by routing vapor from the fuel take to the engine air intake system. Therefore, all vapor generated in the fuel tank should be consumed by the engine, thereby eliminating running loss emissions. However, there may be some inefficiencies in the system such as vapor escaping out the intake at idle. Therefore, we model the running loss emission reduction as only 90 percent. For Class II equipment, we believe that some equipment will inherently meet the final standard because they will have low enough temperature fluctuation in the fuel tanks during operation to certify by design. Based on fuel tank temperatures during operation, we estimate an 80 percent reduction in running loss for Class II equipment.

<u>Large SI Running Loss</u>

A baseline running loss emission factor of 2.41 g/hour is used for all large SI equipment. This is based on an average derived from data collected on eight pieces of equipment. The data and derivation of the emission factor are described in Appendix G.

Regulations resulting in 90% control start in the 2007 model year; the control emission factor used in NONROAD is therefore 0.241 g/hr, beginning in 2007.

<u>Recreational Marine Running Loss</u>

We do not have running loss data for recreational marine engines. Presumably, boats with outboard engines would not have significant running loss emissions from the fuel tank. Also, for larger fuel tanks, we assume that the fuel tank is mounted away from the engine and is not significantly affected by engine heating. For the other categories (PWC and smaller inboard/sterndrive engines), an emission factor of 2.86 g/hour is used, based on data collected for riding mowers. The derivation of the emission factors is described in Appendix G and the resulting emission factors are provided in Table 12. There are no recreational marine running loss controls, so these emission factors are applied for all model years.

Table 12. Recreational Marine Running Loss Emission Rates

Equipment Description	SCC	HP	HC [g/hour]
2-Str Outboard	2282005010	All	0.00
4-Str Inboard/ Sterndrive	2282010005	<=100	2.86
4-Str Inboard/ Sterndrive	2282010005	>100	0.00
2-Str Personal Watercraft	2282005015	All	2.86

<u>Recreational Equipment Running Loss</u>

An ATV emission factor of 11.3 g/hour is used for all recreational equipment, described in Appendix G. Since the activities for off-road motorcycles and ATVs are in units of miles/year, it is necessary to convert the emission factor to consistent units of g/mile for this equipment. This is done by dividing the g/hour emission factor by the average speed in miles/hour. The average speed for ATVs is 9.6 miles/hour, which is a weighted average for utility and sport ATVs. [13] The average speed for off-road motorcycles is 20 miles/hour, which is consistent with the average speed used by California in their modeling. [14] The resulting running loss emission factors used in the model are 1.18 g/mile for ATVs and 0.57 g/mile for off-road motorcycles.

There are no recreational equipment running loss controls.

<u>Running Loss Sample Calculation</u>

A sample calculation is provided for small SI equipment.

<u>User Inputs</u>: SCC: 2265006015 (4-stroke air compressors)
MaxHP: 6
Calendar year: 2005

<u>Model Inputs</u>: EF: 14.23 g/hour (evrunls.emf)
Activity: 484 hours/year (activity.dat)
DF: 1 (evrunls.det)
Engine population in 2005: 65,329 (model output)

<u>Calculations</u>:

1) Calculate tons/year

(14.23 g/hour)*(484 hours/year)*(65,329)*(lb/453.6g)*(ton/2000 lb) = 496 tons/year

Hot Soak Emissions

The hot soak inventory is estimated by multiplying the hot soak emission rates in g/start by starts/hour and hours/year activity information. In this case, starts are equivalent to the engine being turned off, since the latter is when a hot soak occurs. Hot soak emissions are not dependent on temperature, so no temperature adjustment is necessary.

The upper limit for number of starts is 260 starts/year (based on 5 days/week and 52 weeks/year). To check that this limit is not exceeded, for each equipment type, we calculated starts/year by multiplying starts/hour and hours/year. This was done outside the model. If the resulting starts/year was greater than 260, the starts/year was reset to 260 and the starts/hour estimate was adjusted downward accordingly. The starts/hour estimates in the spillage.emf file contain these adjustments.

The emission factors are in the evhotsk.emf input file and also provided in Appendix A, Table A10. The starts/hour estimates by equipment type are provided in the spillage.emf file and provided in Appendix A, Table A3. Both the emission factor and start/hour estimates are described in more detail in Appendix H.

As with the other emission types, the model has the capability of including deterioration, but no deterioration assumed for hot soak emissions (i.e.,all DFs equal to 1.0). The DFs are in the evhotsk.det file.

Small SI Hot Soak

Hot soak emission rates are available for several small SI applications, which are provided in Table 13 below. There are no small SI hot soak controls, so the baseline emission factors are applied to all model years.

Table 13. Hot Soak Emission Factors Used for Small SI Equipment

Equipment Type	Hot Soak (g/start)
Chainsaw	0.27
Lawnmower	0.85
Tractor	1.52
ATV	3.00
Trimmer/Edger	0.29
Leaf blower	0.15
Tiller	0.57
Generator/Welder	3.24
Forklift	10.5

Large SI Hot Soak

A baseline running loss emission factor of 4.34 g/start is used for all large SI equipment. This is based on an average derived from data collected on eight pieces of equipment.

Regulations resulting in 90% control start in the 2004 model year; the control emission factor used in NONROAD is therefore 0.434 g/hr, beginning in 2004.

Recreational Marine Hot Soak

There are no hot soak emission data for recreational marine engines. An emission factor of 3.0 g/start is used for all recreational marine engines, except those using portable tanks. This emission factor is based on ARB tests with ATVs. There are no hot soak emissions for portable equipment (i.e., outboards <=25hp).

There are no recreational marine hot soak controls in the NONROAD model.

Recreational Equipment Hot Soak

An ATV emission factor of 3.0 g/start is used for all recreational equipment. Since the activities for off-road motorcycles and ATVs are in units of miles/year, the hot soak inventory for this equipment is estimated by multiplying the hot soak emission rates in g/start by starts/mile and miles/year activity information. As described in Appendix H, there are 1.00 starts/hour assumed for recreational equipment. To convert to units of starts/mile, the starts/hour are divided by the average speed in miles/hour. The average speed for ATVs is 9.6 miles/hour, which is a weighted average for utility and sport ATVs. [13] The average speed for off-road motorcycles is 20 miles/hour. [14] The resulting starts/mile values used in the model are 0.1042 starts/mile for ATVs and 0.0500 starts/mile for off-road motorcycles. The starts/mile values are contained in the spillage.emf file.

There are no recreational equipment hot soak controls.

Hot Soak Sample Calculation

A sample calculation is provided for small SI equipment.

User Inputs: SCC: 2265006015 (4-stroke air compressors)
MaxHP: 6
Calendar year: 2005

Model Inputs: EF: 3.24 g/start (evhotsk.emf)
0.25 starts/hour (spillage.emf)

Activity: 484 hours/year (activity.dat)
DF: 1 (evhotsk.det)
Engine population in 2005: 65,329 (model output)

Calculations:

1) Calculate tons/year.

(3.24 g/start)*(0.25 starts/hour)*(484 hours/year)*(65,329)*(lb/453.6g)*(ton/2000 lb) = 28 tons/year

References

[1] "Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule," 73 FR 59034, October 8, 2008.

[2] "Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based); Final Rule," 67 FR 68241, November 8, 2002.

[3] D. T. Wade, "Factors Influencing Vehicle Evaporative Emissions," SAE Paper 670126, 1967, Docket A-2000-01, Document II-A-59.

[4] Wade et. al., "Mathematical Expressions Relating Evaporative Emissions from Motor Vehicles without Evaporative Loss-Control Devices to Gasoline Volatility," SAE Paper 720700, 1972, Docket A-2000-01, Document II-A-58.

[5] S. Raghuma Reddy, "Prediction of Fuel Vapor Generation from a Vehicle Fuel Tank as a Function of Fuel RVP and Temperature," SAE Paper 892089, 1989, Docket A-2000-01, Document II-A-61.

[6] "Refueling Emissions for Nonroad Engine Modeling," EPA420-P-04-013, NR-013b, April 2004.

[7] "Final Regulatory Support Document: Control of Emissions from Marine SI and Small SI Engines, Vessels, and Equipment," EPA420-R-08-014, September 2008.http://www.epa.gov/otaq/regs/nonroad/marinesi-equipld/420r08014.pdf

[8] Nulman, M., Olejnik, A., Samus, M., Fead, E., Rossi, G., "Fuel Permeation Performance of Polymeric Materials," SAE Paper 2001-01-1999, 2001, Docket A-2000-01, Document No. IV-A-23.

[9] "Modeling of Ethanol Blend Effects on Nonroad Fuel Hose and Tank Permeation - Updated," EPA memorandum from Craig A. Harvey to Docket EPA-HQ-OAR-2004-0008, Document No. EPA-HQ-OAR-2004-0008-0856, February 22, 2008.

[10] SAE Surface Vehicle Standard, "Marine Fuel Hoses," Society of Automotive Engineers J 1527, Issued 1985-12, Revised 1993-02, Docket A-2000-01, Document IV-A-19.

[11] "Suggested Nationwide Average Fuel Properties," EPA-420-B-09-018, April 2009.

[12] Kathios, D., Ziff, R., "Permeation of Gasoline and Gasoline-Alcohol Fuel Blends Through High-Density Polyethylene Fuel Tanks with Different Barrier Technologies," SAE Paper 920164, 1992, Docket Identification EPA-HQ-OAR-2004-0008-0172.

[13] "Final Regulatory Support Document: Control of Emissions from Unregulated Nonroad Engines," Appendix to Chapter 6: ATV and Off-highway Motorcycle Usage Rates, EPA420-R-02-022, September 2002. http://www.epa.gov/otaq/regs/nonroad/2002/r02022.pdf

[14] "Emission Modeling for Recreational Vehicles," EPA memorandum from Linc Wehrly to Docket A-98-01, Docket A-2000-01, Document No. II-B-19, November 13, 2000.

List of Appendices

Appendix A

Evaporative Inputs for NONROAD2008a

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year*

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
	2260000000	0	6	E00000000	E00100000	E11100010		
1900				1.000	0.000	0.000		
2008				0.050	0.950	0.000		
2009				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260000000	6	25	E00000000	E00100000	E11100010	E12100010	E13100010
1900				1.000	0.000	0.000	0.000	0.000
2008				0.100	0.900	0.000	0.000	0.000
2009				0.000	1.000	0.000	0.000	0.000
2011				0.000	0.000	1.000	0.000	0.000
2013				0.000	0.000	0.000	1.000	0.000
2015				0.000	0.000	0.000	0.000	1.000
	2260000000	25	9999	E00000000	E00010000	E10010010		
1900				1.000	0.000	0.000		
2004				0.000	1.000	0.000		
2007				0.000	0.000	1.000		
	2260001010	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2260001020	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2260001030	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2260004015	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004016	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004025	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004030	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year (cont.)

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
	2260005035	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006005	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006010	0	1	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002009	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002021	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002027	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002039	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002054	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260003030	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year (cont.)

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
2012				0.000	0.000	1.000		
	2260003040	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004015	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004016	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004020	1	3	E00000000	E01000000			
1900				1.000	0.000			
	2260004021	1	3	E00000000	E01000000			
1900				1.000	0.000			
	2260004025	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004026	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004030	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004031	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260004071	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year (cont.)

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
2012				0.000	0.000	1.000		
	2260005035	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006005	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006010	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006015	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260006035	1	3	E00000000	E02000000	E02200000		
1900				1.000	0.000	0.000		
2009				0.500	0.500	0.000		
2010				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2260002006	3	6	E00000000	E02000000	E01100000	E02200000	
1900				1.000	0.000	0.000	0.000	
2009				0.550	0.450	0.000	0.000	
2010				0.100	0.900	0.000	0.000	
2012				0.000	0.000	1.000	0.000	
2013				0.000	0.000	0.000	1.000	
	2260002039	3	6	E00000000	E02000000	E01100000	E02200000	
1900				1.000	0.000	0.000	0.000	
2009				0.550	0.450	0.000	0.000	
2010				0.100	0.900	0.000	0.000	
2012				0.000	0.000	1.000	0.000	
2013				0.000	0.000	0.000	1.000	
	2260004021	3	6	E00000000	E01000000			
1900				1.000	0.000			
	2260004026	3	6	E00000000	E02000000	E01100000	E02200000	
1900				1.000	0.000	0.000	0.000	
2009				0.550	0.450	0.000	0.000	
2010				0.100	0.900	0.000	0.000	

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year (cont.)

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
2012				0.000	0.000	1.000	0.000	
2013				0.000	0.000	0.000	1.000	
	2260004031	3	6	E00000000	E02000000	E01100000	E02200000	
1900				1.000	0.000	0.000	0.000	
2009				0.550	0.450	0.000	0.000	
2010				0.100	0.900	0.000	0.000	
2012				0.000	0.000	1.000	0.000	
2013				0.000	0.000	0.000	1.000	
	2260007005	6	11	E00000000	E01000000			
1900				1.000	0.000			
	2265000000	0	6	E00000000	E00100000	E11100010		
1900				1.000	0.000	0.000		
2008				0.050	0.950	0.000		
2009				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2265000000	6	25	E00000000	E00100000	E11100010	E12100010	E13100010
1900				1.000	0.000	0.000	0.000	0.000
2008				0.100	0.900	0.000	0.000	0.000
2009				0.000	1.000	0.000	0.000	0.000
2011				0.000	0.000	1.000	0.000	0.000
2013				0.000	0.000	0.000	1.000	0.000
2015				0.000	0.000	0.000	0.000	1.000
	2265000000	25	9999	E00000000	E00010000	E10010010		
1900				1.000	0.000	0.000		
2004				0.000	1.000	0.000		
2007				0.000	0.000	1.000		
	2265001010	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2265001020	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2265001030	0	9999	E00000000	E01100000			
1900				1.000	0.000			
2008				0.000	1.000			
	2267000000	0	9999	E00000000				
1900				1.000				
	2268000000	0	9999	E00000000				
1900				1.000				
	2270000000	0	9999	E00000000				
1900				1.000				
	2282005010	0	25	E00000000	E00100000	E10100000	E11100000	
1900				1.000	0.000	0.000	0.000	
2009				0.000	1.000	0.000	0.000	

Table A1. Nonroad Evaporative Technology Distributions by SCC, HP Category and Model Year (cont.)

Model Year	SCC	HPmin	HPmax	Fraction of Population in Each Technology Type				
2010				0.000	0.000	1.000	0.000	
2011				0.000	0.000	0.000	1.000	
	2282005010	25	9999	E00000000	E00100000	E10100000	E11100000	
1900				1.000	0.000	0.000	0.000	
2009				0.000	1.000	0.000	0.000	
2011				0.000	0.000	1.000	0.000	
2012				0.000	0.000	0.000	1.000	
	2282005015	0	9999	E00000000	E00100000	E10100000	E11100000	
1900				1.000	0.000	0.000	0.000	
2009				0.000	1.000	0.000	0.000	
2010				0.000	0.000	1.000	0.000	
2011				0.000	0.000	0.000	1.000	
	2282010005	0	9999	E00000000	E00100000	E10100000	E11100000	
1900				1.000	0.000	0.000	0.000	
2009				0.000	1.000	0.000	0.000	
2011				0.000	0.000	1.000	0.000	
2012				0.000	0.000	0.000	1.000	
	2282020000	0	9999	E00000000				
1900				1.000				
	2285002015	0	9999	E00000000				
1900				1.000				
	2285004015	0	6	E00000000	E00100000	E11100010		
1900				1.000	0.000	0.000		
2008				0.050	0.950	0.000		
2009				0.000	1.000	0.000		
2012				0.000	0.000	1.000		
	2285004015	6	25	E00000000	E00100000	E11100010	E12100010	E13100010
1900				1.000	0.000	0.000	0.000	0.000
2008				0.100	0.900	0.000	0.000	0.000
2009				0.000	1.000	0.000	0.000	0.000
2011				0.000	0.000	1.000	0.000	0.000
2013				0.000	0.000	0.000	1.000	0.000
2015				0.000	0.000	0.000	0.000	1.000
	2285004015	25	9999	E00000000	E00010000	E10010010		
1900				1.000	0.000	0.000		
2004				0.000	1.000	0.000		
2007				0.000	0.000	1.000		
	2285006015	0	9999	E00000000				
1900				1.000				
	2285008015	0	9999	E00000000				
1900				1.000				

*Note: There is one tier of evaporative controls. The technology types with “2” or “3” have been added to account for phase-in of the standards where applicable, and are necessary for compatibility with the current model structure.

Table A2. Nonroad Diurnal Wade Equation Multipliers

Model Year	SCC	HPmin	HPmax	Diurnal Multiplier by Technology Type[a]	
	2260000000	0	25	E0	E1
1900				1.46[b]	1.00
	2260000000	25	9999	E0	E1
1900				1.46	0.10[c]
	2260001010	0	9999	ALL	Mult
1900				1.00	
	2260001020	0	9999	ALL	Mult
1900				1.00	
	2260001030	0	9999	ALL	Mult
1900				1.00	
	2260002006	0	6	ALL	Mult
1900				1.00	
	2260002009	0	3	ALL	Mult
1900				1.00	
	2260002021	0	3	ALL	Mult
1900				1.00	
	2260002027	0	3	ALL	Mult
1900				1.00	
	2260002039	0	6	ALL	Mult
1900				1.00	
	2260002054	0	3	ALL	Mult
1900				1.00	
	2260003030	0	3	ALL	Mult
1900				1.00	
	2260003040	0	3	ALL	Mult
1900				1.00	
	2260004015	0	3	ALL	Mult
1900				1.00	
	2260004016	0	3	ALL	Mult
1900				1.00	
	2260004020	0	6	ALL	Mult
1900				1.00	
	2260004021	0	6	ALL	Mult
1900				1.00	
	2260004025	0	6	ALL	Mult
1900				1.00	
	2260004026	0	6	ALL	Mult
1900				1.00	
	2260004030	0	6	ALL	Mult
1900				1.00	
	2260004031	0	6	ALL	Mult

Table A2. Nonroad Diurnal Wade Equation Multipliers (cont.)

Model Year	SCC	HPmin	HPmax	Diurnal Multiplier by Technology Type[a]	
1900				1.00	
	2260004071	0	6	ALL	Mult
1900				1.00	
	2260005035	0	3	ALL	Mult
1900				1.00	
	2260006005	0	3	ALL	Mult
1900				1.00	
	2260006010	0	3	ALL	Mult
1900				1.00	
	2260006015	0	3	ALL	Mult
1900				1.00	
	2260006035	0	3	ALL	Mult
1900				1.00	
	2260007005	0	11	ALL	Mult
1900				1.00	
	2265000000	0	25	E0	E1
1900				1.46	1.00
	2265000000	25	9999	E0	E1
1900				1.46	0.10
	2265001010	0	9999	ALL	Mult
1900				1.00	
	2265001020	0	9999	ALL	Mult
1900				1.00	
	2265001030	0	9999	ALL	Mult
1900				1.00	
	2267000000	0	9999	ALL	Mult
1900				0.00	
	2268000000	0	9999	ALL	Mult
1900				0.00	
	2270000000	0	9999	ALL	Mult
1900				0.00	
	2282005010	0	25	E0	E1
1900				0.73[d]	0.10
	2282005010	25	9999	E0	E1
1900				1.00	0.40
	2282005015	0	9999	E0	E1
1900				0.30[e]	0.30
	2282010005	0	9999	E0	E1
1900				1.00	0.40
	2282020000	0	9999	ALL	Mult
1900				0.00	

Table A2. Nonroad Diurnal Wade Equation Multipliers (cont.)

Model Year	SCC	HPmin	HPmax	Diurnal Multiplier by Technology Type[a]	
	2285002015	0	9999	ALL	Mult
1900				0.00	
	2285004015	0	25	E0	E1
1900				1.46	1.00
	2285004015	25	9999	E0	E1
1900				1.46	0.10
	2285006015	0	9999	ALL	Mult
1900				0.00	
	2285008015	0	9999	ALL	Mult
1900				0.00	

a E0 = base case (pre-control); E1=control
b 1.46 = diffusion adjustment
c 0.10 = 90% control adjustment for large SI gasoline engines
d 0.73 = 1.46 (diffusion adjustment) x 0.50 (marine portable fuel tank valve adjustment)
e 0.30 = personal watercraft pressure relief valve adjustment

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates

SCC_code	Filled	HPmn	HPmx	Units	--------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2260001010	CONTAINER	0	9999	GALLONS	3.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.05000
2260001020	PUMP	1	175	GALLONS	11.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2260001030	CONTAINER	0	9999	GALLONS	4.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.10417
2260001060	CONTAINER	0	6	GALLONS	3.60000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	1.00000
2260001060	PUMP	6	25	GALLONS	3.60000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	1.00000
2260001060	PUMP	25	40	GALLONS	3.60000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2260001060	PUMP	40	100	GALLONS	6.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2260002006	PUMP	3	6	GALLONS	0.90000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002009	PUMP	1	3	GALLONS	0.90000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002021	PUMP	1	3	GALLONS	1.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002027	PUMP	1	3	GALLONS	1.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002039	PUMP	1	3	GALLONS	0.96747	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002039	PUMP	3	6	GALLONS	2.31132	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260002054	PUMP	1	6	GALLONS	0.91800	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260003030	CONTAINER	1	3	GALLONS	0.65076	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260003040	CONTAINER	1	3	GALLONS	1.04244	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260004015	CONTAINER	0	1	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000
2260004015	CONTAINER	1	3	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000
2260004016	CONTAINER	0	1	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004016	CONTAINER	1	3	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004020	CONTAINER	1	3	GALLONS	0.08440	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004020	CONTAINER	3	6	GALLONS	0.15664	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004021	CONTAINER	1	3	GALLONS	0.08440	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004021	CONTAINER	3	6	GALLONS	0.15664	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004025	CONTAINER	0	1	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004025	CONTAINER	1	3	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004025	CONTAINER	3	6	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004026	CONTAINER	0	1	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2260004026	CONTAINER	1	3	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004026	CONTAINER	3	6	GALLONS	0.20000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004030	CONTAINER	0	1	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004030	CONTAINER	1	3	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004030	CONTAINER	3	6	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	3.00000
2260004031	CONTAINER	0	1	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004031	CONTAINER	1	3	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004031	CONTAINER	3	6	GALLONS	0.70000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004035	CONTAINER	1	3	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2260004035	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2260004036	CONTAINER	1	3	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004036	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2260004071	CONTAINER	1	3	GALLONS	2.50000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.38123
2260005035	PUMP	0	1	GALLONS	1.50000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260005035	PUMP	1	3	GALLONS	1.50000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006005	CONTAINER	0	1	GALLONS	0.80000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006005	CONTAINER	1	3	GALLONS	0.80000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006010	CONTAINER	0	1	GALLONS	0.80000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006010	CONTAINER	1	3	GALLONS	0.80000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006010	PUMP	25	40	GALLONS	19.38000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006010	PUMP	40	100	GALLONS	28.05000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006015	CONTAINER	1	3	GALLONS	1.10000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260006035	PUMP	1	3	GALLONS	0.23000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2260007005	CONTAINER	6	11	GALLONS	0.27240	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265001010	CONTAINER	0	9999	GALLONS	3.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.05000
2265001020	PUMP	16	25	GALLONS	10.80000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2265001030	CONTAINER	0	9999	GALLONS	4.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.10417
2265001050	PUMP	6	11	GALLONS	4.60000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.24074
2265001060	CONTAINER	0	6	GALLONS	3.60000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	1.00000
2265001060	PUMP	6	25	GALLONS	3.60000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	1.00000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265001060	PUMP	25	175	GALLONS	6.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2265002003	PUMP	3	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	6	11	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	11	16	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	16	25	GALLONS	10.63350	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	25	40	GALLONS	16.19250	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002003	PUMP	50	100	GALLONS	31.82910	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002006	PUMP	6	11	GALLONS	0.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002009	PUMP	3	6	GALLONS	0.90000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002009	PUMP	6	11	GALLONS	0.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002009	PUMP	11	16	GALLONS	0.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	3	6	GALLONS	1.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	6	11	GALLONS	4.53951	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	11	16	GALLONS	7.55820	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	16	25	GALLONS	9.73080	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	25	40	GALLONS	18.77820	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002015	PUMP	50	100	GALLONS	35.60310	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	3	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	6	11	GALLONS	4.35285	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	11	16	GALLONS	6.76260	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	16	25	GALLONS	10.20000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	25	40	GALLONS	18.66600	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002021	PUMP	50	100	GALLONS	33.66000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	3	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	6	11	GALLONS	4.54818	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	11	16	GALLONS	7.96110	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	16	25	GALLONS	9.71550	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	25	40	GALLONS	15.42240	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265002024	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002024	PUMP	50	100	GALLONS	33.66000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002027	PUMP	3	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002027	PUMP	6	11	GALLONS	4.20750	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002027	PUMP	11	16	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002027	PUMP	16	25	GALLONS	9.18000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	1	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	6	11	GALLONS	4.53033	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	11	16	GALLONS	6.85440	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	16	25	GALLONS	9.84300	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	25	40	GALLONS	15.30000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002030	PUMP	50	100	GALLONS	35.56740	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	0	1	GALLONS	0.45900	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	1	3	GALLONS	1.12659	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	3	6	GALLONS	2.45259	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	6	11	GALLONS	4.46454	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	11	16	GALLONS	8.16000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	16	25	GALLONS	10.86810	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	25	40	GALLONS	16.00890	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	50	100	GALLONS	31.28340	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002033	PUMP	100	175	GALLONS	60.23100	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	3	6	GAL/HP	0.51000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	6	11	GALLONS	4.35285	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	11	16	GALLONS	7.48680	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	16	25	GALLONS	9.89910	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	25	40	GALLONS	17.74290	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002039	PUMP	40	100	GALLONS	33.54780	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002042	PUMP	1	3	GALLONS	1.47390	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265002042	PUMP	3	6	GALLONS	2.66220	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002042	PUMP	6	11	GALLONS	4.27023	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002042	PUMP	11	16	GALLONS	6.89520	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002042	PUMP	16	25	GALLONS	9.11370	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	6	11	GALLONS	4.08000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	11	16	GALLONS	7.15020	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	16	25	GALLONS	9.26160	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	25	40	GALLONS	18.87000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	50	100	GALLONS	35.21040	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002045	PUMP	100	175	GALLONS	58.75200	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002054	PUMP	3	6	GALLONS	2.20371	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002054	PUMP	6	11	GALLONS	4.55430	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002054	PUMP	11	16	GALLONS	8.16000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002054	PUMP	16	175	GALLONS	31.89030	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002057	PUMP	16	25	GALLONS	11.73000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002057	PUMP	25	40	GALLONS	14.79000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002057	PUMP	40	50	GALLONS	23.46000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002057	PUMP	50	100	GALLONS	33.64980	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002057	PUMP	100	175	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002060	PUMP	25	40	GALLONS	18.87000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002060	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002060	PUMP	50	100	GALLONS	35.90400	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002060	PUMP	100	175	GALLONS	57.63000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002066	PUMP	6	11	GALLONS	5.50800	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002066	PUMP	16	25	GALLONS	9.73080	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002066	PUMP	25	40	GALLONS	15.30000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002066	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002066	PUMP	50	100	GALLONS	23.20000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002072	PUMP	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

					---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					
SCC_code	Filled	HPmn	HPmx	Units	Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265002072	PUMP	16	25	GALLONS	9.38910	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002072	PUMP	25	40	GALLONS	16.28430	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002072	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002072	PUMP	50	100	GALLONS	34.35870	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	3	6	GALLONS	1.00000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	6	11	GALLONS	4.34520	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	11	16	GALLONS	6.26280	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	16	25	GALLONS	9.55740	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	25	40	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	40	50	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002078	PUMP	50	100	GALLONS	33.66000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002081	PUMP	16	25	GALLONS	9.18000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002081	PUMP	25	40	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002081	PUMP	40	50	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002081	PUMP	50	100	GAL/HP	0.51000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265002081	PUMP	100	175	GALLONS	64.26000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	CONTAINER	6	11	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	CONTAINER	11	16	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	PUMP	16	25	GALLONS	10.77630	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	PUMP	25	40	GALLONS	15.92220	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	PUMP	50	100	GALLONS	30.52860	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003010	PUMP	100	175	GALLONS	56.86500	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003020	CONTAINER	16	25	GAL/HP	0.51000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003020	PUMP	25	40	GALLONS	20.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003020	PUMP	40	50	GALLONS	20.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003020	PUMP	50	100	GALLONS	20.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003020	PUMP	100	175	GALLONS	20.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003020	PUMP	175	300	GALLONS	20.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.14444
2265003030	CONTAINER	3	6	GALLONS	2.41485	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265003030	CONTAINER	6	11	GALLONS	5.02605	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	CONTAINER	11	16	GALLONS	7.57350	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	16	25	GALLONS	9.29730	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	25	40	GALLONS	16.27410	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	40	50	GALLONS	23.46000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	50	100	GALLONS	32.44110	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	100	175	GALLONS	76.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	175	300	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003030	PUMP	300	600	GALLONS	209.61000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	CONTAINER	3	6	GALLONS	2.18739	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	CONTAINER	6	11	GALLONS	4.62213	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	CONTAINER	11	16	GALLONS	6.90030	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	16	25	GALLONS	9.30240	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	25	40	GALLONS	15.36120	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	50	100	GALLONS	32.29320	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	100	175	GALLONS	69.36000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003040	PUMP	175	300	GALLONS	99.45000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003050	CONTAINER	1	3	GALLONS	1.53000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003050	PUMP	16	25	GALLONS	9.24120	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003050	PUMP	50	100	GALLONS	41.08050	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003060	PUMP	6	11	GALLONS	4.59000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003060	PUMP	11	16	GALLONS	6.63000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003060	PUMP	16	25	GALLONS	9.18000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003070	PUMP	25	40	GALLONS	17.85000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003070	PUMP	50	100	GALLONS	35.25120	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003070	PUMP	100	175	GALLONS	58.24200	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265003070	PUMP	175	300	GALLONS	127.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265004010	CONTAINER	1	3	GALLONS	0.40000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004010	CONTAINER	3	6	GALLONS	0.40000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2265004010	CONTAINER	6	11	GALLONS	0.40000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004011	CONTAINER	1	3	GALLONS	0.40000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004011	CONTAINER	3	6	GALLONS	0.40000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004011	CONTAINER	6	11	GALLONS	0.40000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004015	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004016	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004025	CONTAINER	3	6	GALLONS	0.20000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004025	CONTAINER	6	11	GALLONS	0.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004025	CONTAINER	11	16	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004025	CONTAINER	16	25	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004026	CONTAINER	3	6	GALLONS	0.20000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004026	CONTAINER	6	11	GALLONS	0.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004026	CONTAINER	11	16	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004026	CONTAINER	16	25	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004030	CONTAINER	3	6	GALLONS	0.70000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004030	CONTAINER	6	11	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004030	CONTAINER	11	16	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004030	CONTAINER	16	25	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	3.00000
2265004031	CONTAINER	3	6	GALLONS	0.70000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	6	11	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	11	16	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	16	25	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	25	40	GALLONS	0.70000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	40	50	GALLONS	0.70000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	50	100	GALLONS	0.70000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004031	CONTAINER	100	175	GALLONS	0.70000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004035	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004035	CONTAINER	6	11	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004035	CONTAINER	11	16	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004035	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2265004036	CONTAINER	3	6	GALLONS	0.30000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004036	CONTAINER	6	11	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004036	CONTAINER	11	16	GALLONS	0.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004036	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004040	CONTAINER	3	6	GALLONS	1.10000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004040	CONTAINER	6	11	GALLONS	2.45000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004040	CONTAINER	11	16	GALLONS	2.45000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004040	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004041	CONTAINER	3	6	GALLONS	1.10000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.45694
2265004041	CONTAINER	6	11	GALLONS	2.45000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.45694
2265004041	CONTAINER	11	16	GALLONS	2.45000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.45694
2265004041	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.45694
2265004046	CONTAINER	6	11	GALLONS	1.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004046	CONTAINER	11	16	GALLONS	2.45000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004046	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004046	CONTAINER	25	40	GALLONS	5.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004050	CONTAINER	1	3	GALLONS	0.31000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004050	CONTAINER	3	6	GALLONS	0.31000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004051	CONTAINER	1	3	GALLONS	0.31000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004051	CONTAINER	3	6	GALLONS	0.31000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004055	CONTAINER	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004055	CONTAINER	6	11	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004055	CONTAINER	11	16	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004055	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004056	CONTAINER	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.36061
2265004056	CONTAINER	6	11	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.36061
2265004056	CONTAINER	11	16	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.36061
2265004056	CONTAINER	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.36061
2265004056	CONTAINER	25	40	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	3	6	GALLONS	1.78500	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2265004066	CONTAINER	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	16	25	GALLONS	10.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	25	40	GALLONS	17.90100	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	50	100	GALLONS	31.07940	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004066	CONTAINER	100	175	GALLONS	60.69000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004071	CONTAINER	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	16	25	GALLONS	9.20000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	25	40	GALLONS	9.20000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004071	CONTAINER	50	100	GALLONS	9.20000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.38123
2265004075	CONTAINER	0	1	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004075	CONTAINER	1	3	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004075	CONTAINER	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004075	CONTAINER	6	11	GALLONS	5.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004075	CONTAINER	11	16	GALLONS	5.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004075	CONTAINER	16	25	GALLONS	10.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	2.00000
2265004076	CONTAINER	0	1	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	1	3	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	6	11	GALLONS	5.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	11	16	GALLONS	5.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	16	25	GALLONS	10.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	25	40	GALLONS	10.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	50	100	GALLONS	10.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000
2265004076	CONTAINER	100	175	GALLONS	10.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.50000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2265005010	PUMP	3	6	GALLONS	2.90000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005010	PUMP	6	11	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005010	PUMP	11	16	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005015	PUMP	16	25	GALLONS	10.40400	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005015	PUMP	25	40	GALLONS	15.55500	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005015	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005015	PUMP	50	100	GALLONS	22.20000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005015	PUMP	100	175	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005020	PUMP	50	100	GALLONS	116.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005020	PUMP	100	175	GALLONS	120.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005025	PUMP	25	40	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005025	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005025	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005025	PUMP	100	175	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005030	PUMP	3	6	GALLONS	2.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005030	PUMP	6	11	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005030	PUMP	11	16	GALLONS	2.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005030	PUMP	16	25	GALLONS	2.90000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	3	6	GALLONS	1.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	16	25	GALLONS	10.46010	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	25	40	GALLONS	16.97280	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	50	100	GALLONS	38.88750	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005035	PUMP	100	175	GALLONS	66.45300	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005040	PUMP	6	11	GALLONS	0.57000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005040	PUMP	11	16	GALLONS	1.10000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005045	PUMP	50	100	GALLONS	40.80000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005045	PUMP	100	175	GALLONS	62.16900	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265005055	PUMP	3	6	GALLONS	0.31000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	16	25	GALLONS	9.50640	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	25	40	GALLONS	16.43730	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	40	50	GAL/HP	0.51000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	50	100	GALLONS	33.60900	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	100	175	GALLONS	50.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005055	PUMP	175	300	GALLONS	50.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	3	6	GALLONS	0.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	6	16	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	16	25	GALLONS	9.18000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	50	100	GALLONS	37.55640	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	100	175	GALLONS	61.45500	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265005060	PUMP	175	300	GALLONS	107.20200	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	CONTAINER	3	6	GALLONS	0.80000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	CONTAINER	6	11	GALLONS	4.49616	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	CONTAINER	11	16	GALLONS	7.31340	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	16	25	GALLONS	10.56720	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	25	40	GALLONS	15.46320	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	40	50	GALLONS	23.45490	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006005	PUMP	175	300	GALLONS	42.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	CONTAINER	3	6	GALLONS	0.80000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	CONTAINER	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	CONTAINER	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	PUMP	16	25	GALLONS	9.35850	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	PUMP	25	40	GALLONS	16.29450	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	PUMP	40	50	GALLONS	23.46000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

					--------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					
SCC_code	Filled	HPmn	HPmx	Units	Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2265006010	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006010	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	CONTAINER	3	6	GALLONS	1.10000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	CONTAINER	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	CONTAINER	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	PUMP	16	25	GALLONS	8.70000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	PUMP	25	50	GALLONS	20.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006015	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	CONTAINER	3	6	GALLONS	1.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	CONTAINER	6	11	GALLONS	1.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	CONTAINER	11	16	GALLONS	1.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	PUMP	16	25	GALLONS	10.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	PUMP	25	40	GALLONS	23.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	PUMP	40	50	GALLONS	23.50000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	PUMP	50	100	GALLONS	42.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006025	PUMP	100	175	GALLONS	58.00000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	CONTAINER	1	3	GALLONS	0.80000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	CONTAINER	3	6	GALLONS	0.80000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	CONTAINER	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	CONTAINER	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	PUMP	16	25	GALLONS	9.20000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	PUMP	25	40	GALLONS	18.90000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	PUMP	40	50	GALLONS	18.90000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006030	PUMP	50	100	GALLONS	18.90000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	3	6	GALLONS	0.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	6	11	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	11	16	GALLONS	4.50000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	16	25	GALLONS	9.35850	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	25	40	GALLONS	17.29410	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					Hot Soak Starts/Hour
					Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	
2265006035	PUMP	40	50	GALLONS	23.46000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	50	100	GALLONS	34.06290	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265006035	PUMP	100	175	GALLONS	57.63000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265007010	CONTAINER	6	11	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265007010	PUMP	11	16	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265007010	PUMP	16	25	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265007015	PUMP	3	6	GALLONS	0.50000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265007015	PUMP	6	11	GALLONS	1.00000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	3	6	GALLONS	2.47911	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	6	11	GALLONS	4.16721	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	11	16	GALLONS	8.16000	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	16	25	GALLONS	9.36360	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	25	40	GALLONS	18.87000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	40	50	GALLONS	23.46000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	50	100	GALLONS	41.33550	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265008005	PUMP	100	175	GALLONS	57.63000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2265010010	PUMP	6	11	GALLONS	4.87968	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.23551
2265010010	PUMP	11	16	GALLONS	6.46680	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.23551
2265010010	PUMP	16	25	GALLONS	10.35810	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.23551
2265010010	PUMP	25	40	GALLONS	18.87000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.23551
2267001060	PUMP	25	175	GALLONS	6.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	1.00000
2267002003	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002015	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002021	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002024	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002030	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002033	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002039	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002045	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002054	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---Tank--- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2267002057	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002060	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002066	PUMP	25	50	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002066	PUMP	50	100	GALLONS	23.20000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002066	PUMP	100	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002072	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267002081	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003010	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003020	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003030	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003040	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003050	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267003070	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267004066	CONTAINER	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.50000
2267005055	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267005060	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006005	PUMP	25	50	GALLONS	14.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006005	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006005	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006005	PUMP	175	300	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006005	PUMP	300	600	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006010	PUMP	25	50	GALLONS	14.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006010	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006010	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006015	PUMP	25	50	GALLONS	20.50000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006015	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006015	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006025	PUMP	25	40	GALLONS	23.50000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006025	PUMP	40	50	GALLONS	23.50000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006025	PUMP	50	100	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

					---------------------Tank--------------------			Fractions of Total (for Diurnal Calculations)					
SCC_code	Filled	HPmn	HPmx	Units	Size	Full	Metal	Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2267006025	PUMP	100	175	GALLONS	58.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006030	PUMP	25	50	GALLONS	18.90000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006030	PUMP	50	100	GALLONS	18.90000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267006035	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2267008005	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268003020	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268002081	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268003030	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268003040	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268003060	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268003070	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268005055	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268005060	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006005	PUMP	25	50	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006005	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006005	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006005	PUMP	175	300	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006005	PUMP	300	600	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006010	PUMP	25	50	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006010	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006010	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006010	PUMP	175	300	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006010	PUMP	300	600	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006015	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006015	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006020	PUMP	25	40	GALLONS	20.50000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006020	PUMP	40	50	GALLONS	20.50000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006020	PUMP	50	100	GALLONS	28.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006020	PUMP	100	175	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006020	PUMP	175	300	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank-------------------- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2268006020	PUMP	300	600	GALLONS	42.00000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268006035	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2268010010	PUMP	25	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.25000
2270000000	PUMP	0	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.00000
2282005010	CONTAINER	1	3	GALLONS	2.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2282005010	CONTAINER	3	6	GALLONS	5.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2282005010	CONTAINER	6	11	GALLONS	6.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2282005010	CONTAINER	11	16	GALLONS	6.00000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2282005010	PUMP	16	25	GALLONS	9.14158	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	1.00000
2282005010	PUMP	25	40	GALLONS	15.27840	0.50000	0.33333	0.000	0.603	0.067	0.297	0.033	1.00000
2282005010	PUMP	40	50	GALLONS	20.93990	0.50000	0.33333	0.000	0.536	0.134	0.264	0.066	1.00000
2282005010	PUMP	50	100	GALLONS	33.17535	0.50000	0.33333	0.000	0.469	0.201	0.231	0.099	1.00000
2282005010	PUMP	100	175	GALLONS	59.16136	0.50000	0.33333	0.000	0.402	0.268	0.198	0.132	1.00000
2282005010	PUMP	175	300	GALLONS	92.47676	0.50000	0.33333	0.000	0.335	0.335	0.165	0.165	1.00000
2282005015	CONTAINER	0	25	GALLONS	4.41840	0.50000	0.00000	0.000	0.950	0.050	0.000	0.000	1.00000
2282005015	PUMP	25	40	GALLONS	8.82000	0.50000	0.00000	0.000	0.950	0.050	0.000	0.000	1.00000
2282005015	PUMP	40	50	GALLONS	10.54800	0.50000	0.00000	0.000	0.950	0.050	0.000	0.000	1.00000
2282005015	PUMP	50	100	GALLONS	15.00000	0.50000	0.00000	0.000	0.950	0.050	0.000	0.000	1.00000
2282005015	PUMP	100	300	GALLONS	18.00000	0.50000	0.00000	0.000	0.950	0.050	0.000	0.000	1.00000
2282010005	CONTAINER	3	6	GALLONS	3.00000	0.50000	0.33333	0.000	0.667	0.000	0.333	0.000	1.00000
2282010005	CONTAINER	6	11	GALLONS	5.00000	0.50000	0.33333	0.000	0.667	0.000	0.333	0.000	1.00000
2282010005	CONTAINER	11	25	GALLONS	6.00000	0.50000	0.33333	0.000	0.667	0.000	0.333	0.000	1.00000
2282010005	PUMP	25	50	GALLONS	10.16175	0.50000	0.33333	0.000	0.603	0.067	0.297	0.033	1.00000
2282010005	PUMP	50	100	GALLONS	19.85993	0.50000	0.33333	0.000	0.536	0.134	0.264	0.066	1.00000
2282010005	PUMP	100	175	GALLONS	49.92495	0.50000	0.33333	0.000	0.469	0.201	0.231	0.099	1.00000
2282010005	PUMP	175	300	GALLONS	70.40185	0.50000	0.33333	0.000	0.402	0.268	0.198	0.132	1.00000
2282010005	PUMP	300	600	GALLONS	126.99680	0.50000	0.33333	0.000	0.335	0.335	0.165	0.165	1.00000
2282010005	PUMP	600	750	GALLONS	210.10500	0.50000	0.33333	0.000	0.000	0.670	0.000	0.330	1.00000
2282020005	PUMP	0	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.00000
2282020010	PUMP	0	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.00000

Table A3. Fuel Tank Characteristics and Hot Soak Activity (Starts per Hour) Estimates (cont.)

SCC_code	Filled	HPmn	HPmx	Units	---------------------Tank--------------------- Size	Full	Metal	Fractions of Total (for Diurnal Calculations) Portable Plastic	Plastic Trailer	Installed Plastic Water	Installed Metal Trailer	Installed Metal Water	Hot Soak Starts/Hour
2282020025	PUMP	0	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.00000
2285002015	PUMP	0	9999	GAL/HP	0.51000	0.50000	1.00000	0.000	0.000	0.000	0.000	0.000	0.00000
2285004015	CONTAINER	1	3	GALLONS	1.53000	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	3	6	GALLONS	1.79520	0.50000	0.20000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	6	11	GALLONS	3.36090	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	11	16	GALLONS	6.15570	0.50000	0.10000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	16	25	GALLONS	9.27690	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	25	40	GALLONS	16.90650	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2285004015	PUMP	100	175	GALLONS	57.63000	0.50000	1.00000	1.000	0.000	0.000	0.000	0.000	0.25000
2285006015	PUMP	25	175	GAL/HP	0.51000	0.50000	0.00000	1.000	0.000	0.000	0.000	0.000	0.25000

Table A4. Fuel Hose Characteristics

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2260001010	0	9999	0.45750	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001020	1	175	1.06750	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001030	0	9999	0.30500	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001060	0	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001060	6	25	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001060	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260001060	40	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002006	3	6	0.09379	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002009	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002021	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002027	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002039	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002039	3	6	0.09379	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260002054	1	6	0.09760	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260003030	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260003040	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004015	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004015	1	3	0.11971	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004016	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004016	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004020	1	3	0.11971	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004020	3	6	0.04778	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004021	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004021	3	6	0.09379	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004025	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004025	1	3	0.11971	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004025	3	6	0.04778	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004026	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004026	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2260004026	3	6	0.09379	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004030	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004030	1	3	0.11971	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004030	3	6	0.04778	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004031	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004031	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004031	3	6	0.09379	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004035	1	3	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004035	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004036	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004036	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260004071	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260005035	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260005035	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006005	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006005	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006010	0	1	0.07625	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006010	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006010	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006010	40	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006015	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260006035	1	3	0.09760	0.003177	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2260007005	6	11	0.06100	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001010	0	9999	0.45750	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001020	16	25	1.06750	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001030	0	9999	0.30500	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001050	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001060	0	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265001060	6	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265001060	25	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002003	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002006	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002009	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002009	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002009	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	3	6	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002015	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002021	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265002024	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002024	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002027	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002027	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002027	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002027	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	1	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002030	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	0	1	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002033	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002039	3	6	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002039	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002039	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002039	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002039	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

						Rec Marine Hose Types					
			Non-Rec Marine Hose			Fill Neck Hose		Supply/Return Hose		Vent Hose	
SCC	HPmn	HPmx	Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265002039	40	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002042	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002042	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002042	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002042	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002042	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002045	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002054	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002054	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002054	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002054	16	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002057	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002057	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002057	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002057	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002057	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002060	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002060	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002060	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002060	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002066	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002066	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002066	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265002066	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002066	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002072	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002072	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002072	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002072	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002072	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	25	40	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	40	50	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002078	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002081	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002081	25	40	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002081	40	50	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002081	50	100	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265002081	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003010	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003020	16	25	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003020	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003020	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265003020	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003020	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003020	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003030	300	600	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003040	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003050	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003050	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003050	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003060	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003060	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003060	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003070	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

			Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
SCC	HPmn	HPmx	Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265003070	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003070	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265003070	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004010	1	3	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004010	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004010	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004011	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004011	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004011	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004015	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004016	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004025	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004025	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004025	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004025	16	25	1.50210	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004026	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004026	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004026	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004026	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004030	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004030	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004030	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004030	16	25	1.50210	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	25	40	0.06100	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	40	50	0.06100	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265004031	50	100	0.06100	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004031	100	175	0.06100	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004035	3	6	0.09150	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004035	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004035	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004035	16	25	0.09150	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004036	3	6	0.09150	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004036	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004036	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004036	16	25	0.09150	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004040	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004040	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004040	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004040	16	25	1.50210	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004041	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004041	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004041	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004041	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004046	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004046	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004046	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004046	25	40	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004050	1	3	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004050	3	6	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004051	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004051	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004055	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004055	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004055	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265004055	16	25	1.50210	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004056	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004056	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004056	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004056	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004056	25	40	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	25	40	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	40	50	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	50	100	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004066	100	175	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	25	40	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	40	50	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004071	50	100	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	0	1	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	1	3	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	3	6	0.18810	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	6	11	0.31770	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	11	16	0.93530	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004075	16	25	1.50210	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	0	1	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265004076	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	25	40	0.09150	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	40	50	0.09150	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	50	100	0.09150	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265004076	100	175	0.09150	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005010	3	6	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005010	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005010	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005015	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005015	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005015	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005015	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005015	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005020	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005020	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005025	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005025	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005025	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005025	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005030	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005030	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005030	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005030	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265005035	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005035	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005040	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005040	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005045	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005045	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005055	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	6	16	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265005060	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265006005	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006005	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006010	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006015	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006025	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	1	3	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

			Non-Rec Marine Hose			Rec Marine Hose Types: Fill Neck Hose		Rec Marine Hose Types: Supply/Return Hose		Rec Marine Hose Types: Vent Hose	
SCC	HPmn	HPmx	Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265006030	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006030	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265006035	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265007010	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265007010	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265007010	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265007015	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265007015	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	3	6	0.21860	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265008005	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265010010	6	11	0.39900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265010010	11	16	1.84780	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types					
						Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2265010010	16	25	2.83900	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2265010010	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267001060	25	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002003	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002015	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002021	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002024	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002030	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002033	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002039	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002045	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002054	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002057	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002060	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002066	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002066	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002066	100	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002072	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267002081	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003010	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003020	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003030	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003040	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003050	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267003070	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267004066	25	9999	0.15250	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267005055	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267005060	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006005	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose			Rec Marine Hose Types: Fill Neck Hose		Supply/Return Hose		Vent Hose	
			Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2267006005	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006005	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006005	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006005	300	600	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006010	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006010	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006010	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006015	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006015	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006015	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006025	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006025	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006025	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006025	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006030	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006030	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267006035	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2267008005	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268003020	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268002081	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268003030	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268003040	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268003060	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268003070	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268005055	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268005060	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006005	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006005	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006005	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A4. Fuel Hose Characteristics (cont.)

						Rec Marine Hose Types					
			Non-Rec Marine Hose			Fill Neck Hose		Supply/Return Hose		Vent Hose	
SCC	HPmn	HPmx	Length (meters)	Diameter (meters)	Metal Fraction	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)	Length (meters)	Diameter (meters)
2268006005	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006005	300	600	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006010	25	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006010	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006010	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006010	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006010	300	600	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006015	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006015	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	40	50	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	50	100	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	175	300	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006020	300	600	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268006035	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2268010010	25	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2270000000	0	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2282005010	1	3	0.00000	0.000000	0.00000	0.00000	0.038100	2.44040	0.006350	0.00000	0.006350
2282005010	3	6	0.00000	0.000000	0.00000	0.00000	0.038100	2.44040	0.006350	0.00000	0.006350
2282005010	6	11	0.00000	0.000000	0.00000	0.00000	0.038100	2.44040	0.006350	0.00000	0.006350
2282005010	11	16	0.00000	0.000000	0.00000	0.00000	0.038100	2.44040	0.006350	0.00000	0.006350
2282005010	16	25	0.00000	0.000000	0.00000	0.00000	0.038100	2.44040	0.006350	0.00000	0.006350
2282005010	25	40	0.00000	0.000000	0.00000	1.83000	0.038100	1.83000	0.009525	1.52500	0.015875
2282005010	40	50	0.00000	0.000000	0.00000	2.44000	0.038100	2.44000	0.009525	1.83000	0.015875
2282005010	50	100	0.00000	0.000000	0.00000	3.05000	0.038100	3.05000	0.009525	2.13500	0.015875
2282005010	100	175	0.00000	0.000000	0.00000	3.66000	0.038100	3.66000	0.009525	2.44000	0.015875
2282005010	175	300	0.00000	0.000000	0.00000	4.27000	0.038100	4.27000	0.009525	2.74500	0.015875
2282005015	0	25	0.00000	0.000000	0.00000	0.30500	0.038100	0.61000	0.006350	0.61000	0.006350

Table A4. Fuel Hose Characteristics (cont.)

SCC	HPmn	HPmx	Non-Rec Marine Hose Length (meters)	Non-Rec Marine Hose Diameter (meters)	Non-Rec Marine Hose Metal Fraction	Rec Marine Hose Types: Fill Neck Hose Length (meters)	Fill Neck Hose Diameter (meters)	Supply/Return Hose Length (meters)	Supply/Return Hose Diameter (meters)	Vent Hose Length (meters)	Vent Hose Diameter (meters)
2282005015	25	40	0.00000	0.000000	0.00000	0.30500	0.038100	0.91500	0.006350	0.61000	0.006350
2282005015	40	50	0.00000	0.000000	0.00000	0.30500	0.038100	1.22000	0.006350	0.61000	0.006350
2282005015	50	100	0.00000	0.000000	0.00000	0.45750	0.038100	1.52500	0.006350	0.61000	0.006350
2282005015	100	300	0.00000	0.000000	0.00000	0.61000	0.038100	1.83000	0.006350	0.61000	0.006350
2282010005	3	6	0.00000	0.000000	0.00000	0.31000	0.038100	1.22000	0.009525	0.30500	0.015875
2282010005	6	11	0.00000	0.000000	0.00000	0.31000	0.038100	1.22000	0.009525	0.30500	0.015875
2282010005	11	25	0.00000	0.000000	0.00000	0.31000	0.038100	1.22000	0.009525	0.30500	0.015875
2282010005	25	50	0.00000	0.000000	0.00000	0.61000	0.038100	1.22000	0.009525	1.22000	0.015875
2282010005	50	100	0.00000	0.000000	0.00000	1.22000	0.038100	1.52500	0.009525	1.83000	0.015875
2282010005	100	175	0.00000	0.000000	0.00000	1.83000	0.038100	1.83000	0.009525	2.44000	0.015875
2282010005	175	300	0.00000	0.000000	0.00000	2.44000	0.038100	2.13500	0.009525	3.05000	0.015875
2282010005	300	600	0.00000	0.000000	0.00000	3.05000	0.038100	2.44000	0.009525	3.66000	0.015875
2282010005	600	750	0.00000	0.000000	0.00000	3.66000	0.038100	2.74500	0.009525	4.27000	0.015875
2282020005	0	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2282020010	0	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2282020025	0	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285002015	0	9999	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	1	3	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	3	6	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	6	11	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	11	16	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	16	25	0.10000	0.006354	0.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	25	40	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285004015	100	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000
2285006015	25	175	0.10000	0.006354	1.00000	0.00000	0.000000	0.00000	0.000000	0.00000	0.000000

Table A5. Ethanol (E10) Permeation Adjustment Factors*

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2260001010	0	9999	1.000	1.000	0.000	0.000	0.000
2260001020	1	175	1.000	1.000	0.000	0.000	0.000
2260001030	0	9999	1.000	1.000	0.000	0.000	0.000
2260001060	0	6	1.100	1.820	0.000	0.000	0.000
2260001060	6	25	1.100	1.820	0.000	0.000	0.000
2260001060	25	40	1.100	1.820	0.000	0.000	0.000
2260001060	40	100	1.100	1.820	0.000	0.000	0.000
2260002006	3	6	1.100	1.820	0.000	0.000	0.000
2260002009	1	3	1.100	1.820	0.000	0.000	0.000
2260002021	1	3	1.100	1.820	0.000	0.000	0.000
2260002027	1	3	1.100	1.820	0.000	0.000	0.000
2260002039	1	3	1.100	1.820	0.000	0.000	0.000
2260002039	3	6	1.100	1.820	0.000	0.000	0.000
2260002054	1	6	1.100	1.820	0.000	0.000	0.000
2260003030	1	3	1.100	1.820	0.000	0.000	0.000
2260003040	1	3	1.100	1.820	0.000	0.000	0.000
2260004015	0	1	1.100	1.820	0.000	0.000	0.000
2260004015	1	3	1.100	1.820	0.000	0.000	0.000
2260004016	0	1	1.100	1.820	0.000	0.000	0.000
2260004016	1	3	1.100	1.820	0.000	0.000	0.000
2260004020	1	3	2.000	1.820	0.000	0.000	0.000
2260004020	3	6	2.000	1.820	0.000	0.000	0.000
2260004021	1	3	2.000	1.820	0.000	0.000	0.000
2260004021	3	6	2.000	1.820	0.000	0.000	0.000
2260004025	0	1	1.110	1.820	0.000	0.000	0.000
2260004025	1	3	1.110	1.820	0.000	0.000	0.000
2260004025	3	6	1.110	1.820	0.000	0.000	0.000
2260004026	0	1	1.110	1.820	0.000	0.000	0.000
2260004026	1	3	1.110	1.820	0.000	0.000	0.000
2260004026	3	6	1.110	1.820	0.000	0.000	0.000
2260004030	0	1	1.100	1.820	0.000	0.000	0.000
2260004030	1	3	1.100	1.820	0.000	0.000	0.000
2260004030	3	6	1.100	1.820	0.000	0.000	0.000
2260004031	0	1	1.100	1.820	0.000	0.000	0.000
2260004031	1	3	1.100	1.820	0.000	0.000	0.000
2260004031	3	6	1.100	1.820	0.000	0.000	0.000
2260004035	1	3	1.100	1.820	0.000	0.000	0.000
2260004035	3	6	1.100	1.820	0.000	0.000	0.000
2260004036	1	3	1.100	1.820	0.000	0.000	0.000
2260004036	3	6	1.100	1.820	0.000	0.000	0.000
2260004071	1	3	1.100	1.820	0.000	0.000	0.000
2260005035	0	1	1.100	1.820	0.000	0.000	0.000
2260005035	1	3	1.100	1.820	0.000	0.000	0.000
2260006005	0	1	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2260006005	1	3	1.100	1.820	0.000	0.000	0.000
2260006010	0	1	1.100	1.820	0.000	0.000	0.000
2260006010	1	3	1.100	1.820	0.000	0.000	0.000
2260006010	25	40	1.100	1.820	0.000	0.000	0.000
2260006010	40	100	1.100	1.820	0.000	0.000	0.000
2260006015	1	3	1.100	1.820	0.000	0.000	0.000
2260006035	1	3	1.110	1.820	0.000	0.000	0.000
2260007005	6	11	2.000	1.820	0.000	0.000	0.000
2265001010	0	9999	1.000	1.000	0.000	0.000	0.000
2265001020	16	25	1.000	1.000	0.000	0.000	0.000
2265001030	0	9999	1.000	1.000	0.000	0.000	0.000
2265001050	6	11	1.100	1.820	0.000	0.000	0.000
2265001060	0	6	1.100	1.820	0.000	0.000	0.000
2265001060	6	25	1.100	1.820	0.000	0.000	0.000
2265001060	25	175	1.100	1.820	0.000	0.000	0.000
2265002003	3	6	1.100	1.820	0.000	0.000	0.000
2265002003	6	11	1.100	1.820	0.000	0.000	0.000
2265002003	11	16	1.100	1.820	0.000	0.000	0.000
2265002003	16	25	1.100	1.820	0.000	0.000	0.000
2265002003	25	40	1.100	1.820	0.000	0.000	0.000
2265002003	40	50	1.100	1.820	0.000	0.000	0.000
2265002003	50	100	1.100	1.820	0.000	0.000	0.000
2265002006	6	11	1.100	1.820	0.000	0.000	0.000
2265002009	3	6	1.100	1.820	0.000	0.000	0.000
2265002009	6	11	1.100	1.820	0.000	0.000	0.000
2265002009	11	16	1.100	1.820	0.000	0.000	0.000
2265002015	3	6	1.100	1.820	0.000	0.000	0.000
2265002015	6	11	1.100	1.820	0.000	0.000	0.000
2265002015	11	16	1.100	1.820	0.000	0.000	0.000
2265002015	16	25	1.100	1.820	0.000	0.000	0.000
2265002015	25	40	1.100	1.820	0.000	0.000	0.000
2265002015	40	50	1.100	1.820	0.000	0.000	0.000
2265002015	50	100	1.100	1.820	0.000	0.000	0.000
2265002021	3	6	1.100	1.820	0.000	0.000	0.000
2265002021	6	11	1.100	1.820	0.000	0.000	0.000
2265002021	11	16	1.100	1.820	0.000	0.000	0.000
2265002021	16	25	1.100	1.820	0.000	0.000	0.000
2265002021	25	40	1.100	1.820	0.000	0.000	0.000
2265002021	50	100	1.100	1.820	0.000	0.000	0.000
2265002024	3	6	1.100	1.820	0.000	0.000	0.000
2265002024	6	11	1.100	1.820	0.000	0.000	0.000
2265002024	11	16	1.100	1.820	0.000	0.000	0.000
2265002024	16	25	1.100	1.820	0.000	0.000	0.000
2265002024	25	40	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265002024	40	50	1.100	1.820	0.000	0.000	0.000
2265002024	50	100	1.100	1.820	0.000	0.000	0.000
2265002027	3	6	1.100	1.820	0.000	0.000	0.000
2265002027	6	11	1.100	1.820	0.000	0.000	0.000
2265002027	11	16	1.100	1.820	0.000	0.000	0.000
2265002027	16	25	1.100	1.820	0.000	0.000	0.000
2265002030	1	6	1.100	1.820	0.000	0.000	0.000
2265002030	6	11	1.100	1.820	0.000	0.000	0.000
2265002030	11	16	1.100	1.820	0.000	0.000	0.000
2265002030	16	25	1.100	1.820	0.000	0.000	0.000
2265002030	25	40	1.100	1.820	0.000	0.000	0.000
2265002030	40	50	1.100	1.820	0.000	0.000	0.000
2265002030	50	100	1.100	1.820	0.000	0.000	0.000
2265002033	0	1	1.100	1.820	0.000	0.000	0.000
2265002033	1	3	1.100	1.820	0.000	0.000	0.000
2265002033	3	6	1.100	1.820	0.000	0.000	0.000
2265002033	6	11	1.100	1.820	0.000	0.000	0.000
2265002033	11	16	1.100	1.820	0.000	0.000	0.000
2265002033	16	25	1.100	1.820	0.000	0.000	0.000
2265002033	25	40	1.100	1.820	0.000	0.000	0.000
2265002033	40	50	1.100	1.820	0.000	0.000	0.000
2265002033	50	100	1.100	1.820	0.000	0.000	0.000
2265002033	100	175	1.100	1.820	0.000	0.000	0.000
2265002039	3	6	1.100	1.820	0.000	0.000	0.000
2265002039	6	11	1.100	1.820	0.000	0.000	0.000
2265002039	11	16	1.100	1.820	0.000	0.000	0.000
2265002039	16	25	1.100	1.820	0.000	0.000	0.000
2265002039	25	40	1.100	1.820	0.000	0.000	0.000
2265002039	40	100	1.100	1.820	0.000	0.000	0.000
2265002042	1	3	1.100	1.820	0.000	0.000	0.000
2265002042	3	6	1.100	1.820	0.000	0.000	0.000
2265002042	6	11	1.100	1.820	0.000	0.000	0.000
2265002042	11	16	1.100	1.820	0.000	0.000	0.000
2265002042	16	25	1.100	1.820	0.000	0.000	0.000
2265002045	6	11	1.100	1.820	0.000	0.000	0.000
2265002045	11	16	1.100	1.820	0.000	0.000	0.000
2265002045	16	25	1.100	1.820	0.000	0.000	0.000
2265002045	25	40	1.100	1.820	0.000	0.000	0.000
2265002045	40	50	1.100	1.820	0.000	0.000	0.000
2265002045	50	100	1.100	1.820	0.000	0.000	0.000
2265002045	100	175	1.100	1.820	0.000	0.000	0.000
2265002054	3	6	1.100	1.820	0.000	0.000	0.000
2265002054	6	11	1.100	1.820	0.000	0.000	0.000
2265002054	11	16	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265002054	16	175	1.100	1.820	0.000	0.000	0.000
2265002057	16	25	1.100	1.820	0.000	0.000	0.000
2265002057	25	40	1.100	1.820	0.000	0.000	0.000
2265002057	40	50	1.100	1.820	0.000	0.000	0.000
2265002057	50	100	1.100	1.820	0.000	0.000	0.000
2265002057	100	175	1.100	1.820	0.000	0.000	0.000
2265002060	25	40	1.100	1.820	0.000	0.000	0.000
2265002060	40	50	1.100	1.820	0.000	0.000	0.000
2265002060	50	100	1.100	1.820	0.000	0.000	0.000
2265002060	100	175	1.100	1.820	0.000	0.000	0.000
2265002066	6	11	1.100	1.820	0.000	0.000	0.000
2265002066	16	25	1.100	1.820	0.000	0.000	0.000
2265002066	25	40	1.100	1.820	0.000	0.000	0.000
2265002066	40	50	1.100	1.820	0.000	0.000	0.000
2265002066	50	100	1.100	1.820	0.000	0.000	0.000
2265002072	11	16	1.100	1.820	0.000	0.000	0.000
2265002072	16	25	1.100	1.820	0.000	0.000	0.000
2265002072	25	40	1.100	1.820	0.000	0.000	0.000
2265002072	40	50	1.100	1.820	0.000	0.000	0.000
2265002072	50	100	1.100	1.820	0.000	0.000	0.000
2265002078	3	6	1.100	1.820	0.000	0.000	0.000
2265002078	6	11	1.100	1.820	0.000	0.000	0.000
2265002078	11	16	1.100	1.820	0.000	0.000	0.000
2265002078	16	25	1.100	1.820	0.000	0.000	0.000
2265002078	25	40	1.100	1.820	0.000	0.000	0.000
2265002078	40	50	1.100	1.820	0.000	0.000	0.000
2265002078	50	100	1.100	1.820	0.000	0.000	0.000
2265002081	16	25	1.100	1.820	0.000	0.000	0.000
2265002081	25	40	1.100	1.820	0.000	0.000	0.000
2265002081	40	50	1.100	1.820	0.000	0.000	0.000
2265002081	50	100	1.100	1.820	0.000	0.000	0.000
2265002081	100	175	1.100	1.820	0.000	0.000	0.000
2265003010	6	11	1.100	1.820	0.000	0.000	0.000
2265003010	11	16	1.100	1.820	0.000	0.000	0.000
2265003010	16	25	1.100	1.820	0.000	0.000	0.000
2265003010	25	40	1.100	1.820	0.000	0.000	0.000
2265003010	40	50	1.100	1.820	0.000	0.000	0.000
2265003010	50	100	1.100	1.820	0.000	0.000	0.000
2265003010	100	175	1.100	1.820	0.000	0.000	0.000
2265003020	16	25	1.100	1.820	0.000	0.000	0.000
2265003020	25	40	1.100	1.820	0.000	0.000	0.000
2265003020	40	50	1.100	1.820	0.000	0.000	0.000
2265003020	50	100	1.100	1.820	0.000	0.000	0.000
2265003020	100	175	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265003020	175	300	1.100	1.820	0.000	0.000	0.000
2265003030	3	6	1.100	1.820	0.000	0.000	0.000
2265003030	6	11	1.100	1.820	0.000	0.000	0.000
2265003030	11	16	1.100	1.820	0.000	0.000	0.000
2265003030	16	25	1.100	1.820	0.000	0.000	0.000
2265003030	25	40	1.100	1.820	0.000	0.000	0.000
2265003030	40	50	1.100	1.820	0.000	0.000	0.000
2265003030	50	100	1.100	1.820	0.000	0.000	0.000
2265003030	100	175	1.100	1.820	0.000	0.000	0.000
2265003030	175	300	1.100	1.820	0.000	0.000	0.000
2265003030	300	600	1.100	1.820	0.000	0.000	0.000
2265003040	3	6	1.100	1.820	0.000	0.000	0.000
2265003040	6	11	1.100	1.820	0.000	0.000	0.000
2265003040	11	16	1.100	1.820	0.000	0.000	0.000
2265003040	16	25	1.100	1.820	0.000	0.000	0.000
2265003040	25	40	1.100	1.820	0.000	0.000	0.000
2265003040	40	50	1.100	1.820	0.000	0.000	0.000
2265003040	50	100	1.100	1.820	0.000	0.000	0.000
2265003040	100	175	1.100	1.820	0.000	0.000	0.000
2265003040	175	300	1.100	1.820	0.000	0.000	0.000
2265003050	1	3	1.100	1.820	0.000	0.000	0.000
2265003050	16	25	1.100	1.820	0.000	0.000	0.000
2265003050	50	100	1.100	1.820	0.000	0.000	0.000
2265003060	6	11	1.100	1.820	0.000	0.000	0.000
2265003060	11	16	1.100	1.820	0.000	0.000	0.000
2265003060	16	25	1.100	1.820	0.000	0.000	0.000
2265003070	25	40	1.100	1.820	0.000	0.000	0.000
2265003070	50	100	1.100	1.820	0.000	0.000	0.000
2265003070	100	175	1.100	1.820	0.000	0.000	0.000
2265003070	175	300	1.100	1.820	0.000	0.000	0.000
2265004010	1	3	1.100	1.820	0.000	0.000	0.000
2265004010	3	6	1.100	1.820	0.000	0.000	0.000
2265004010	6	11	1.100	1.820	0.000	0.000	0.000
2265004011	1	3	1.100	1.820	0.000	0.000	0.000
2265004011	3	6	1.100	1.820	0.000	0.000	0.000
2265004011	6	11	1.100	1.820	0.000	0.000	0.000
2265004015	3	6	1.100	1.820	0.000	0.000	0.000
2265004016	3	6	1.100	1.820	0.000	0.000	0.000
2265004025	3	6	1.110	1.820	0.000	0.000	0.000
2265004025	6	11	1.100	1.820	0.000	0.000	0.000
2265004025	11	16	1.100	1.820	0.000	0.000	0.000
2265004025	16	25	1.100	1.820	0.000	0.000	0.000
2265004026	3	6	1.110	1.820	0.000	0.000	0.000
2265004026	6	11	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265004026	11	16	1.100	1.820	0.000	0.000	0.000
2265004026	16	25	1.100	1.820	0.000	0.000	0.000
2265004030	3	6	1.100	1.820	0.000	0.000	0.000
2265004030	6	11	1.100	1.820	0.000	0.000	0.000
2265004030	11	16	1.100	1.820	0.000	0.000	0.000
2265004030	16	25	1.100	1.820	0.000	0.000	0.000
2265004031	3	6	1.100	1.820	0.000	0.000	0.000
2265004031	6	11	1.100	1.820	0.000	0.000	0.000
2265004031	11	16	1.100	1.820	0.000	0.000	0.000
2265004031	16	25	1.100	1.820	0.000	0.000	0.000
2265004031	25	40	1.100	1.820	0.000	0.000	0.000
2265004031	40	50	1.100	1.820	0.000	0.000	0.000
2265004031	50	100	1.100	1.820	0.000	0.000	0.000
2265004031	100	175	1.100	1.820	0.000	0.000	0.000
2265004035	3	6	1.100	1.820	0.000	0.000	0.000
2265004035	6	11	1.100	1.820	0.000	0.000	0.000
2265004035	11	16	1.100	1.820	0.000	0.000	0.000
2265004035	16	25	1.100	1.820	0.000	0.000	0.000
2265004036	3	6	1.100	1.820	0.000	0.000	0.000
2265004036	6	11	1.100	1.820	0.000	0.000	0.000
2265004036	11	16	1.100	1.820	0.000	0.000	0.000
2265004036	16	25	1.100	1.820	0.000	0.000	0.000
2265004040	3	6	1.100	1.820	0.000	0.000	0.000
2265004040	6	11	1.100	1.820	0.000	0.000	0.000
2265004040	11	16	1.100	1.820	0.000	0.000	0.000
2265004040	16	25	1.100	1.820	0.000	0.000	0.000
2265004041	3	6	1.100	1.820	0.000	0.000	0.000
2265004041	6	11	1.100	1.820	0.000	0.000	0.000
2265004041	11	16	1.100	1.820	0.000	0.000	0.000
2265004041	16	25	1.100	1.820	0.000	0.000	0.000
2265004046	6	11	1.100	1.820	0.000	0.000	0.000
2265004046	11	16	1.100	1.820	0.000	0.000	0.000
2265004046	16	25	1.100	1.820	0.000	0.000	0.000
2265004046	25	40	1.100	1.820	0.000	0.000	0.000
2265004050	1	3	1.100	1.820	0.000	0.000	0.000
2265004050	3	6	1.100	1.820	0.000	0.000	0.000
2265004051	1	3	1.100	1.820	0.000	0.000	0.000
2265004051	3	6	1.100	1.820	0.000	0.000	0.000
2265004055	3	6	1.100	1.820	0.000	0.000	0.000
2265004055	6	11	1.100	1.820	0.000	0.000	0.000
2265004055	11	16	1.100	1.820	0.000	0.000	0.000
2265004055	16	25	1.100	1.820	0.000	0.000	0.000
2265004056	3	6	1.100	1.820	0.000	0.000	0.000
2265004056	6	11	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265004056	11	16	1.100	1.820	0.000	0.000	0.000
2265004056	16	25	1.100	1.820	0.000	0.000	0.000
2265004056	25	40	1.100	1.820	0.000	0.000	0.000
2265004066	3	6	1.100	1.820	0.000	0.000	0.000
2265004066	6	11	1.100	1.820	0.000	0.000	0.000
2265004066	11	16	1.100	1.820	0.000	0.000	0.000
2265004066	16	25	1.100	1.820	0.000	0.000	0.000
2265004066	25	40	1.100	1.820	0.000	0.000	0.000
2265004066	40	50	1.100	1.820	0.000	0.000	0.000
2265004066	50	100	1.100	1.820	0.000	0.000	0.000
2265004066	100	175	1.100	1.820	0.000	0.000	0.000
2265004071	3	6	1.100	1.820	0.000	0.000	0.000
2265004071	6	11	1.100	1.820	0.000	0.000	0.000
2265004071	11	16	1.100	1.820	0.000	0.000	0.000
2265004071	16	25	1.100	1.820	0.000	0.000	0.000
2265004071	25	40	1.100	1.820	0.000	0.000	0.000
2265004071	40	50	1.100	1.820	0.000	0.000	0.000
2265004071	50	100	1.100	1.820	0.000	0.000	0.000
2265004075	0	1	1.100	1.820	0.000	0.000	0.000
2265004075	1	3	1.100	1.820	0.000	0.000	0.000
2265004075	3	6	1.100	1.820	0.000	0.000	0.000
2265004075	6	11	1.100	1.820	0.000	0.000	0.000
2265004075	11	16	1.100	1.820	0.000	0.000	0.000
2265004075	16	25	1.100	1.820	0.000	0.000	0.000
2265004076	0	1	1.100	1.820	0.000	0.000	0.000
2265004076	1	3	1.100	1.820	0.000	0.000	0.000
2265004076	3	6	1.100	1.820	0.000	0.000	0.000
2265004076	6	11	1.100	1.820	0.000	0.000	0.000
2265004076	11	16	1.100	1.820	0.000	0.000	0.000
2265004076	16	25	1.100	1.820	0.000	0.000	0.000
2265004076	25	40	1.100	1.820	0.000	0.000	0.000
2265004076	40	50	1.100	1.820	0.000	0.000	0.000
2265004076	50	100	1.100	1.820	0.000	0.000	0.000
2265004076	100	175	1.100	1.820	0.000	0.000	0.000
2265005010	3	6	1.100	1.820	0.000	0.000	0.000
2265005010	6	11	1.100	1.820	0.000	0.000	0.000
2265005010	11	16	1.100	1.820	0.000	0.000	0.000
2265005015	16	25	1.100	1.820	0.000	0.000	0.000
2265005015	25	40	1.100	1.820	0.000	0.000	0.000
2265005015	40	50	1.100	1.820	0.000	0.000	0.000
2265005015	50	100	1.100	1.820	0.000	0.000	0.000
2265005015	100	175	1.100	1.820	0.000	0.000	0.000
2265005020	50	100	1.100	1.820	0.000	0.000	0.000
2265005020	100	175	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265005025	25	40	1.100	1.820	0.000	0.000	0.000
2265005025	40	50	1.100	1.820	0.000	0.000	0.000
2265005025	50	100	1.100	1.820	0.000	0.000	0.000
2265005025	100	175	1.100	1.820	0.000	0.000	0.000
2265005030	3	6	1.100	1.820	0.000	0.000	0.000
2265005030	6	11	1.100	1.820	0.000	0.000	0.000
2265005030	11	16	1.100	1.820	0.000	0.000	0.000
2265005030	16	25	1.100	1.820	0.000	0.000	0.000
2265005035	3	6	1.100	1.820	0.000	0.000	0.000
2265005035	6	11	1.100	1.820	0.000	0.000	0.000
2265005035	11	16	1.100	1.820	0.000	0.000	0.000
2265005035	16	25	1.100	1.820	0.000	0.000	0.000
2265005035	25	40	1.100	1.820	0.000	0.000	0.000
2265005035	40	50	1.100	1.820	0.000	0.000	0.000
2265005035	50	100	1.100	1.820	0.000	0.000	0.000
2265005035	100	175	1.100	1.820	0.000	0.000	0.000
2265005040	6	11	1.100	1.820	0.000	0.000	0.000
2265005040	11	16	1.100	1.820	0.000	0.000	0.000
2265005045	50	100	1.100	1.820	0.000	0.000	0.000
2265005045	100	175	1.100	1.820	0.000	0.000	0.000
2265005055	3	6	1.100	1.820	0.000	0.000	0.000
2265005055	6	11	1.100	1.820	0.000	0.000	0.000
2265005055	11	16	1.100	1.820	0.000	0.000	0.000
2265005055	16	25	1.100	1.820	0.000	0.000	0.000
2265005055	25	40	1.100	1.820	0.000	0.000	0.000
2265005055	40	50	1.100	1.820	0.000	0.000	0.000
2265005055	50	100	1.100	1.820	0.000	0.000	0.000
2265005055	100	175	1.100	1.820	0.000	0.000	0.000
2265005055	175	300	1.100	1.820	0.000	0.000	0.000
2265005060	3	6	1.100	1.820	0.000	0.000	0.000
2265005060	6	16	1.100	1.820	0.000	0.000	0.000
2265005060	16	25	1.100	1.820	0.000	0.000	0.000
2265005060	50	100	1.100	1.820	0.000	0.000	0.000
2265005060	100	175	1.100	1.820	0.000	0.000	0.000
2265005060	175	300	1.100	1.820	0.000	0.000	0.000
2265006005	3	6	1.100	1.820	0.000	0.000	0.000
2265006005	6	11	1.100	1.820	0.000	0.000	0.000
2265006005	11	16	1.100	1.820	0.000	0.000	0.000
2265006005	16	25	1.100	1.820	0.000	0.000	0.000
2265006005	25	40	1.100	1.820	0.000	0.000	0.000
2265006005	40	50	1.100	1.820	0.000	0.000	0.000
2265006005	50	100	1.100	1.820	0.000	0.000	0.000
2265006005	100	175	1.100	1.820	0.000	0.000	0.000
2265006005	175	300	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265006010	3	6	1.100	1.820	0.000	0.000	0.000
2265006010	6	11	1.100	1.820	0.000	0.000	0.000
2265006010	11	16	1.100	1.820	0.000	0.000	0.000
2265006010	16	25	1.100	1.820	0.000	0.000	0.000
2265006010	25	40	1.100	1.820	0.000	0.000	0.000
2265006010	40	50	1.100	1.820	0.000	0.000	0.000
2265006010	50	100	1.100	1.820	0.000	0.000	0.000
2265006010	100	175	1.100	1.820	0.000	0.000	0.000
2265006015	3	6	1.100	1.820	0.000	0.000	0.000
2265006015	6	11	1.100	1.820	0.000	0.000	0.000
2265006015	11	16	1.100	1.820	0.000	0.000	0.000
2265006015	16	25	1.100	1.820	0.000	0.000	0.000
2265006015	25	50	1.100	1.820	0.000	0.000	0.000
2265006015	50	100	1.100	1.820	0.000	0.000	0.000
2265006015	100	175	1.100	1.820	0.000	0.000	0.000
2265006025	3	6	1.100	1.820	0.000	0.000	0.000
2265006025	6	11	1.100	1.820	0.000	0.000	0.000
2265006025	11	16	1.100	1.820	0.000	0.000	0.000
2265006025	16	25	1.100	1.820	0.000	0.000	0.000
2265006025	25	40	1.100	1.820	0.000	0.000	0.000
2265006025	40	50	1.100	1.820	0.000	0.000	0.000
2265006025	50	100	1.100	1.820	0.000	0.000	0.000
2265006025	100	175	1.100	1.820	0.000	0.000	0.000
2265006030	1	3	1.100	1.820	0.000	0.000	0.000
2265006030	3	6	1.100	1.820	0.000	0.000	0.000
2265006030	6	11	1.100	1.820	0.000	0.000	0.000
2265006030	11	16	1.100	1.820	0.000	0.000	0.000
2265006030	16	25	1.100	1.820	0.000	0.000	0.000
2265006030	25	40	1.100	1.820	0.000	0.000	0.000
2265006030	40	50	1.100	1.820	0.000	0.000	0.000
2265006030	50	100	1.100	1.820	0.000	0.000	0.000
2265006035	3	6	1.100	1.820	0.000	0.000	0.000
2265006035	6	11	1.100	1.820	0.000	0.000	0.000
2265006035	11	16	1.100	1.820	0.000	0.000	0.000
2265006035	16	25	1.100	1.820	0.000	0.000	0.000
2265006035	25	40	1.100	1.820	0.000	0.000	0.000
2265006035	40	50	1.100	1.820	0.000	0.000	0.000
2265006035	50	100	1.100	1.820	0.000	0.000	0.000
2265006035	100	175	1.100	1.820	0.000	0.000	0.000
2265007010	6	11	1.100	1.820	0.000	0.000	0.000
2265007010	11	16	1.100	1.820	0.000	0.000	0.000
2265007010	16	25	1.100	1.820	0.000	0.000	0.000
2265007015	3	6	1.100	1.820	0.000	0.000	0.000
2265007015	6	11	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2265008005	3	6	1.100	1.820	0.000	0.000	0.000
2265008005	6	11	1.100	1.820	0.000	0.000	0.000
2265008005	11	16	1.100	1.820	0.000	0.000	0.000
2265008005	16	25	1.100	1.820	0.000	0.000	0.000
2265008005	25	40	1.100	1.820	0.000	0.000	0.000
2265008005	40	50	1.100	1.820	0.000	0.000	0.000
2265008005	50	100	1.100	1.820	0.000	0.000	0.000
2265008005	100	175	1.100	1.820	0.000	0.000	0.000
2265010010	6	11	1.100	1.820	0.000	0.000	0.000
2265010010	11	16	1.100	1.820	0.000	0.000	0.000
2265010010	16	25	1.100	1.820	0.000	0.000	0.000
2265010010	25	40	1.100	1.820	0.000	0.000	0.000
2267001060	25	175	1.100	1.820	0.000	0.000	0.000
2267002003	25	9999	1.100	1.820	0.000	0.000	0.000
2267002015	25	9999	1.100	1.820	0.000	0.000	0.000
2267002021	25	9999	1.100	1.820	0.000	0.000	0.000
2267002024	25	9999	1.100	1.820	0.000	0.000	0.000
2267002030	25	9999	1.100	1.820	0.000	0.000	0.000
2267002033	25	9999	1.100	1.820	0.000	0.000	0.000
2267002039	25	9999	1.100	1.820	0.000	0.000	0.000
2267002045	25	9999	1.100	1.820	0.000	0.000	0.000
2267002054	25	9999	1.100	1.820	0.000	0.000	0.000
2267002057	25	9999	1.100	1.820	0.000	0.000	0.000
2267002060	25	9999	1.100	1.820	0.000	0.000	0.000
2267002066	25	50	1.100	1.820	0.000	0.000	0.000
2267002066	50	100	1.100	1.820	0.000	0.000	0.000
2267002066	100	9999	1.100	1.820	0.000	0.000	0.000
2267002072	25	9999	1.100	1.820	0.000	0.000	0.000
2267002081	25	9999	1.100	1.820	0.000	0.000	0.000
2267003010	25	9999	1.100	1.820	0.000	0.000	0.000
2267003020	25	9999	1.100	1.820	0.000	0.000	0.000
2267003030	25	9999	1.100	1.820	0.000	0.000	0.000
2267003040	25	9999	1.100	1.820	0.000	0.000	0.000
2267003050	25	9999	1.100	1.820	0.000	0.000	0.000
2267003070	25	9999	1.100	1.820	0.000	0.000	0.000
2267004066	25	9999	1.100	1.820	0.000	0.000	0.000
2267005055	25	9999	1.100	1.820	0.000	0.000	0.000
2267005060	25	9999	1.100	1.820	0.000	0.000	0.000
2267006005	25	50	1.100	1.820	0.000	0.000	0.000
2267006005	50	100	1.100	1.820	0.000	0.000	0.000
2267006005	100	175	1.100	1.820	0.000	0.000	0.000
2267006005	175	300	1.100	1.820	0.000	0.000	0.000
2267006005	300	600	1.100	1.820	0.000	0.000	0.000
2267006010	25	50	1.100	1.820	0.000	0.000	0.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2267006010	50	100	1.100	1.820	0.000	0.000	0.000
2267006010	100	175	1.100	1.820	0.000	0.000	0.000
2267006015	25	50	1.100	1.820	0.000	0.000	0.000
2267006015	50	100	1.100	1.820	0.000	0.000	0.000
2267006015	100	175	1.100	1.820	0.000	0.000	0.000
2267006025	25	40	1.100	1.820	0.000	0.000	0.000
2267006025	40	50	1.100	1.820	0.000	0.000	0.000
2267006025	50	100	1.100	1.820	0.000	0.000	0.000
2267006025	100	175	1.100	1.820	0.000	0.000	0.000
2267006030	25	50	1.100	1.820	0.000	0.000	0.000
2267006030	50	100	1.100	1.820	0.000	0.000	0.000
2267006035	25	9999	1.100	1.820	0.000	0.000	0.000
2267008005	25	9999	1.100	1.820	0.000	0.000	0.000
2268003020	25	9999	1.100	1.820	0.000	0.000	0.000
2268002081	25	9999	1.100	1.820	0.000	0.000	0.000
2268003030	25	9999	1.100	1.820	0.000	0.000	0.000
2268003040	25	9999	1.100	1.820	0.000	0.000	0.000
2268003060	25	9999	1.100	1.820	0.000	0.000	0.000
2268003070	25	9999	1.100	1.820	0.000	0.000	0.000
2268005055	25	9999	1.100	1.820	0.000	0.000	0.000
2268005060	25	9999	1.100	1.820	0.000	0.000	0.000
2268006005	25	50	1.100	1.820	0.000	0.000	0.000
2268006005	50	100	1.100	1.820	0.000	0.000	0.000
2268006005	100	175	1.100	1.820	0.000	0.000	0.000
2268006005	175	300	1.100	1.820	0.000	0.000	0.000
2268006005	300	600	1.100	1.820	0.000	0.000	0.000
2268006010	25	50	1.100	1.820	0.000	0.000	0.000
2268006010	50	100	1.100	1.820	0.000	0.000	0.000
2268006010	100	175	1.100	1.820	0.000	0.000	0.000
2268006010	175	300	1.100	1.820	0.000	0.000	0.000
2268006010	300	600	1.100	1.820	0.000	0.000	0.000
2268006015	50	100	1.100	1.820	0.000	0.000	0.000
2268006015	100	175	1.100	1.820	0.000	0.000	0.000
2268006020	25	40	1.100	1.820	0.000	0.000	0.000
2268006020	40	50	1.100	1.820	0.000	0.000	0.000
2268006020	50	100	1.100	1.820	0.000	0.000	0.000
2268006020	100	175	1.100	1.820	0.000	0.000	0.000
2268006020	175	300	1.100	1.820	0.000	0.000	0.000
2268006020	300	600	1.100	1.820	0.000	0.000	0.000
2268006035	25	9999	1.100	1.820	0.000	0.000	0.000
2268010010	25	9999	1.100	1.820	0.000	0.000	0.000
2270000000	0	9999	1.100	1.820	0.000	0.000	0.000
2282005010	1	3	1.100	0.000	2.000	1.820	2.000
2282005010	3	6	1.100	0.000	2.000	1.820	2.000

Table A5. Ethanol (E10) Permeation Adjustment Factors (cont.)

SCC	HPmn	HPmx	E10 Adjustment Factors				
			Non-Metal Tank	Non-RecMar Hose	RecMarine Fill Neck	RecMarine Sup/Ret	RecMarine Vent
2282005010	6	11	1.100	0.000	2.000	1.820	2.000
2282005010	11	16	1.100	0.000	2.000	1.820	2.000
2282005010	16	25	1.100	0.000	2.000	1.820	2.000
2282005010	25	40	1.100	0.000	2.000	2.980	2.000
2282005010	40	50	1.100	0.000	2.000	2.980	2.000
2282005010	50	100	1.100	0.000	2.000	2.980	2.000
2282005010	100	175	1.100	0.000	2.000	2.980	2.000
2282005010	175	300	1.100	0.000	2.000	2.980	2.000
2282005015	0	25	1.100	0.000	2.000	2.980	2.000
2282005015	25	40	1.100	0.000	2.000	2.980	2.000
2282005015	40	50	1.100	0.000	2.000	2.980	2.000
2282005015	50	100	1.100	0.000	2.000	2.980	2.000
2282005015	100	300	1.100	0.000	2.000	2.980	2.000
2282010005	3	6	1.100	0.000	2.000	1.820	2.000
2282010005	6	11	1.100	0.000	2.000	1.820	2.000
2282010005	11	25	1.100	0.000	2.000	1.820	2.000
2282010005	25	50	1.100	0.000	2.000	1.820	2.000
2282010005	50	100	1.100	0.000	2.000	1.820	2.000
2282010005	100	175	1.100	0.000	2.000	1.820	2.000
2282010005	175	300	1.100	0.000	2.000	1.820	2.000
2282010005	300	600	1.100	0.000	2.000	1.820	2.000
2282010005	600	750	1.100	0.000	2.000	1.820	2.000
2282020005	0	9999	1.100	1.820	0.000	0.000	0.000
2282020010	0	9999	1.100	1.820	0.000	0.000	0.000
2282020025	0	9999	1.100	1.820	0.000	0.000	0.000
2285002015	0	9999	1.100	1.820	0.000	0.000	0.000
2285004015	1	3	1.100	1.820	0.000	0.000	0.000
2285004015	3	6	1.100	1.820	0.000	0.000	0.000
2285004015	6	11	1.100	1.820	0.000	0.000	0.000
2285004015	11	16	1.100	1.820	0.000	0.000	0.000
2285004015	16	25	1.100	1.820	0.000	0.000	0.000
2285004015	25	40	1.100	1.820	0.000	0.000	0.000
2285004015	100	175	1.100	1.820	0.000	0.000	0.000
2285006015	25	175	1.100	1.820	0.000	0.000	0.000

*These adjustment factors are applied to the baseline emission factors only.

Table A6. Tank Permeation Emission Factors*

Model Year	SCC	HPmn	HPmx	Tank Permeation Emission Factor (g/m2/day)			
	2260000000	0	6	E0	E1		
1900				9.70	0.750		
	2260000000	6	25	E0	E1	E2	E3
1900				9.70	2.272	1.377	0.750
	2260000000	25	9999	ALL			
1900				0.00			
	2260001010	0	9999	E0	E1		
1900				9.70	0.750		
	2260001020	0	9999	E0	E1		
1900				9.70	0.750		
	2260001030	0	9999	E0	E1		
1900				9.70	0.750		
	2260002006	3	6	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002009	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002021	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002027	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002039	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002039	3	6	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260002054	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260003030	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260003040	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004015	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004015	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004016	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004016	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004020	0	1	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004020	1	3	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004020	3	25	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004021	0	1	E0	E1	E2	

Table A6. Tank Permeation Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Tank Permeation Emission Factor (g/m2/day)			
1900				1.25	1.25	1.25	
	2260004021	1	3	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004021	3	6	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004021	6	25	E0	E1	E2	
1900				1.25	1.25	1.25	
	2260004025	0	1	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004025	1	3	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004025	3	25	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004026	0	1	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004026	1	3	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004026	3	6	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260004026	6	25	E0	E1	E2	E3
1900				9.70	2.272	1.377	0.750
	2260004030	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004030	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004031	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004031	3	6	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260004071	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260005035	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260005035	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260006005	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260006005	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260006010	0	1	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260006010	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	
	2260006015	1	3	E0	E1	E2	
1900				9.70	1.645	0.750	

Table A6. Tank Permeation Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Tank Permeation Emission Factor (g/m2/day)			
	2260006035	0	1	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260006035	1	3	E0	E1	E2	
1900				6.50	1.325	0.750	
	2260007005	6	11	E0	E1	E2	
1900				1.25	1.250	1.250	
	2265000000	0	6	E0	E1		
1900				9.70	0.750		
	2265000000	6	25	E0	E1	E2	E3
1900				9.70	2.272	1.377	0.750
	2265000000	25	9999	ALL			
1900				0.00			
	2265001010	0	9999	E0	E1		
1900				9.70	0.750		
	2265001020	0	9999	E0	E1		
1900				9.70	0.750		
	2265001030	0	9999	E0	E1		
1900				9.70	0.750		
	2265004025	0	6	E0	E1		
1900				6.50	1.325		
	2265004026	0	6	E0	E1		
1900				6.50	1.325		
	2267000000	0	9999	ALL			
1900				0.00			
	2268000000	0	9999	ALL			
1900				0.00			
	2270000000	0	9999	ALL			
1900				0.00			
	2282005010	0	25	E0	E1		
1900				9.90	0.75		
	2282005010	25	9999	E0	E1		
1900				8.00	0.75		
	2282005015	0	9999	E0	E1		
1900				9.90	0.75		
	2282010005	0	9999	E0	E1		
1900				8.00	0.75		
	2282020000	0	9999	ALL			
1900				0.00			
	2285002015	0	9999	ALL			
1900				0.00			
	2285004015	0	6	E0	E1		
1900				9.70	0.750		
	2285004015	6	25	E0	E1	E2	E3
1900				9.70	2.272	1.377	0.750
	2285004015	25	9999	ALL			

Table A6. Tank Permeation Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Tank Permeation Emission Factor (g/m2/day)			
1900				0.00			
	2285006015	0	9999	ALL			
1900				0.00			
	2285008015	0	9999	ALL			
1900				0.00			

*Note: There is one tier of evaporative controls. The technology types with “2” or “3” have been added to account for phase-in of the standards where applicable, and are necessary for compatibility with the current model structure.

Table A7. Hose Permeation Emission Factors for Non-Recreational Marine Engines*

Model Year	SCC	HPmn	HPmx	Hose Permeation Emission Factor (g/m2/day)		
	2260000000	0	25	E0	E1	
1900				122.0	3.75	
	2260000000	25	9999	ALL		
1900				0.0		
	2260001010	0	9999	E0	E1	
1900				450.0	7.50	
	2260001020	0	9999	E0	E1	
1900				450.0	7.50	
	2260001030	0	9999	E0	E1	
1900				450.0	7.50	
	2260002006	0	6	E0	E1	E2
1900				140.0	17.38	3.75
	2260002009	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260002021	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260002027	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260002039	0	6	E0	E1	E2
1900				140.0	17.38	3.75
	2260002054	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260003030	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260003040	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260004015	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260004016	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260004020	0	3	E0	E1	E2
1900				140.0	140.00	140.00
	2260004021	0	6	E0	E1	E2
1900				140.0	140.00	140.00
	2260004025	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260004026	0	6	E0	E1	E2
1900				140.0	17.38	3.75

Table A7. Hose Permeation Emission Factors for Non-Recreational Marine Engines (cont.)

Model Year	SCC	HPmn	HPmx	Hose Permeation Emission Factor (g/m2/day)		
	2260004030	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260004031	0	6	E0	E1	E2
1900				140.0	17.38	3.75
	2260004071	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260005035	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260006005	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260006010	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260006015	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260006035	0	3	E0	E1	E2
1900				140.0	17.38	3.75
	2260007005	0	11	E0	E1	E2
1900				140.0	140.00	140.00
	2265000000	0	25	E0	E1	
1900				122.0	3.75	
	2265000000	25	9999	ALL		
1900				0.0		
	2265001010	0	9999	E0	E1	
1900				450.0	7.50	
	2265001020	0	9999	E0	E1	
1900				450.0	7.50	
	2265001030	0	9999	E0	E1	
1900				450.0	7.50	
	2267000000	0	9999	ALL		
1900				0.0		
	2268000000	0	9999	ALL		
1900				0.0		
	2270000000	0	9999	ALL		
1900				0.0		
	2285002015	0	9999	ALL		
1900				0.0		
	2285003015	0	25	ALL	E1	
1900				122.0	3.75	

Table A7. Hose Permeation Emission Factors for Non-Recreational Marine Engines (cont.)

Model Year	SCC	HPmn	HPmx	Hose Permeation Emission Factor (g/m2/day)		
	2285003015	25	9999	ALL		
1900				0.0		
	2285004015	0	25	E0	E1	
1900				122.0	3.75	
	2285004015	25	9999	ALL		
1900				0.0		
	2285006015	0	9999	ALL		
1900				0.0		
	2285008015	0	9999	ALL		
1900				0.0		

*Note: There is one tier of evaporative controls. The technology types with “2” or “3” have been added to account for phase-in of the standards where applicable, and are necessary for compatibility with the current model structure.

Table A8. Hose Permeation Emission Factors for Recreational Marine Engines

Model Year	SCC	HPmn	HPmx	Hose Permeation Emission Factors (g/m2/day)					
				Fill Neck		Supply/Return		Vent	
	2282005010	0	25	E0	E1	E0	E1	E0	E1
1900				0.00	0.00	122.0	3.75	0.0	0.00
	2282005010	25	9999	E0	E1	E0	E1	E0	E1
1900				2.50	2.50	42.0	3.75	2.5	2.50
	2282005015	0	9999	E0	E1	E0	E1	E0	E1
1900				2.50	2.50	42.0	3.75	2.5	2.50
	2282010005	0	9999	E0	E1	E0	E1	E0	E1
1900				2.50	2.50	22.0	3.75	2.5	2.50
	2282020000	0	9999	ALL		ALL		ALL	
1900				0.0		0.0		0.0	

Table A9. Running Loss Emission Factors

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
	2260000000	25	9999	E0	E1
1900				2.41	0.241
	2260000000	0	3	E0	E1
1900				0.58	0.580
	2260000000	3	6	E0	E1
1900				3.34	0.334
	2260000000	6	25	E0	E1
1900				4.61	0.922
	2260001010	0	9999	ALL	
1900				0.57	
	2260001020	0	9999	ALL	
1900				11.30	
	2260001030	0	9999	ALL	
1900				1.18	
	2260001050	0	6	E0	E1
1900				11.30	1.130
	2260001050	6	25	E0	E1
1900				11.30	2.260
	2260001050	25	9999	E0	E1
1900				11.30	1.130
	2260001060	0	6	E0	E1
1900				11.30	1.130
	2260001060	6	25	E0	E1
1900				11.30	2.260
	2260001060	25	9999	E0	E1
1900				11.30	1.130
	2260002000	3	6	E0	E1
1900				3.34	0.334
	2260002000	6	25	E0	E1
1900				4.61	0.922
	2260002006	0	6	E0	E1
1900				0.58	0.580
	2260002009	0	3	E0	E1
1900				0.58	0.580
	2260002021	0	3	E0	E1
1900				0.58	0.580
	2260002027	0	3	E0	E1
1900				14.23	14.230
	2260002027	3	6	E0	E1
1900				14.23	1.423
	2260002027	6	25	E0	E1
1900				14.23	2.846
	2260002039	0	6	E0	E1
1900				0.58	0.580
	2260002054	0	3	E0	E1

Table A9. Running Loss Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
1900				0.58	0.580
	2260003030	0	3	E0	E1
1900				0.58	0.580
	2260003040	0	3	E0	E1
1900				0.58	0.580
	2260003050	0	6	E0	E1
1900				3.34	0.334
	2260003060	6	25	E0	E1
1900				14.23	2.846
	2260004010	0	6	E0	E1
1900				3.34	0.334
	2260004010	6	25	E0	E1
1900				3.34	0.668
	2260004011	0	6	E0	E1
1900				3.34	0.334
	2260004011	6	25	E0	E1
1900				3.34	0.668
	2260004015	0	3	E0	E1
1900				0.58	0.580
	2260004016	0	3	E0	E1
1900				0.58	0.580
	2260004020	0	25	E0	E1
1900				0.58	0.580
	2260004021	0	25	E0	E1
1900				0.58	0.580
	2260004025	0	6	E0	E1
1900				0.58	0.580
	2260004026	0	6	E0	E1
1900				0.58	0.580
	2260004030	0	6	E0	E1
1900				0.58	0.580
	2260004031	0	6	E0	E1
1900				0.58	0.580
	2260004035	0	6	E0	E1
1900				0.334	0.334
	2260004036	0	6	E0	E1
1900				0.334	0.334
	2260004040	0	6	E0	E1
1900				2.86	0.286
	2260004041	0	6	E0	E1
1900				2.86	0.286
	2260004045	0	6	E0	E1
1900				2.86	0.286
	2260004046	0	6	E0	E1
1900				2.86	0.286

Table A9. Running Loss Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
	2260004050	0	6	E0	E1
1900				3.34	0.334
	2260004051	0	6	E0	E1
1900				3.34	0.334
	2260004055	0	6	E0	E1
1900				2.86	0.286
	2260004056	0	6	E0	E1
1900				2.86	0.286
	2260004065	0	6	E0	E1
1900				3.34	0.334
	2260004066	0	6	E0	E1
1900				3.34	0.334
	2260004071	0	6	E0	E1
1900				0.58	0.580
	2260004075	0	6	E0	E1
1900				2.86	0.286
	2260004076	0	6	E0	E1
1900				2.86	0.286
	2260005030	0	6	E0	E1
1900				3.34	0.334
	2260005035	0	3	E0	E1
1900				0.58	0.580
	2260005060	3	6	E0	E1
1900				14.23	1.423
	2260006000	0	3	E0	E1
1900				14.23	14.230
	2260006000	3	6	E0	E1
1900				14.23	1.423
	2260006000	6	25	E0	E1
1900				14.23	2.846
	2260007005	0	25	E0	E1
1900				0.58	0.580
	2265000000	25	9999	E0	E1
1900				2.41	0.241
	2265000000	0	6	E0	E1
1900				3.34	0.334
	2265000000	6	25	E0	E1
1900				4.61	0.922
	2265001010	0	9999	ALL	
1900				0.57	
	2265001020	0	9999	ALL	
1900				11.30	
	2265001030	0	9999	ALL	
1900				1.18	
	2265001050	0	6	E0	E1

Table A9. Running Loss Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
1900				11.30	1.130
	2265001050	6	25	E0	E1
1900				11.30	2.260
	2265001050	25	9999	E0	E1
1900				11.30	1.130
	2265001060	0	6	E0	E1
1900				11.30	1.130
	2265001060	6	25	E0	E1
1900				11.30	2.260
	2265001060	25	9999	E0	E1
1900				11.30	1.130
	2265003060	0	6	E0	E1
1900				14.23	1.423
	2265003060	6	25	E0	E1
1900				14.23	2.846
	2265004010	0	6	E0	E1
1900				3.34	0.334
	2265004010	6	25	E0	E1
1900				3.34	0.668
	2265004011	0	6	E0	E1
1900				3.34	0.334
	2265004011	6	25	E0	E1
1900				3.34	0.668
	2265004035	0	6	E0	E1
1900				0.334	0.334
	2265004035	6	25	E0	E1
1900				0.922	0.922
	2265004036	0	6	E0	E1
1900				0.334	0.334
	2265004036	6	25	E0	E1
1900				0.922	0.922
	2265004040	0	6	E0	E1
1900				2.86	0.286
	2265004040	6	25	E0	E1
1900				2.86	0.572
	2265004041	0	6	E0	E1
1900				2.86	0.286
	2265004041	6	25	E0	E1
1900				2.86	0.572
	2265004045	0	6	E0	E1
1900				2.86	0.286
	2265004045	6	25	E0	E1
1900				2.86	0.572
	2265004046	0	6	E0	E1
1900				2.86	0.286

Table A9. Running Loss Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
	2265004046	6	25	E0	E1
1900				2.86	0.572
	2265004050	0	6	E0	E1
1900				3.34	0.334
	2265004050	6	25	E0	E1
1900				3.34	0.668
	2265004051	0	6	E0	E1
1900				3.34	0.334
	2265004051	6	25	E0	E1
1900				3.34	0.668
	2265004055	0	6	E0	E1
1900				2.86	0.286
	2265004055	6	25	E0	E1
1900				2.86	0.572
	2265004056	0	6	E0	E1
1900				2.86	0.286
	2265004056	6	25	E0	E1
1900				2.86	0.572
	2265004065	0	6	E0	E1
1900				3.34	0.334
	2265004065	6	25	E0	E1
1900				3.34	0.668
	2265004066	0	6	E0	E1
1900				3.34	0.334
	2265004066	6	25	E0	E1
1900				3.34	0.668
	2265004075	0	6	E0	E1
1900				2.86	0.286
	2265004075	6	25	E0	E1
1900				2.86	0.572
	2265004076	0	6	E0	E1
1900				2.86	0.286
	2265004076	6	25	E0	E1
1900				2.86	0.572
	2265005060	0	6	E0	E1
1900				14.23	1.423
	2265005060	6	25	E0	E1
1900				14.23	2.846
	2265006000	0	6	E0	E1
1900				14.23	1.423
	2265006000	6	25	E0	E1
1900				14.23	2.846
	2267000000	0	9999	ALL	
1900				0.00	
	2268000000	0	9999	ALL	

Table A9. Running Loss Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Running Loss Emission Factors (g/hour)	
1900				0.00	
	2270000000	0	9999	ALL	
1900				0.00	
	2282005010	0	9999	ALL	
1900				0.00	
	2282005015	0	9999	ALL	
1900				2.86	
	2282010005	0	100	ALL	
1900				2.86	
	2282010005	100	9999	ALL	
1900				0.00	
	2282020000	0	9999	ALL	
1900				0.00	
	2285002015	0	9999	ALL	
1900				0.00	
	2285004015	0	6	E0	E1
1900				3.34	0.334
	2285004015	6	25	E0	E1
1900				4.61	0.922
	2285004015	25	9999	E0	E1
1900				2.41	0.241
	2285006015	0	9999	ALL	
1900				0.00	
	2285008015	0	9999	ALL	
1900				0.00	

Table A10. Hot Soak Emission Factors

Model Year	SCC	HPmn	HPmx	Hot Soak Emission Factors (g/start)	
	2260000000	25	9999	E0	E1
1900				4.34	0.43
	2260001000	0	9999	ALL	
1900				3.00	
	2260001050	0	25	ALL	
1900				3.00	
	2260001060	0	25	ALL	
1900				3.00	
	2260001060	25	9999	E0	E1
1900				3.00	0.30
	2260002000	0	25	ALL	
1900				10.50	
	2260002027	0	25	ALL	
1900				3.24	
	2260002033	0	25	ALL	
1900				3.24	
	2260003000	0	25	ALL	
1900				10.50	
	2260004010	0	25	ALL	
1900				0.85	
	2260004011	0	25	ALL	
1900				0.85	
	2260004015	0	25	ALL	
1900				0.57	
	2260004016	0	25	ALL	
1900				0.57	
	2260004020	0	25	ALL	
1900				0.27	
	2260004021	0	25	ALL	
1900				0.27	
	2260004025	0	25	ALL	
1900				0.29	
	2260004026	0	25	ALL	
1900				0.29	
	2260004030	0	25	ALL	
1900				0.15	
	2260004031	0	25	ALL	
1900				0.15	
	2260004035	0	25	ALL	
1900				0.85	
	2260004036	0	25	ALL	
1900				0.85	
	2260004040	0	25	ALL	
1900				1.52	
	2260004041	0	25	ALL	

Table A10. Hot Soak Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Hot Soak Emission Factors (g/start)	
1900				1.52	
	2260004045	0	25	ALL	
1900				1.52	
	2260004046	0	25	ALL	
1900				1.52	
	2260004050	0	25	ALL	
1900				0.27	
	2260004051	0	25	ALL	
1900				0.27	
	2260004055	0	25	ALL	
1900				1.52	
	2260004056	0	25	ALL	
1900				1.52	
	2260004065	0	25	ALL	
1900				0.85	
	2260004066	0	25	ALL	
1900				0.85	
	2260004071	0	25	ALL	
1900				1.52	
	2260004075	0	25	ALL	
1900				0.85	
	2260004076	0	25	ALL	
1900				0.85	
	2260005000	0	25	ALL	
1900				3.00	
	2260005020	0	25	ALL	
1900				10.50	
	2260005025	0	25	ALL	
1900				10.50	
	2260005045	0	25	ALL	
1900				10.50	
	2260006000	0	25	ALL	
1900				3.24	
	2260007000	0	25	ALL	
1900				0.27	
	2260007015	0	25	ALL	
1900				10.50	
	2260008005	0	25	ALL	
1900				10.50	
	2260009010	0	25	ALL	
1900				3.24	
	2260010010	0	25	ALL	
1900				3.24	
	2265000000	25	9999	E0	E1
1900				4.34	0.43

Table A10. Hot Soak Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Hot Soak Emission Factors (g/start)	
	2265001000	0	9999	ALL	
1900				3.00	
	2265001050	0	25	ALL	
1900				3.00	
	2265001060	0	25	ALL	
1900				3.00	
	2265001060	25	9999	E0	E1
1900				3.00	0.30
	2265002000	0	25	ALL	
1900				10.50	
	2265002027	0	25	ALL	
1900				3.24	
	2265002033	0	25	ALL	
1900				3.24	
	2265003000	0	25	ALL	
1900				10.50	
	2265004010	0	25	ALL	
1900				0.85	
	2265004011	0	25	ALL	
1900				0.85	
	2265004015	0	25	ALL	
1900				0.57	
	2265004016	0	25	ALL	
1900				0.57	
	2265004020	0	25	ALL	
1900				0.27	
	2265004021	0	25	ALL	
1900				0.27	
	2265004025	0	25	ALL	
1900				0.29	
	2265004026	0	25	ALL	
1900				0.29	
	2265004030	0	25	ALL	
1900				0.15	
	2265004031	0	25	ALL	
1900				0.15	
	2265004035	0	25	ALL	
1900				0.85	
	2265004036	0	25	ALL	
1900				0.85	
	2265004040	0	25	ALL	
1900				1.52	
	2265004041	0	25	ALL	
1900				1.52	
	2265004045	0	25	ALL	

Table A10. Hot Soak Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Hot Soak Emission Factors (g/start)	
1900				1.52	
	2265004046	0	25	ALL	
1900				1.52	
	2265004050	0	25	ALL	
1900				0.27	
	2265004051	0	25	ALL	
1900				0.27	
	2265004055	0	25	ALL	
1900				1.52	
	2265004056	0	25	ALL	
1900				1.52	
	2265004065	0	25	ALL	
1900				0.85	
	2265004066	0	25	ALL	
1900				0.85	
	2265004071	0	25	ALL	
1900				1.52	
	2265004075	0	25	ALL	
1900				0.85	
	2265004076	0	25	ALL	
1900				0.85	
	2265005000	0	25	ALL	
1900				3.00	
	2265005020	0	25	ALL	
1900				10.50	
	2265005025	0	25	ALL	
1900				10.50	
	2265005045	0	25	ALL	
1900				10.50	
	2265006000	0	25	ALL	
1900				3.24	
	2265007000	0	25	ALL	
1900				0.27	
	2265007015	0	25	ALL	
1900				10.50	
	2265008005	0	25	ALL	
1900				10.50	
	2265009010	0	25	ALL	
1900				3.24	
	2265010010	0	25	ALL	
1900				3.24	
	2267000000	0	9999	ALL	
1900				0.00	
	2268000000	0	9999	ALL	
1900				0.00	

Table A10. Hot Soak Emission Factors (cont.)

Model Year	SCC	HPmn	HPmx	Hot Soak Emission Factors (g/start)	
	2270000000	0	9999	ALL	
1900				0.00	
	2282005000	0	9999	ALL	
1900				3.00	
	2282005010	0	25	ALL	
1900				0.00	
	2282010000	0	9999	ALL	
1900				3.00	
	2282020000	0	9999	ALL	
1900				0.00	
	2285004015	0	25	ALL	
1900				3.00	
	2285004015	25	9999	E0	E1
1900				4.34	0.43
	2285006015	0	9999	ALL	
1900				0.00	

Appendix B
Wade Equations

Vapor space (ft^3) = ((1.15 - tank fill) $\times$ tank size) / 7.841 (Eq. B-1)

where:

tank fill = fuel in tank/fuel tank capacity

tank size = fuel tank capacity in gallons

T_1 (°F) = (T_{max} - T_{min}) $\times$ 0.922 + Tmin (Eq. B-2)

where:

T_{max} = maximum diurnal temperature (°F)

T_{min} = minimum diurnal temperature (°F)

V_{100} (psi) = 1.0223 $\times$ RVP + [(0.0357 $\times$ RVP)/(1-0.0368 $\times$ RVP)] (Eq. B-3)

where:

V_{100} = vapor pressure at 100°F

RVP = Reid Vapor Pressure of the fuel

E_{100} (%) = 66.401-12.718 $\times$ V_{100} +1.3067 $\times$ V_{100}^2 - 0.077934 $\times$ V_{100}^3 + 0.0018407 $\times$ V_{100}^4 (Eq. B-4)

D_{min} (%) = E_{100} + [(262 / (0.1667 * E_{100} + 560) - 0.113] $\times$ (100 - T_{min}) (Eq. B-5a)

D_{max} (%) = E_{100} + [(262 / (0.1667 * E_{100} + 560) - 0.113] $\times$ (100 - T_1) (Eq. B-5b)

where:

$D_{min/max}$ = distillation percent at the max/min temperatures in the fuel tank

E_{100} = percent of fuel evaporated at 100°F from equation 3-5

P_I (psi) = 14.697 - 0.53089 $\times$ D_{min} + 0.0077215 $\times$ D_{min}^2 - 0.000055631 $\times$ D_{min}^3 + 0.0000001769 $\times$ D_{min}^4 (Eq. B-6a)

P_F (psi) = 14.697 - 0.53089 $\times$ D_{max} + 0.0077215 $\times$ D_{max}^2 - 0.000055631 $\times$ D_{max}^3 + 0.0000001769 $\times$ D_{max}^4 (Eq. B-6b)

Density (lb/gal) = 6.386 - 0.0186 $\times$ RVP (Eq. B-7)

MW (lb/lb mole) = (73.23 - 1.274 $\times$ RVP) + [0.5 $\times$ (T_{min} + T_1) - 60] $\times$ 0.059 (Eq. B-8)

Diurnal emissions (grams) = vapor space $\times$ 454 $\times$ density $\times$ [520 / (690 - 4 $\times$ MW)] $\times$ 0.5 $\times$ [P_I / (14.7 - P_I) + P_F / (14.7 - P_F)] $\times$ [(14.7 - P_I) / (T_{min} + 460) - (14.7 - P_F) / (T_1 + 460)] (Eq. B-9) where:

MW = molecular weight of hydrocarbons from equation 3-9

$P_{I/F}$ = initial and final pressures from equation B-6

Appendix C
Diurnal Test Data

Comparison of Test Data to Theoretical Results Using the Wade Equations

We tested two marine fuel tanks in their baseline configurations for diurnal emissions. These fuel tanks included a portable plastic fuel tank and two aluminum fuel tanks. The 17 gallon aluminum tank was constructed for this testing, but is representative of a typical marine fuel tank; the 30 gallon aluminum tank was removed from an 18 foot runabout. The fuel tanks were tested with the venting through a length of 5/8 inch hose to ensure that the emissions measured were a direct result of the fuel temperature heating and not diffusion. The advantage of using the aluminum fuel tanks for this testing was to exclude permeation emissions from the measured results. All testing was performed with fuel tanks filled to 40% of capacity with 9 RVP test fuel.

The diurnal test results are presented in units of grams per gallon capacity of the fuel tank per day. These units are used because gallons capacity is a defining characteristic of the fuel tank. Diurnal vapor formation itself is actually a function of the vapor space above the fuel in the fuel tank rather than the total capacity.

Table C1 presents the test results compared to theoretical results. The theoretical results are based on the Wade model which is a set of theoretical calculations for determining diurnal emissions based on fill level, fuel RVP, and temperature profile. These calculations are presented in Appendix B. Although the Wade model over-predicts the vapor generation, it does show a similar trend with respect to temperature. To account for this over prediction, we use a correction factor of 0.78. This correction factor is based on empirical data [1], has historically been used in our automotive emission models, and appears to be consistent with the data presented in Table C1.

We also contracted with an outside lab [2,3] for the testing of thirteen small SI fuel tanks over various test temperature profiles. This testing was performed with the tanks filled to 50% capacity with certification gasoline. These data are presented in Table C2. In cases where the fuel temperature profiles were within the input range of the Wade model for diurnal emissions, theoretical emissions were also calculated using the Wade model and applying the same correction factor discussed above for SI marine fuel tanks. As shown in Table C2, the measured values are fairly consistent with the theoretical values.

---

[1] Reddy, S., "Prediction of Fuel Vapor Generation from a Vehicle Fuel Tank as a Function of Fuel RVP and Temperature," SAE Paper 892089, 1989.

[2] Cushing, T., "Fuel Tank Hydrocarbon Emission Testing," prepared by Sterling Performance for the U.S. EPA, Report #040107, September 30, 2004. Contained in docket OAR-2004-0008.

[3] Cushing, T., "Fuel Tank Hydrocarbon Emission Testing," prepared by Sterling Performance for the U.S. EPA, Report #040137, November 3, 2004. Contained in docket OAR-2004-0008.

Table C1. Diurnal Evaporative Emission Results for Marine Fuel Tanks and Comparison to the Wade Model

Temperature Profile	Fuel Capacity [gallons]	Measured [g/gallon/day]	Wade Model [g/gallon/day]	Corrected Wade [g/gallon/day]*
22 - 36°C (72 - 96°F)	17	1.50	2.30	1.79
22 - 36°C (72 - 96°F)	30	1.39	2.30	1.79
24 - 33°C (74 - 91°F)	30	1.13	1.33	1.04
22 - 30°C (71 - 86°F)	30	0.88	1.02	0.80
25 - 31°C (77 - 88°F)	30	0.66	0.88	0.69
26 - 32°C (78 - 90°F)	30	0.84	1.04	0.81
28 - 31°C (82 - 87°F)	30	0.47	0.43	0.34

* Corrected Wade = Wade Model x 0.78

Table C2. Fuel Temperature Measurements During Operation of Small SI Equipment

Equipment Type	Fuel Capacity [gallons]	Temperature Profile °C	Measured [grams/gallon]	Corrected Wade [grams/gallon]
Riding mower	1.1	15.7 - 28.4	0.92	0.91
	1.4 x 2	21.9 - 29.7	0.88	0.71
	1.7	19.5 - 30.3	0.82	0.94
	2.5	27.0 - 35.0	1.29	1.16
	3.0	26.6 - 28.4	0.25	0.17
	6.5	24.3 - 33.2	1.20	1.08
	6.5 x 2	20.5 - 23.9	0.26	0.23
Walk-behind mower	0.34	23.3 - 33.0	0.76	1.18
	0.25	28.7 - 46.7	4.92	NA*
	0.22	28.7 - 59.7	36.9	NA*
Generator set	8.5	20.6 - 25.8	0.45	0.38
	7.0	25.8 - 50.0	9.90	NA*
Pressure washer	1.8	19.0 - 50.6	11.6	NA*

* outside the temperature range of the model

Ambient vs Fuel Diurnal Temperature Swings

In boats with installed fuel tanks, the fuel tank is generally hidden beneath the deck. As a result, there is a certain amount of "inherent" insulation caused by the boat itself. This effect is increased for a boat that is stored in the water. The water acts as a cooling medium for the fuel tank, especially if it is installed in the bottom of the boat. In addition, the thermal inertia of the fuel in the tank can act to dampen temperature variation imposed from the diurnal heating of the ambient air. To investigate this effect, we tested several boats by recording the ambient air temperature and fuel temperatures over a series of days. Two boats were tested on trailers outside in the summer, two boats were tested on trailers in a SHED, and two boats were tested in the water on summer days. Table C3 presents the average results of this testing

Table C3. Ratio of Ambient to Fuel Diurnal Temperature Swing for Boats

Boat Type	Test Conditions	Capacity [gallons]	Fuel Tank Fill Level	Temperature Ratio*
9 ft. personal watercraft	outside, on trailer	13	50%	66%
16 ft. jet boat	outside, on trailer	40	50%	52%
18 ft. runabout	in SHED, on trailer	30	40%	68%
16 ft. jet boat	in SHED, on trailer	40	90%	33%
18 ft. runabout	outside, in water	30	100%	19%
21 ft. deck boat	outside, in water	20	90%	27%

* Average ratio of change in fuel temperature to change in ambient air temperature over test days.

In their comments on the proposed rule, the National Marine Manufacturers Association presented temperature data on an 18 foot runabout, with a 32 gallon tank, tested in a SHED with an ambient temperature of 72-96°F.[4] The average fuel to ambient temperature ratio was 54% for this testing. This ratio is in the range of EPA test results for boats tested on a trailer. Brunswick also included temperature data in their comments.[5] The average days test on a boat on the water was 19%, which is consistent with our water tests. Brunswick's average for boats tested while stored out of the water was 27% which is considerably lower than the EPA and NMMA testing. Combining all of the EPA and industry data, the average fuel to ambient temperature ratio (based on test days) is about 20% for boats in the water and 50% for boats stored out of the water.

[4] "Docket No. A-2000-02; Notice or Proposed Rulemaking for the Control of Emissions from Spark-Ignition Marine Vessels and Highway Motorcycles; 40 C.F.R. Parts 86, 90, 1045, 1051, and 1068," Comments from the National Marine Manufacturers Association, Docket A-2000-02, Document IV-D-219.

[5] "Before the United States Environmental Protection Agency, Comments by Brunswick Corporation, Notice of Proposed Rulemaking, Part 1045 Control of Emissions from Spark-Ignition Marine Vessels," Comments from Brunswick Corporation, Docket A-2000-02.

During diurnal testing of lawnmowers, ARB found that the fuel and tank skin temperature follow the ambient temperature closely.[6] This same phenomenon would be expected for other small SI equipment as well (and portable fuel tanks) because of the small fuel volumes and because these tanks are generally exposed to ambient air.

Diffusion Effect

In testing diurnal emissions from fuel tanks with open vents, the configuration of the vent can have a significant effect on the measured emissions due to the diffusion of vapor out of any opening in the fuel tank. Depending on the size and configuration of the vent, diffusion can actually occur when the fuel temperature is cooling. To quantify this diffusion component for a typical fuel tank, we ran four 72-96°F diurnal tests on a 17 gallon aluminum tank using various configurations for venting. The first configuration was with the fuel cap cracked open and the vent sealed, the second configuration was with a 68 cm length of vent hose, and the third configuration was with a 1000 micron limiting flow orifice in the vent opening. This 1000 micron orifice was large enough to allow venting without any measurable pressure increase in the fuel tank during the diurnal test. The fourth configuration was a combination of the limited flow orifice and the vent hose. Table C4 presents the results of this testing.

Table C4. Diurnal Test Results with Varied Venting Configurations

Vent Configuration	Evaporative HC [g/gallon/day]
cracked fuel cap	2.05
68 cm of 5/8" fuel hose	1.39
1000 micron orifice	1.47
1000 micron orifice + 68 cm of 5/8" fuel hose	1.34

In the test with the cracked fuel cap, an increase in HC concentration in the SHED was observed throughout the test, even when the fuel temperature was cooling. For the other three tests, the HC concentration leveled off when the temperature began to cool. This suggests that the difference in measured emissions of 0.6 - 0.7 g/gal/day was due to diffusion losses.

Based on these data, we see about 40-50% higher emissions over a diurnal test for a tank with a small vent directly to the atmosphere than for a tank that is vented through a hose. In our modeling, we use a correction factor of 1.46, which is equal to the open vent rate (2.05 g/gallon/day) divided by the average of the three limited vent rates (1.40 g/gallon/day=avg[1.39,1.47,1.34]).

[6] Diurnal Emissions Testing of Walk-Behind Mowers Configured with Fuel Tank Pressure Relief Valves (September 2002)," California Air Resources Board, September 17, 2002.

To further investigate this diffusion effect, we tested the 17 gallon aluminum tank with several venting configuration, at two constant temperature settings. Under these conditions, all of the measured evaporative emissions would be expected to be due to diffusion. As seen in Table C5, diffusion can be very high with too large of a vent opening unless a vent hose is used. The two lengths of vent hose tested did not show a significant difference in diffusion emissions. We believe that the vent hose limits diffusion by creating a gradual gradient in fuel vapor concentration.

Table C5. Constant Temperature Test Results with Varied Venting Configurations

Vent Configuration	22°C (72°F) Evaporative HC [g/gal/day]	36°C (96°F) Evaporative HC [g/gal/day]
½" vent opening	5.65	10.0
68 cm of 5/8" fuel hose	0.11	0.18
137 cm of 5/8" fuel hose	0.07	0.24
1000 micron orifice	0.28	0.41

The above data suggest that, at least for open vent fuel systems, the size and configuration of the venting system can have a significant effect on evaporative emissions. In marine applications, there is typically a vent hose attached to the fuel tank. Diffusion emissions appear to be minimal if the fuel tank is vented through a length of hose. This is probably because the long residence times in the hose cause more opportunities for molecular collisions which direct the HC molecules back towards the fuel tank.

One study looked at the evaporation of liquids from a tube filled to various fill heights.[7] As the fill height decreased (effectively increasing the length of the tube above the liquid surface) the evaporation quickly decreased. These results are consistent with the observed effects of venting through a hose in our testing. Installed marine fuel tanks typically vent through a hose to the outside of the boat; therefore, diffusion losses are likely relatively small for these applications.

For small SI applications and portable marine fuel tanks, the tanks are typically vented through an opening in the fuel cap. Therefore, unless the cap is sealed, we would expect diffusion emissions to occur. The above data suggest that diffusion can account for a significant portion of the evaporative HC emissions measured from a metal tank with a small vent in the cap

[7] Beverley, K., Clint, J., Fletcher, P., “Evaporation Rates of Pure Liquids Measured Using a Gravimetric Technique,” Phys. Chem. Chem. Phys., 1999, 1, 149-153, Received July 9, 1998, Accepted October 13, 1998, Docket Identification OAR-2004-0008-0103.

over a 72-96°F diurnal test. The contribution of diffusion to measured diurnal emissions would increase, on a percentage basis, as the diurnal temperature swing approached zero.

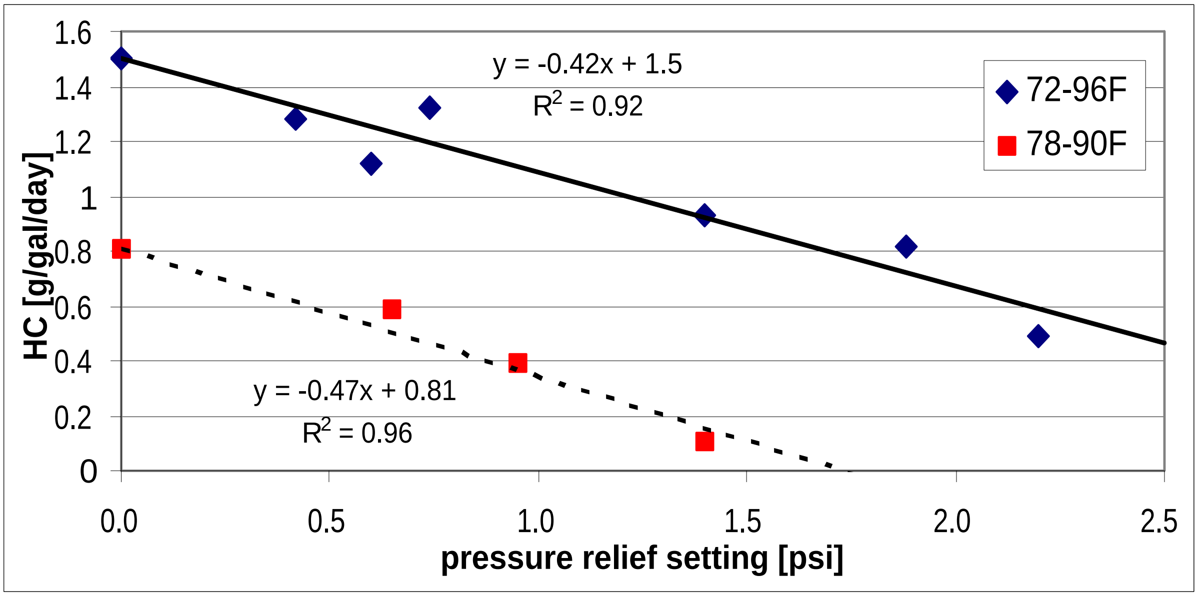
Sealed System with Pressure Relief

For the pressure relief valve testing, we looked at several pressures ranging from 0.5 to 2.25 psi. The 2.25 psi valve was an off-the-shelf automotive fuel cap with a nominal 2 psi pressure relief valve and 0.5 psi vacuum relief valve. For the other pressure settings, we used another automotive cap modified to allow adjustments to the spring tension in the pressure relief valve. We performed these tests on the 17 gallon aluminum fuel tank to remove the variable of permeation. Emissions were vented through a hose to prevent diffusion losses from affecting the measurements. We operated over two temperature profiles. The first set of tests were performed in a variable temperature SHED with a 72-96°F air temperature profile. This temperature profile was based on the existing automotive cycle which is intended to represent a typical summer day on which a high ozone event may occur. The second set of tests were performed using a heating blanket to create a 78-90°F fuel temperature profile. This testing was intended to represent a fuel tank in a boat, where the tank may be inherently insulated, during the same ambient temperature profile. This inherent insulation creates a time lag on the heating and cooling of the fuel and reduces the amplitude of the temperature profile by half.

As shown in Figure C1, there was a fairly linear relationship between the pressure setting of the valve and the emissions measured over the proposed test procedure. In addition, the slope of the lines are similar for both test temperature scenarios. This suggests that over a smaller temperature profile, a greater percent reduction in HC can be achieved at a given pressure setting. This is reasonable because, in each case, a constant amount of vapor is captured. In other words, regardless of the temperature profile, the same amount of vapor must be generated to create a given pressure. For instance, with a 1 psi valve, about 0.4 grams/gallon of HC are captured over each temperature profile. However, this represents a 50% reduction over a 78-90°F temperature profile while only about a 25% reduction over the 72-96°F temperature profile.

Personal watercraft have sealed systems with pressure relief valves that range from 0.5 to 4.0 psi. These tanks are modeled as having a 1 psi pressure relief valve. The effect of a 1 psi valve on diurnal emissions is estimated to be a 70% reduction, which is based on a comparison of annual diurnal emissions with and without the relief valves, using regional daily RVP values.

Figure C1. Effect of Pressure Cap on Diurnal Emissions



Appendix D
Relationship Between Tank Size and Surface Area

Both EPA and ARB measured the fuel tank surface areas of a number of different fuel tanks of varying applications and volumes. These data are shown in Table D1. EPA developed a hyperbolic expression to fit through the volume and surface area data, which is shown in Figure 1. The expression is shown below:

surface area (m^2) = 0.15*SQRT((((gal+2)^2)/4)-1)

With regard to data not falling exactly on this curve, there is point at about 4 gallons, where the surface area is around 0.7 m^2, and the curve predicts about 0.5 m^2. For this case, we would be underpredicting emissions by about 29%. However, there are several points around 15 gallons, where the curve predicts tank surface area to be about 1 m^2, but the data indicates about 0.75 m^2. Here, we would be overpredicting emissions by about 30%. Note that at very small tank sizes, which represent lawnmowers, the curve appears to do a good job of predicting surface area.

Table D1. Fuel Tank Surface Area Data from ARB and EPA

Tank ID	Volume (Gallons)	Surface Area (m^2)	Source
T36	0.06	0.039	ARB
T34	0.07	0.038	ARB
T12	0.08	0.039	ARB
T35	0.09	0.032	ARB
T25	0.12	0.059	ARB
T26	0.15	0.057	ARB
T15	0.16	0.061	ARB
T29-2	0.25	0.068	ARB
T30-2	0.25	0.068	ARB
T40	0.25	0.068	ARB
U1	0.25	0.068	ARB
U2	0.25	0.068	ARB
U3	0.25	0.068	ARB
T29	0.25	0.068	ARB
T30	0.25	0.068	ARB
T24B	0.25	0.114	ARB
T41	0.25	0.114	ARB
T41	0.25	0.114	ARB
T44	0.25	0.114	ARB
T42	0.25	0.114	ARB
T42-2	0.25	0.114	ARB
U4	0.25	0.114	ARB
U5	0.25	0.114	ARB
T24A	0.25	0.114	ARB

Tank ID	Volume (Gallons)	Surface Area (m^2)	Source
C#010	0.26	0.0625	EPA
V#1	0.26	0.078	EPA
T17	0.29	0.085	ARB
T43	0.38	0.100	ARB
T43-2	0.38	0.100	ARB
T19	0.50	0.110	ARB
T19-2	0.50	0.110	ARB
T20	0.50	0.122	ARB
T20-2	0.50	0.122	ARB
T4	1.40	0.221	ARB
T28	1.75	0.237	ARB
MB3.3#1	3.3	0.25	EPA
T6	3.90	0.677	ARB
T6-2	3.90	0.677	ARB
AB4#3	4	0.513	EPA
GB5	5	0.432	EPA
T7	5	0.434	ARB
TB5#1	5	0.453	EPA
DB5.3	5.3	0.481	EPA
TR6#4	6	0.44	EPA
MB6#4w	6	0.54	EPA
MB6.6b#1	6.6	0.552	EPA
MB6.6a#1	6.6	0.606	EPA
T8	7.5	0.724	ARB
TR12#4	12	0.72	EPA
MR12i#2	12	0.79	EPA
MR12k#26	12	0.82	EPA
MR12m#5	12	0.98	EPA
FC14	14	0.99	EPA
MR23	23	1.81	EPA
MR31	31	2.44	EPA

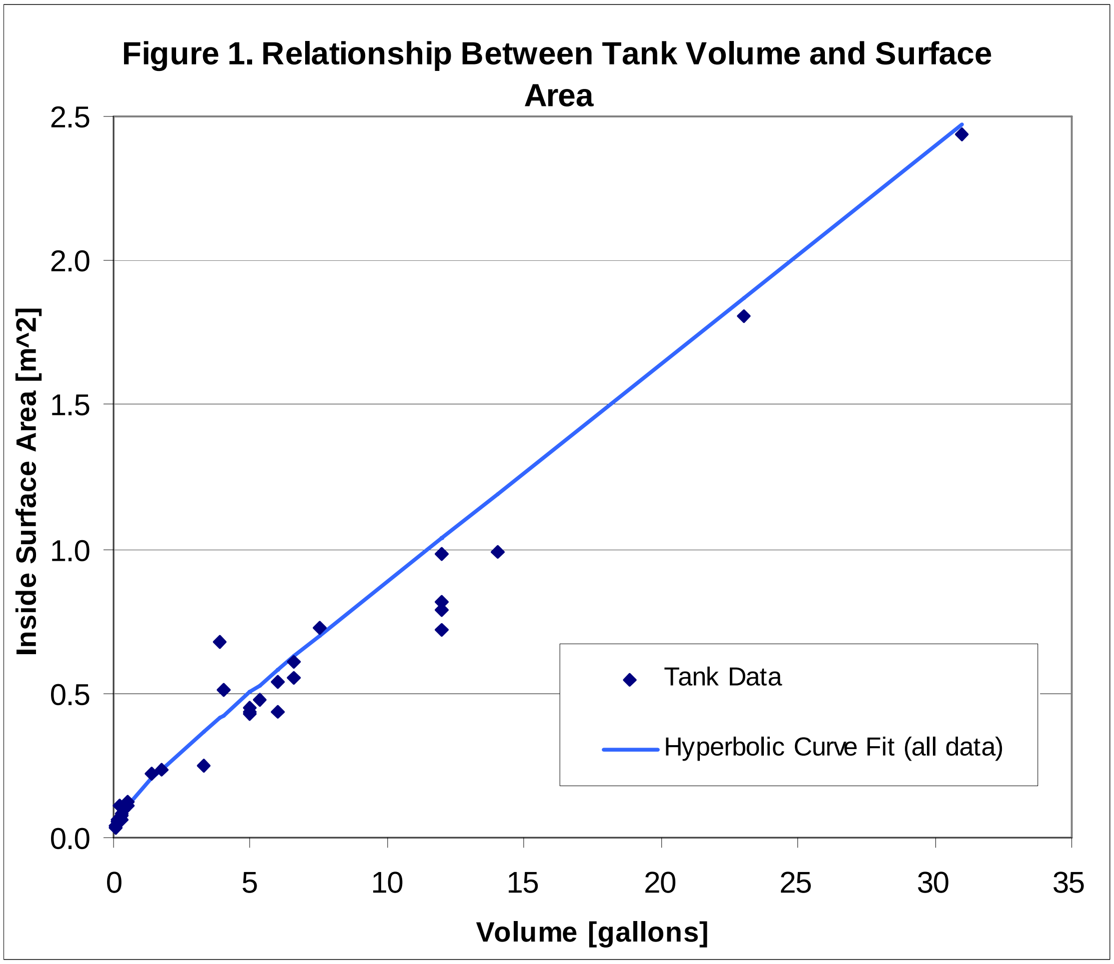
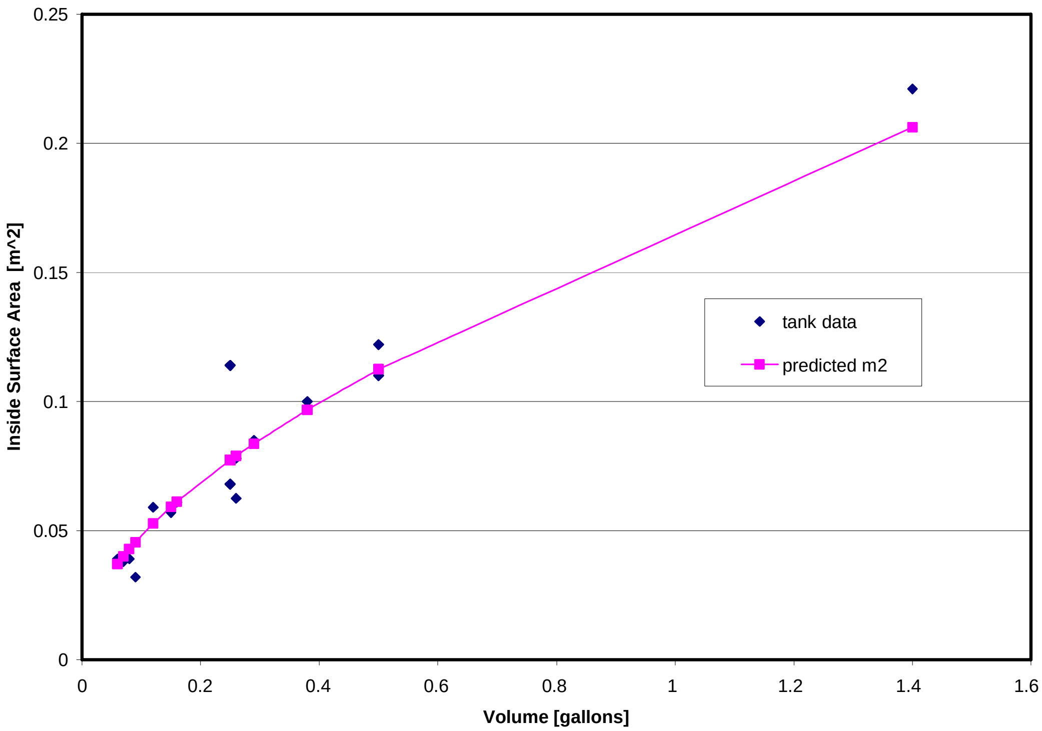


Figure 1. Relationship Between Tank Volume and Surface Area
Inside Surface Area [m^2]
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
35
Volume [gallons]
Tank Data
Hyperbolic Curve Fit (all data)

Figure 2. Close-up of Figure 1 at Small Tank Volumes



Appendix E
Derivation of Tank Permeation Emission Factors (precontrolled on gasoline)

Small SI and Recreational Equipment

ARB tested a number of equipment fuel tanks for permeation emission rates. The ARB data is compiled in several data reports on their web site.[8,9,10,11,12] In the testing, the equipment tanks were fueled to 100% with California Phase 2 fuel, and allowed to sit for a couple of months. ARB measured the tank volumes, and also the surface area of each of the tanks. ARB used the 18 - 41°C 24 hour diurnal test, but the tanks were sealed so that they did not emit any vapor emissions. The results are shown in Table E1 below. Where multiple tests were run on a given tank or tank type, the average results are presented. Although the temperature in the ARB testing is cycled from 18 - 41°C rather than held at a constant temperature, the results would likely be similar if the data were collected at the average temperature of 29°C.

Table E1. ARB CERT Fuel Testing – Untreated HDPE Tanks

tank ID	tank volume gallons	Surface area square inches	Surface area square meters	average hc loss grams/day	permeation rate grams/square meter/day
T36	0.06	60	0.04	0.20	5.39
T12	0.08	61	0.04	0.26	6.67
T35	0.09	50	0.03	0.19	5.88
T25	0.12	91	0.06	0.53	9.01
T26	0.15	88	0.06	0.42	7.32
T15	0.16	94	0.06	0.29	4.79
T24	0.25	177	0.11	1.32	11.56
T29	0.25	106	0.07	0.73	10.65
T30	0.25	106	0.07	0.67	9.75
T31	0.25	106	0.07	0.74	10.75
T32	0.25	106	0.07	0.86	12.54
T40	0.25	106	0.07	0.68	9.91
T41	0.25	177	0.11	1.06	9.24
T42	0.25	177	0.11	1.24	10.84
T44	0.25	177	0.11	0.99	8.68

[8] California Air Resources Board, "Permeation Rates of Small Off Road Engine High-Density Polyethylene Fuel Tanks (February 2001 Testing)," June 8, 2001.
[9] California Air Resources Board, "Permeation Rates of Small Off Road Engine High-Density Polyethylene Fuel Tanks (April 2001 Testing)," June 8, 2001.
[10] California Air Resources Board, "Permeation Rates of High-Density Polyethylene Fuel Tanks (May 2001)," June 11, 2001.
[11] California Air Resources Board, "Permeation Rates of High-Density Polyethylene Fuel Tanks (June 2001)," June 12, 2001.
[12] California Air Resources Board, "Average Permeation Rates of High-Density Polyethylene Off-Road Equipment Fuel Tanks Using a Surface Area Approach (March 2002)," March 15, 2002.

tank ID	tank volume gallons	Surface area square inches	Surface area square meters	average hc loss grams/day	permeation rate grams/square meter/day
U1	0.25	106	0.07	0.67	9.80
U2	0.25	106	0.07	0.66	9.65
U3	0.25	106	0.07	0.62	9.07
U4	0.25	177	0.11	1.39	12.17
U5	0.25	177	0.11	1.26	11.03
T17	0.29	131	0.08	1.27	15.00
T20	0.38	189	0.12	1.30	10.66
T43	0.38	155	0.10	0.92	9.18
T19	0.5	170	0.11	1.39	12.69
T20	0.5	189	0.12	1.04	8.53
T4	1.4	342	0.22	1.72	7.81
T28	1.75	368	0.24	1.47	6.19
T6	3.9	1049	0.68	3.28	4.84
T7	5.0	672	0.43	3.82	8.80
T8	7.5	1122	0.72	2.07	2.86

Average emissions for various tanks size categories are shown in the table below.

Table E2. Summary of HDPE Small SI Fuel Tank Permeation Emission Factors

Tank Size	Min [g/m^2/day]	Max [g/m^2/day]	Avg [g/m^2/day]	Std Dev
<0.25 gal	4.8	9.0	6.5	1.5
>0.25 gal	2.9	15.0	9.7	2.6
All	2.9	15.0	9.1	2.7

Some handheld equipment, primarily chainsaws, use structurally-integrated fuel tanks where the tank is molded as part of the body of the equipment. In these applications, the frames (and tanks) are typically molded out of nylon for strength. We tested structurally-integrated fuel tanks from four handheld equipment manufacturers at 29°C on both gasoline and a 10 percent ethanol blend. In the cases where the permeation rates were high, it was observed that the fuel cap seals had large exposed surface areas on the O-rings, which were not made of low permeation materials. Emissions could likely be reduced significantly from these tanks with improved seal designs. Table E3 presents the results of this testing. Note that permeation emissions are 20 to 70 percent higher on E10 than on gasoline for these fuel tanks.

Table E3. Permeation Rates for Nylon Handheld Fuel Tanks Testing by EPA at 29°C

Tank ID	Application	Material	Test Fuel	Permeation Loss [g/m²/day]
R1	clearing saw	nylon 6	gasoline	0.34
R2	(0.24 gallons)		E10	0.42
R3			E10	0.48
B1	hedge clipper	nylon 6, 33% glass	gasoline	0.62
B2	(0.05 gallons)		E10	1.01
B3			E10	1.12
B4			E10	0.93
W1	chainsaw	nylon 6, 30% glass	gasoline	1.45
W2	(0.06 gallons)		E10	2.18
W3			E10	2.46
G1	chainsaw	nylon 6, 30% glass	gasoline	1.30
G2	(0.06 gallons)		E10	1.41
G3			E10	2.14

Based on the above, it is reasonable to break the tanks into three categories, HDPE tanks below 0.25 gallons, HDPE tanks above 0.25 gallons, and nylon handheld fuel tanks. Because all recreational equipment have tank sizes above 0.25 gallon, the emission factor of 9.7 $g/m^2/day$ is used for all uncontrolled recreational equipment tanks.

Recreational Marine Equipment

To determine the baseline permeation emissions from marine fuel tanks, we have collected permeation data on several plastic fuel tanks. Because gasoline does not permeate through aluminum, we did not perform permeation testing on aluminum fuel tanks.

We tested ten plastic fuel tanks that were either intended for marine use or are of similar construction. This permeation testing was performed at 29°C with gasoline. Prior to testing, the fuel tanks were stored with gasoline in them for about 20 weeks to ensure stable permeation rates. Table E4 presents the measured permeation rates for these fuel tanks in grams per gallon of fuel tank capacity. Where the internal surface area was either easily determined or supplied by the manufacturer, we also calculated the permeation rate in terms of grams per square meter of inside surface area. The 31 gallon tank showed much lower permeation than the other fuel tanks. This was likely due to the thickness of the walls in this tank. Even after stabilization, permeation is a function of material thickness. According to Fick's Law, if the wall thickness of a fuel tank were double, the permeation rate would be halved.[13] Smaller plastic marine fuel tanks are currently constructed out of high-density polyethylene (HDPE) while larger ones are generally constructed out of cross-link polyethylene (XLPE). Marine fuel tanks may also be

[13] Tuckner, P., Baker, J., "Fuel Permeation Testing using Gravimetric Methods," SAE Paper 2000-01-1096, 2000, Docket A-2000-01, Document IV-A-96.

constructed out of metal which does not permeate.

Table E4. Permeation Rates for Plastic Marine Fuel Tanks Tested by EPA at 29°C

Tank Capacity [gallons]	Permeation		Construction	Application
	[g/gal/day]	[g/m²/day]		
3.3	0.96	12.7	HDPE	portable marine
6.0	0.61	6.8	HDPE	portable marine
6.0	1.21	13.4	HDPE	portable marine
6.0	0.77	8.6	HDPE	portable marine
6.6	0.75	8.2	HDPE	portable marine
6.6	0.83	9.1	HDPE	portable marine
6.6	0.77	8.4	HDPE	portable marine
6.0	0.62	8.5	cross-link	marine test tank
23	0.68	8.6	cross-link	installed marine
31	0.44	5.5	cross-link	installed marine

The Coast Guard tested three rotationally-molded, cross-link polyethylene marine fuel tanks at 40°C (104°F) for 30 days.[14] The results are presented in Table E5. Because permeation emissions are a function of surface area and wall thickness, there was some variation in the permeation rates from the three tanks on a g/gal/day basis. These results are not directly comparable to the EPA testing because of the difference in test temperature. However, we can adjust the permeation rates for temperature using Arrhenius' relationship[15] combined with empirical data collected on permeation rates for materials used in fuel tank constructions (described below). These adjusted permeation rates are shown in Table E5 and are consistent with the EPA test data.

[14] Allen, S.J., "Fuel Tank Permeability Test Procedure Development; Final Report," U.S. Coast Guard, December 1986, Docket A-2000-01, Document II-A-17.
[15] Nulman, M., Olejnik, A., Samus, M., Fead, E., Rossi, G., "Fuel Permeation Performance of Polymeric Materials," SAE Paper 2001-01-1999, 2001, Docket A-2000-01, Document IV-A-23.

Table E5. Permeation Rates for Cross-Link Marine Fuel Tanks at 40°C

Tank Capacity [gallons]	Measured Permeation Loss [g/gal/day]	Average Wall Thickness [mm]	Adjusted to 29°C [g/gal/day]
12	1.48	5.3	0.71
18	1.39	5.6	0.67
18	1.12	6.9	0.54

In addition to the data presented above in Table E1, the California Air Resources Board (ARB) also investigated permeation rates from portable fuel containers using the same test methodology.[16] This data is presented in Table E6. Although this testing was not on portable marine fuel tanks, the fuel tanks tested are of similar construction. Because most marine fuel tanks are 5 gallons and above only the data in for tanks 5 gallons and above are included. Table E6 also includes data on small SI fuel tanks 5 gallons and larger from the reports cited above for small SI fuel tanks.

Table E6. Permeation Rates for HDPE Portable Fuel Containers Tested by ARB Over a 18-41°C Diurnal

Application	Tank Capacity [gallons]	Permeation Loss [g/gal/day]
Portable fuel tanks	5.0	0.89
	5.0	0.62
	5.0	0.99
	5.0	1.39
	5.0	1.46
	5.0	1.41
	5.0	1.47
	6.6	1.09
Small SI equipment	5.0	0.64
	5.0	0.55
	5.0	0.76
	7.5	0.28

To develop emission factors for marine fuel tanks, we use the data in tables E4 through E6. Because permeation is a function of surface area, we base the emission factors on units of $g/m^2/day$. In cases where the data was reported only in terms of g/gal/day, we convert the data using the relationship established in Appendix D. Table E7 presents these emission factors. We use the HDPE emission factor for portable marine fuel tanks and for personal watercraft. For

[16] www.arb.ca.gov/msprog/spillcon/reg.htm, Updated March 26, 2001, Copy of linked data reports available in Docket A-2000-01, Document IV-A-09.,3131. Email from Jim Watson, California Air Resources Board, to Phil Carlson, U.S. EPA, "Early Container Data," August 29, 2002, Docket A-2000-01, Docket No. IV-A-103

installed plastic fuel tanks, we use the XLPE emission factor. For installed metal fuel tanks we use a permeation emission factor of zero.

Table E7. Summary of Plastic Marine Fuel Tank Permeation Emission Factors

Tank Type	Min [g/m^2/day]	Max [g/m^2/day]	Avg [g/m^2/day]	Std Dev
HDPE	5.5	14.6	9.9	3.1
Cross-link PE	5.5	8.6	8.0	0.8

Appendix F
Suggested Nationwide Average Fuel Properties for Ethanol Blends

Year	Ethanol Blends		Nationwide Fuel Oxygen Weight %*
	Market Share %	Volume %	
2000	13.5	8.2	0.39
2001	14.5	8.2	0.42
2002	17.0	8.2	0.49
2003	22.2	8.2	0.64
2004	27.3	8.2	0.78
2005	31.0	9.3	1.01
2006	41.5	9.3	1.35
2007	46.3	9.3	1.51
2008	57.5	9.3	1.87
2009	75.1	9.3	2.44
2010	78.8	9.5	2.62
2011	78.8	9.5	2.62
2012	78.8	9.5	2.62
2013	78.8	9.5	2.62
2014	78.8	9.5	2.62
2015	78.8	9.5	2.62
2016	78.8	9.5	2.62
2017	78.8	9.5	2.62
2018	78.8	9.5	2.62
2019	78.8	9.5	2.62
2020+	78.8	9.5	2.62

* Calculated using the formula:

OxyWtPct = EtOHblendMktPct * EthOHvolPct * 0.35 * 0.01

Where: OxyWtPct = Nationwide average oxygen weight percent
EtOHblend MktPct = Ethanol blend market percent
EthOHvolPct = Ethanol blend volume percent
0.35 = Ethanol oxygen fraction
0.01 = Conversion from weight fraction to weight percent

Appendix G
Derivation of Running Loss Emission Factors and SCC Assignments

Sources of Data

The California Air Resources Board performed running loss tests on several pieces of small SI equipment. [17] This equipment included four lawnmowers (2 new and 2 old), one string trimmer, two generators, two ATVs, and two forklifts. To measure running loss emissions, the equipment were operated on California certification fuel in a SHED and the exhaust was routed outside the SHED. Running loss emissions were determined by measuring the HC concentration in the SHED. Therefore, the measurements included all evaporative emissions during operation including those from fuel heating, permeation, carburetor losses, and, for the two older lawnmowers, liquid fuel leaks. Although permeation is included, its contribution to total running loss emissions should be minimal. Although the ATVs and forklifts are not considered to be small offroad engines, these data can be used as surrogates for equipment that were not tested. Table G1 presents these data.

Table G1. Results from ARB Running Loss Tests

Equipment Type	ARB Designation	Model Year*	HC [g/hr]
Walk-behind Mower (plastic tank)	Mower8	2000	0.8
	Mower9	2001	2.6
	Mower19**	1994	27.0
	Mower23**	1989	12.1
String Trimmer	Trimmer6	1999	**0.58*** **
Generator Set	Generator1	1995	19.45
	Generator2	2001	1.8
ATV	ATV2	2001	21.35
	ATV3	2001	1.25
	Average		**11.30*** **
Forklift	Forklift1	1995	1.83
	Forklift2	1987	7.39
	Average		**4.61*** **

* The 2000 and 2001 equipment were new at the time of testing.
** Mower19 and Mower23 were determined to be leakers.
*** The values in bold for trimmers, ATVs, and forklifts were used in the NONROAD model. The data for the other equipment were combined with similar equipment from other data sources to derive the values used in the NONROAD model.

[17] Wong, W., "Addition of Evaporative Emissions for Small Off-Road Engines," California Air Resources Board OFFROAD Model Change Technical Memo, Revised April 21, 2003, Docket OAR-2004-0008, Document OAR-2004-0008-0006.

EPA also collected running loss data. To investigate running loss emissions, we instrumented seven riding lawnmowers, three walk-behind lawnmowers, two generators, and one pressure washer to measure the fuel temperature during typical operation. Of the riding mowers, two had fuel tanks in front near the engine, three had fuel tanks in rear away from engine (but near the hydraulic system), and two were "zero-turn" mowers that had pairs of side saddle engines that were relatively close to the rear mounted engine. All of the riding mowers had plastic fuel tanks. One of the walk-behind mowers had a metal tank directly mounted to the block while the others had plastic tanks near the top/side of the engine. Both generators had plastic tanks mounted above the engine while the pressure washer had a metal tank mounted above the engine. All of the equipment vented through the fuel caps. The pressure washer had a metal fuel tank mounted above the engine. The equipment was operated in the field until the fuel temperature stabilized. For lawnmowers, the fuel temperature stabilized within 20 to 30 minutes while the larger equipment took up to an hour.

By measuring the increase in fuel temperature during operation, we were able to make a simple determination of the running loss emissions vented from the fuel tank. Other potential running loss emissions would be from the carburetor, due to permeation increases due to heating the fuel, or vibration-induced leaks in the fuel system. However, we believed that the majority of the running loss emissions would be due to breathing losses associated with heating the fuel. Table G2 presents the results of the temperature testing.

We contracted with an independent testing laboratory to test fuel tanks from most of the above pieces of equipment over the measured fuel temperature profiles.[18] For three of the tests on larger fuel tanks, we found that the measured emissions were inconsistent with theoretical predictions. An investigation of the test data suggested that the test had been ended too soon to see the full effect of the heat build. Repeat tests were performed with a longer sample time.[19] From these data we get the running loss emissions due to the breathing losses associated with the heating of the fuel tank. New tanks were purchased for this testing that had not been previously exposed to fuel so permeation emissions would not be included in the emission measurements. Table G2 also presents the test results for the above equipment.

[18] Cushing, T., "Fuel Tank Hydrocarbon Emission Testing," prepared by Sterling Performance for the U.S. EPA, Report #040107, September 30, 2004.
[19] Cushing, T., "Fuel Tank Hydrocarbon Emission Testing," prepared by Sterling Performance for the U.S. EPA, Report #040137, November 3, 2004.

Table G2. Results from EPA Running Loss Tests on Small SI Equipment

Equipment Type	Fuel Capacity [gallons]	Min. Temp °C	Max. Temp °C	HC [g/hr]
Riding mower front tank near engine	1.7 1.1	19.5 15.7	30.3 28.4	1.4 1.01
Riding mower rear tank away from engine	6.5 3.0 2.5	24.3 26.6 27.0	33.2 28.4 35.0	7.8 0.74 3.23
Zero-turn riding mower 2 saddle tanks near engine	6.5 x 2 1.4 x 2	20.5 21.9	23.9 29.7	3.4 2.46
Riding mower average				**2.86***
Walk-behind mower (plastic)	0.34 0.25	23.3 28.7	33.0 46.7	0.26 1.23
Walk-behind mower (metal)	0.22	28.7	59.7	8.12
Generator set	8.5 7.0	20.6 25.8	25.8 50.0	3.8 69.3
Pressure washer	1.8	19.0	50.6	20.29

* The value in bold for riding mowers was used in the NONROAD model. The data for the other equipment were combined with similar equipment from other data sources to derive the values used in the NONROAD model.

The South Coast Air Quality Management District (SCAQMD) also sponsored running loss tests on several pieces of large SI equipment, using California Phase II fuel. This equipment included three forklifts, one sweeper, one scrubber, one tow tractor, one baggage belt loader, and one boom lift. [20] The data are provided in Table G3.

[20] James N. Carroll and Jeff J. White, Southwest Research Institute, "Measurement of Evaporative Emissions from Off-Road Equipment," Prepared for South Coast Air Quality Management District, November 1998, EPA Docket A-2000-01, II-A-10. (Table 3)

Table G3. Results from SCAQMD Running Loss Tests on Large SI Equipment

Equipment Type	Model Year	HC [g/hour]
Forklift	1985	0.75
Forklift	1995	0.75
Forklift	1989	0.25
Sweeper	1998	0.25
Scrubber	1998	1.25
Tow Tractor	1997	2.00
Baggage Belt Loader	1994	0.50
Boom Lift	1996	13.50
Average		**2.41**

Running Loss Emission Factors for Small SI Equipment

The emission factors used for small SI equipment are provided in Table G4.

Table G4. Small SI Running Loss Emission Factors

Application	Source of Data	HC [g/hour]
ATV	ARB	11.30
Forklift	ARB	4.61
Riding Mower	EPA	2.86
Trimmer/Edger	ARB	0.58
Lawnmower (walk-behind)	ARB and EPA	3.34
Generator/Pressure Washer	ARB and EPA	14.23

The ATV, forklift, and trimmer/edger emission factors are the averages of the ARB data for each application presented in Table G1. Similarly, the riding mower emission factor is the average of the EPA data for this application presented in Table G2.

For lawnmowers (walk-behind mowers), the emission factor was derived from the ARB and EPA data presented in Tables G1 and G2. First, separate emission factors were estimated for metal and plastic tanks. The emission factor for lawnmowers with metal tanks is 8.12 g/hour, from the EPA data in Table G2. For lawnmowers with plastic tanks, there are both ARB and EPA data. Two of the walk-behind mowers tested by ARB (Mower19 and Mower23) were determined to be leakers in the original test report. It is not possible to determine the incidence of leakers with accuracy. These two mowers are also near the end of their useful life. To attempt to correct for these outliers without excluding them, they are averaged and given a minimum weighting of 5% rather than given equal weighting. The remaining data (Mower8 and Mower9 in Table G1 and the two lawnmowers with plastic tanks in Table G2) were averaged and weighted at 95%, and a composite emission factor of 2.14 g/hr was calculated for lawnmowers with plastic tanks.

Second, the emission factors for metal and plastic tanks were combined to determine a composite lawnmower emission factor. The lawnmower with the metal tank represents a model with a high sales volume. Therefore, we weighted this data into the emission factor determination based on our understanding of the sales fraction of similar model types. As a result, the emission factor for lawnmowers with metal tanks (8.12 g/hour) was weighted at 20% and the emission factor for lawnmowers with plastic tanks (2.14 g/hr) was weighted at 80% to obtain the composite lawnmower emission factor of 3.34 g/hour.

The data for pressure washers was weighted in with the generator sets to create a single emission factor, due to the similarity of the equipment configurations. For the generator/pressure washer category, the emission factor was derived from the ARB and EPA data presented in Tables G1 and G2. One of the generators tested by EPA is an extreme outlier, having an emission factor of 69.3 g/hour in Table G2. Because this effect was real and because of the limited data available, this data point was not excluded. Rather, it was given a low weighting (5%) similar to the approach taken for the leaking lawnmowers. The remaining data (Generator1 and Generator2 in Table G1 and the other generator and pressure washer in Table G2) were averaged and weighted at 95%, and a composite emission factor of 14.23 g/hr was calculated for generator/pressure washers.

Running Loss Emission Factors for Large SI Equipment

A running loss emission factor of 2.41 g/hour is used for all large SI equipment. It is the average of all equipment included in the SCAQMD test program. The data are provided in Table G3.

Running Loss Emission Factors for Recreational Marine Engines

We do not have running loss data for recreational marine engines. Presumably, boats with outboard engines would not have significant running loss emissions from the fuel tank. To generate a rough estimate, we use the emission factor for riding mowers given in Table F4 (2.86 g/hour) for personal watercraft and smaller SD/I vessels (tank sizes up to 20 gallons). SD/I vessels with tank sizes up to 20 gallons correspond to SD/I vessels <=100 hp. For larger fuel tanks, we assume that the fuel tank is mounted away from the engine and is not significantly affected by engine heating. A summary of the recreational marine running loss emissions rates used in the NONROAD model are given in Table G5.

Table G5. Recreational Marine Running Loss Emission Rates

Equipment Description	SCC	HP	HC [g/hour]
2-Str Outboard	2282005010	All	0.00
4-Str Inboard/ Sterndrive	2282010005	<=100	2.86
4-Str Inboard/ Sterndrive	2282010005	>100	0.00
2-Str Personal Watercraft	2282005015	All	2.86

Running Loss Emission Factors for Recreational Equipment

The ATV emission factor of 11.3 g/hour given in Table G4 is used for all recreational equipment. Since the activities for off-road motorcycles and ATVs are in units of miles/year, it is necessary to convert the emission factor to consistent units of g/mile for these equipment. This is done by dividing the g/hour emission factor by the average speed in miles/hour. The average speed for ATVs is 9.6 miles/hour, which is a weighted average for utility and sport ATVs. The average speed for off-road motorcycles is 20 miles/hour. The resulting running loss emission factors used in the model are 1.18 g/mile for ATVs and 0.57 g/mile for off-road motorcycles.

Assignment of Small SI Emission Factors to Equipment Types

The small SI emission factors were then mapped to other applications based on similar characteristics of the equipment. Specialty vehicle carts and golf carts were assigned the ATV emission factor. In general, equipment less than or equal to 3 hp were assigned the trimmer/edger emission factor, with 3-6 hp equipment assigned the lawnmower emission factor, and 6-25 hp equipment assigned the forklift emission factor. For construction equipment, equipment less than or equal to 6 hp were generally assigned the lawnmower emission factor. The riding mower emission factor was used instead for certain lawn and garden equipment. The generator/pressure washer emission factor was used generally for 6-25 hp commercial equipment and for other equipment used in a similar fashion (i.e., signal boards/light plants and AC/refrigeration).

The small SI running loss emission factor assignments by SCC and hp are provided in Table G6.

Table G6. Running Loss Small SI Emission Factor Assignments by SCC/hp

SCC	Equipment Description	HPmn	HPmx	Assignment
2260001060	Specialty Vehicle Carts	6	11	ATV
2260002006	Tampers/Rammers	3	6	Trimmer/Edger
2260002009	Plate Compactors	1	3	Trimmer/Edger
2260002021	Paving Equipment	1	3	Trimmer/Edger
2260002027	Signal Boards/Light Plants	1	3	Generator/Pressure Washer
2260002039	Concrete/Industrial Saws	1	6	Trimmer/Edger
2260002054	Crushing/Proc. Equipment	1	3	Trimmer/Edger
2260003030	Sweepers/Scrubbers	1	3	Trimmer/Edger
2260003040	Other General Industrial Eqp	1	3	Trimmer/Edger
2260004015	Rotary Tillers < 6 HP (res)	0	3	Trimmer/Edger
2260004016	Rotary Tillers < 6 HP (com)	0	3	Trimmer/Edger
2260004020	Chain Saws < 6 HP (res)	1	6	Trimmer/Edger
2260004021	Chain Saws < 6 HP (com)	1	6	Trimmer/Edger
2260004025	Trimmers/Edgers/Brush Cutter (res)	0	6	Trimmer/Edger
2260004026	Trimmers/Edgers/Brush Cutter (com)	0	6	Trimmer/Edger
2260004030	Leafblowers/Vacuums (res)	0	6	Trimmer/Edger
2260004031	Leafblowers/Vacuums (com)	0	6	Trimmer/Edger
2260004035	Snowblowers (res)	1	6	Trimmer/Edger
2260004036	Snowblowers (com)	1	6	Trimmer/Edger
2260004071	Commercial Turf Equipment (com)	1	3	Trimmer/Edger
2260005035	Sprayers	0	3	Trimmer/Edger
2260006005	Generator Sets	0	3	Trimmer/Edger
2260006010	Pumps	0	3	Trimmer/Edger
2260006015	Air Compressors	1	3	Trimmer/Edger
2260006035	Hydro Power Units	1	3	Trimmer/Edger
2260007005	Chain Saws > 6 HP	6	11	Trimmer/Edger
2265001050	Golf Carts	6	11	ATV
2265001060	Specialty Vehicle Carts	1	25	ATV
2265002003	Pavers	0	6	Lawnmower
2265002003	Pavers	6	25	Forklift
2265002006	Tampers/Rammers	6	11	Forklift
2265002009	Plate Compactors	3	6	Lawnmower
2265002009	Plate Compactors	6	16	Forklift
2265002015	Rollers	6	25	Forklift
2265002021	Paving Equipment	3	6	Lawnmower
2265002021	Paving Equipment	6	25	Forklift
2265002024	Surfacing Equipment	3	6	Lawnmower
2265002024	Surfacing Equipment	6	25	Forklift
2265002027	Signal Boards/Light Plants	3	25	Generator/Pressure Washer
2265002030	Trenchers	1	6	Lawnmower
2265002030	Trenchers	6	25	Forklift

SCC	Equipment Description	HPmn	HPmx	Assignment
2265002033	Bore/Drill Rigs	0	6	Lawnmower
2265002033	Bore/Drill Rigs	6	25	Forklift
2265002039	Concrete/Industrial Saws	6	25	Forklift
2265002042	Cement & Mortar Mixers	1	6	Lawnmower
2265002042	Cement & Mortar Mixers	6	25	Forklift
2265002045	Cranes	6	25	Forklift
2265002054	Crushing/Proc. Equipment	1	3	Trimmer/Edger
2265002054	Crushing/Proc. Equipment	3	6	Lawnmower
2265002054	Crushing/Proc. Equipment	6	25	Forklift
2265002057	Rough Terrain Forklift	16	25	Forklift
2265002066	Tractors/Loaders/Backhoes	6	25	Forklift
2265002072	Skid Steer Loaders	11	25	Forklift
2265002078	Dumpers/Tenders	3	6	Lawnmower
2265002078	Dumpers/Tenders	6	25	Forklift
2265002081	Other Agricultural Equipment	16	25	Forklift
2265003010	Aerial Lifts	6	25	Forklift
2265003030	Sweepers/Scrubbers	3	6	Lawnmower
2265003030	Sweepers/Scrubbers	6	25	Forklift
2265003040	Other General Industrial Eqp	3	6	Lawnmower
2265003040	Other General Industrial Eqp	6	25	Forklift
2265003050	Other Material Handling Eqp	1	3	Trimmer/Edger
2265003050	Other Material Handling Eqp	3	6	Lawnmower
2265003050	Other Material Handling Eqp	6	25	Forklift
2265003060	AC\Refrigeration	6	25	Generator/Pressure Washer
2265004010	Lawn mowers (res)	1	11	Lawnmower
2265004011	Lawn mowers (Com)	1	11	Lawnmower
2265004015	Rotary Tillers < 6 HP (res)	3	6	Lawnmower
2265004016	Rotary Tillers < 6 HP (com)	3	6	Lawnmower
2265004025	Trimmers/Edgers/Brush Cutter (res)	3	6	Lawnmower
2265004025	Trimmers/Edgers/Brush Cutter (res)	6	25	Forklift
2265004026	Trimmers/Edgers/Brush Cutter (com)	3	6	Lawnmower
2265004026	Trimmers/Edgers/Brush Cutter (com)	6	25	Forklift
2265004030	Leafblowers/Vacuums (res)	3	6	Lawnmower
2265004030	Leafblowers/Vacuums (res)	6	25	Forklift
2265004031	Leafblowers/Vacuums (com)	3	6	Lawnmower
2265004031	Leafblowers/Vacuums (com)	6	25	Forklift
2265004035	Snowblowers (res)	6	16	Forklift
2265004036	Snowblowers (com)	6	16	Forklift
2265004040	Rear Engine Riding Mowers (res)	3	25	Riding Mower
2265004041	Rear Engine Riding Mowers (com)	3	25	Riding Mower
2265004046	Front Mowers (com)	6	25	Riding Mower
2265004051	Shredders < 6 HP (com)	1	6	Lawnmower

SCC	Equipment Description	HPmn	HPmx	Assignment
2265004055	Lawn & Garden Tractors (res)	3	25	Riding Mower
2265004056	Lawn & Garden Tractors (com)	3	25	Riding Mower
2265004066	Chippers/Stump Grinders (com)	3	25	Lawnmower
2265004071	Commercial Turf Equipment (com)	3	25	Riding Mower
2265004075	Other Lawn & Garden Eqp. (res)	0	25	Riding Mower
2265004076	Other Lawn & Garden Eqp. (com)	0	25	Riding Mower
2265005010	2-Wheel Tractors	6	16	Forklift
2265005015	Agricultural Tractors	16	25	Forklift
2265005030	Agricultural Mowers	3	6	Lawnmower
2265005030	Agricultural Mowers	6	25	Forklift
2265005035	Sprayers	0	25	Forklift
2265005040	Tillers > 6 HP	6	16	Forklift
2265005055	Other Agricultural Equipment	3	6	Lawnmower
2265005055	Other Agricultural Equipment	6	25	Forklift
2265005060	Irrigation Sets	3	25	Generator/Pressure Washer
2265006005	Generator Sets	3	6	Lawnmower
2265006005	Generator Sets	6	25	Generator/Pressure Washer
2265006010	Pumps	3	6	Lawnmower
2265006010	Pumps	6	25	Generator/Pressure Washer
2265006015	Air Compressors	3	6	Lawnmower
2265006015	Air Compressors	6	25	Generator/Pressure Washer
2265006025	Welders	3	6	Lawnmower
2265006025	Welders	6	25	Generator/Pressure Washer
2265006030	Pressure Washers	1	3	Trimmer/Edger
2265006030	Pressure Washers	3	6	Lawnmower
2265006030	Pressure Washers	6	25	Generator/Pressure Washer
2265006035	Hydro Power Units	3	6	Lawnmower
2265006035	Hydro Power Units	6	25	Generator/Pressure Washer
2265007010	Shredders > 6 HP	6	25	Forklift
2265007015	Forest Eqp - Feller/Bunch/Skidder	3	6	Lawnmower
2265007015	Forest Eqp - Feller/Bunch/Skidder	6	11	Forklift
2265008005	Airport Support Equipment	3	6	Lawnmower
2265008005	Airport Support Equipment	6	25	Forklift
2285004015	Railway Maintenance	1	6	Lawnmower
2285004015	Railway Maintenance	6	25	Forklift
2265010010	Other Oil Field Equipment	6	25	Forklift

Appendix H
Derivation of Hot Soak Emission Factors, Starts/Year, and SCC Assignments

Sources of Emissions Data

Test data on hot soak emissions for different equipment types is available from testing by the Air Resources Board. [21] Hot soak emissions were measured after operating each piece of equipment for 15 minutes after which the equipment was placed in a shed at a constant temperature of 95°F for three hours.

ARB divided the various pieces of equipment into “new”, “used”, and “old”, where ARB felt there was enough data to do this (i.e., lawnmowers and generators), and used the new engine to represent emissions at zero hours, used engines to represent emissions at the useful life, and old engines to represent the emissions at the end of life. These emission levels were then used to develop deterioration rates.

Rather than take this approach, we simply assumed that there is no deterioration and estimated average hot soak emissions rates from the ARB data. The ARB data and average emissions by equipment type are provided in Tables H1 and H2.

Because of the lack of data at different fuel volatilities and temperatures, the hot soak emission factors are not corrected for either fuel volatility or ambient temperature. Also, since the hot soak emissions are based on a SHED test, they include permeation emissions. Without knowing the exact materials used in each of these equipment types, it is difficult to subtract the permeation emissions, so the hot soak emissions obtained with this test program may be overestimated. However, the permeation emissions during the 15 minute test period should be very small compared to the hot soak emissions.

The South Coast Air Quality Management District (SCAQMD) also sponsored hot soak tests on several pieces of large SI equipment, using California Phase II fuel. This equipment included three forklifts, one sweeper, one scrubber, one tow tractor, one baggage belt loader, and one boom lift. [22] The data are provided in Table H3.

[21] Walter Wong, ARB,“Addition of Evaporative Emissions for Small Off-Road Engines,” Revised 4/21/03.
[22] James N. Carroll and Jeff J. White, Southwest Research Institute, “Measurement of Evaporative Emissions from Off-Road Equipment,” Prepared for South Coast Air Quality Management District, November 1998, EPA Docket A-2000-01, II-A-10. (Table 3)

Table H1. ARB Hot Soak Data for Non-Mowers

Equipment Type	Hot Soak (g/3 hours)
Chainsaw1	0.1
Chainsaw2	0.15
Chainsaw3	0.56
Average	**0.27**
Leafblower1	0.11
Leafblower2	0.22
Leafblower3	0.11
Average	**0.15**
Tractor1	1.25
Tractor2	1.22
Tractor3	2.09
Average	**1.52**
Trimmer1	1.2
Trimmer2	0.07
Trimmer3	0.07
Trimmer4	0.08
Trimmer5	0.13
Trimmer6	0.17
Trimmer7	0.4
Trimmer8	0.23
Average	**0.29**
Generator1	4.64
Generator2	2.72
Generator3	2.36
Average	**3.24**
Forklift	10.5
Average	**10.5**
ATV1	2.24
ATV2	2.64
ATV3	2.16
ATV4	4.96
Average	**3.00**

Table H2. ARB Hot Soak Data for Walk-Behind Mowers (Lawnmowers)

Mower	Manufacturer	Year	Strata	Hot Soak (g/event)
Mower1	Lawn Boy	01	New	0.41
Mower2	Craftsman	01	New	0.58
Mower3	Craftsman	01	New	0.55
Mower4	Yard Machine	01	New	0.41
Mower5	Yard Machine	01	New	0.61
Mower6	Yard Machine	01	New	0.63
Mower7	Honda	01	New	0.48
Mower8	Honda	00	New	0.89
Mower9	Scott's	01	New	0.58
Mower10	Toro	99	New	0.72
Mower11	Murray	01	New	2.18
Mower12	Briggs & Stratton	01	New	0.52
Mower13	Briggs & Stratton	01	New	0.67
Mower14	Tecumseh	01	New	0.70
Mower15	Tecumseh	01	New	0.75
Mower16	Honda	01	New	0.47
Mower17	Honda	01	New	0.39
Mower18	Toro	90	Used	1.56
Mower19	Sears	94	Used	1.06
Mower20	Builders Best	73	Old	0.87
Mower21	Murray	?	Used	0.70
Mower22	Murray	99	Used	1.00
Mower23	Toro	89	Old	2.88
Average				**0.853**

Table H3. Results from SCAQMD Hot Soak Tests on Large SI Equipment

Equipment Type	Model Year	HC [g/start]
Forklift	1985	0.00
Forklift	1995	0.96
Forklift	1989	2.23
Sweeper	1998	1.06
Scrubber	1998	0.96
Tow Tractor	1997	14.31
Baggage Belt Loader	1994	1.00
Boom Lift	1996	14.2
Average		**4.34**

Hot Soak Emission Factors for Small SI Equipment

The ARB data (averages by equipment type) were used for the small SI hot soak emission factors. A summary of these emission factors is given in Table H4. Each 3-hour event is considered one start, so the emission factors are expressed as g/start.

Table H4. Hot Soak Emission Factors Used for Small SI Equipment

Equipment Type	Hot Soak (g/start)
Chainsaw	0.27
Lawnmower	0.85
Tractor	1.52
ATV	3.00
Trimmer/Edger	0.29
Leaf blower	0.15
Tiller	0.57
Generator/Welder	3.24
Forklift	10.5

Hot Soak Emission Factors for Large SI Equipment

A baseline hot soak emission factor of 4.34 g/start is used for all large SI equipment. It is the average of all equipment used in the SCAQMD program. The data are provided in Table H3.

Hot Soak Emission Factors for Recreational Marine Engines

We do not have hot soak data for recreational marine engines. The ATV emission factor of 3.00 g/start from Table H1 is used for all recreational marine engines.

Hot Soak Emission Factors for Recreational Equipment

The ATV emission factor of 3.00 g/start from Table H1 is used for all recreational equipment.

Starts Per Hour Activity Estimates

A summary of the starts per hour activity estimates is given in Table H5. Starts and soaks are used interchangeably.

The residential lawnmower estimate of 2.0 soaks/hour is modified from an ARB data logger study showing 2.9 soaks/hour, with an annual use of just 12.9 hours/year. [23] The NONROAD default activity is 25 hours/year, implying somewhat larger yards (and possibly longer growing season) than the average in the ARB study, so the soaks/hour has been reduced somewhat to 2.0 soaks/hour. The commercial lawnmower value of 0.5 soaks/hour is taken directly from the ARB study.

For the remaining equipment, values were estimated based on engineering judgment regarding how these equipment are likely used. An estimated lower bound is 0.125 soaks per hour of use, which is equivalent to 1 soak per 8 hours of use. A likely upper bound is 12 soaks per hour of use, which is equivalent to something used briefly on any given day, but long enough to warm up for 5 minutes, which would mean 1 soak per 0.083 hours of use.

The upper limit for number of starts is 260 starts/year (based on 5 days/week and 52 weeks/year). For each equipment type, starts/year is calculated by multiplying starts/hour and hours/year. If the resulting starts/year is greater than 260, the starts/year is reset to 260 and the starts/hour estimate is adjusted downward accordingly. This check and adjustment was done outside the model. The starts/hour estimates in the spillage.emf file already contain these adjustments.

Since the activities for off-road motorcycles and ATVs are in units of miles/year, the hot soak inventory for this equipment is estimated by multiplying the hot soak emission rates in g/start by starts/mile and miles/year activity information. As shown in Table H5, there are 1.00 starts/hour assumed for recreational equipment. To convert to units of starts/mile, the starts/hour are divided by the average speed in miles/hour. The average speed for ATVs is 9.6 miles/hour, which is a weighted average for utility and sport ATVs. The average speed for off-road motorcycles is 20 miles/hour. The resulting starts/mile values used in the model are 0.1042 starts/mile for ATVs and 0.0500 starts/mile for off-road motorcycles.

Assignment of Small SI Emission Factors to Equipment Types

The small SI emission factors were then mapped to other applications based on similar characteristics of the equipment. The ARB mapping scheme[19] is used with minor modifications. We use the generator/welder emission factor rather than the forklift for several applications (i.e., for signal boards/light plants and bore/drill rigs). We also use the lawnmower emission factor rather than the leaf blower for snowblowers. The assignments by SCC are given in Table H6.

[23] ARB lawn and garden data logger and activity survey.

Table H5. Starts (Soaks) per Hour Activity Estimates by SCC Segment

SCC Segment	SCC Segment Description	Starts per Hour of Use
1000	Recreational Land: MC, ATV, Snowmobile	1.00
2000	Construction	0.25
3000	Industrial	0.25
4000	Residential Other Lawn Equipment	2.00
4010	Residential Walk-Behind Lawnmowers	2.00
4020	Residential Handheld Lawn Equipment: Trimmers, Chainsaws, Blowers	3.00
4001	Commercial Lawn & Garden	0.50
5000	Farm	0.25
6000	Commercial	0.25
7000	Logging	0.25
8000	Airport Service	0.25
9000	Underground Mining	0.25
10000	Oil Field Equipment	0.25
2282	Recreational Marine	1.0
2285	Rail Maintenance	0.25

Table H6. Hot Soak Small SI Emission Factor Assignments by SCC/hp

SCC	Equipment Description	HPmn	HPmx	Assignment
2260001060	Specialty Vehicle Carts	6	11	ATV
2260002006	Tampers/Rammers	3	6	Forklift
2260002009	Plate Compactors	1	3	Forklift
2260002021	Paving Equipment	1	3	Forklift
2260002027	Signal Boards/Light Plants	1	3	Generator/Welder
2260002039	Concrete/Industrial Saws	1	6	Forklift
2260002054	Crushing/Proc. Equipment	1	3	Forklift
2260003030	Sweepers/Scrubbers	1	3	Forklift
2260003040	Other General Industrial Eqp	1	3	Forklift
2260004015	Rotary Tillers < 6 HP (res)	0	3	Tiller
2260004016	Rotary Tillers < 6 HP (com)	0	3	Tiller
2260004020	Chain Saws < 6 HP (res)	1	6	Chainsaw
2260004021	Chain Saws < 6 HP (com)	1	6	Chainsaw
2260004025	Trimmers/Edgers/Brush Cutter (res)	0	6	Trimmer/Edger
2260004026	Trimmers/Edgers/Brush Cutter (com)	0	6	Trimmer/Edger
2260004030	Leafblowers/Vacuums (res)	0	6	Leaf Blower
2260004031	Leafblowers/Vacuums (com)	0	6	Leaf Blower
2260004035	Snowblowers (res)	1	6	Lawnmower
2260004036	Snowblowers (com)	1	6	Lawnmower

SCC	Equipment Description	HPmn	HPmx	Assignment
2260004071	Commercial Turf Equipment (com)	1	3	Tractor
2260005035	Sprayers	0	3	ATV
2260006005	Generator Sets	0	3	Generator/Welder
2260006010	Pumps	0	3	Generator/Welder
2260006015	Air Compressors	1	3	Generator/Welder
2260006035	Hydro Power Units	1	3	Generator/Welder
2260007005	Chain Saws > 6 HP	6	11	Chainsaw
2265001050	Golf Carts	6	11	ATV
2265001060	Specialty Vehicle Carts	6	11	ATV
2265002003	Pavers	0	25	Forklift
2265002006	Tampers/Rammers	3	11	Forklift
2265002009	Plate Compactors	3	16	Forklift
2265002015	Rollers	6	25	Forklift
2265002021	Paving Equipment	3	25	Forklift
2265002024	Surfacing Equipment	3	25	Forklift
2265002027	Signal Boards/Light Plants	3	25	Generator/Welder
2265002030	Trenchers	1	25	Forklift
2265002033	Bore/Drill Rigs	0	25	Generator/Welder
2265002039	Concrete/Industrial Saws	6	25	Forklift
2265002042	Cement & Mortar Mixers	1	25	Forklift
2265002045	Cranes	6	25	Forklift
2265002054	Crushing/Proc. Equipment	1	25	Forklift
2265002057	Rough Terrain Forklift	16	25	Forklift
2265002066	Tractors/Loaders/Backhoes	6	25	Forklift
2265002072	Skid Steer Loaders	11	25	Forklift
2265002078	Dumpers/Tenders	3	25	Forklift
2265002081	Other Agricultural Equipment	16	25	Forklift
2265003010	Aerial Lifts	6	25	Forklift
2265003030	Sweepers/Scrubbers	3	25	Forklift
2265003040	Other General Industrial Eqp	3	25	Forklift
2265003050	Other Material Handling Eqp	1	25	Forklift
2265003060	AC\Refrigeration	6	25	Forklift
2265004010	Lawn mowers (res)	1	11	Lawnmower
2265004011	Lawn mowers (Com)	1	11	Lawnmower
2265004015	Rotary Tillers < 6 HP (res)	0	6	Tiller
2265004016	Rotary Tillers < 6 HP (com)	0	6	Tiller
2265004025	Trimmers/Edgers/Brush Cutter (res)	3	25	Trimmer/Edger
2265004026	Trimmers/Edgers/Brush Cutter (com)	3	25	Trimmer/Edger
2265004030	Leafblowers/Vacuums (res)	3	25	Leaf Blower
2265004031	Leafblowers/Vacuums (com)	3	25	Leaf Blower
2265004035	Snowblowers (res)	6	16	Lawnmower
2265004036	Snowblowers (com)	6	16	Lawnmower

SCC	Equipment Description	HPmn	HPmx	Assignment
2265004040	Rear Engine Riding Mowers (res)	3	25	Tractor
2265004041	Rear Engine Riding Mowers (com)	3	25	Tractor
2265004046	Front Mowers (com)	6	25	Tractor
2265004051	Shredders < 6 HP (com)	1	6	Chainsaw
2265004055	Lawn & Garden Tractors (res)	3	25	Tractor
2265004056	Lawn & Garden Tractors (com)	3	25	Tractor
2265004066	Chippers/Stump Grinders (com)	3	25	Lawnmower
2265004071	Commercial Turf Equipment (com)	3	25	Tractor
2265004075	Other Lawn & Garden Eqp. (res)	0	25	Lawnmower
2265004076	Other Lawn & Garden Eqp. (com)	0	25	Lawnmower
2265005010	2-Wheel Tractors	6	16	ATV
2265005015	Agricultural Tractors	16	25	ATV
2265005030	Agricultural Mowers	3	25	ATV
2265005035	Sprayers	0	25	ATV
2265005040	Tillers > 6 HP	6	16	ATV
2265005055	Other Agricultural Equipment	3	25	ATV
2265005060	Irrigation Sets	3	25	ATV
2265006005	Generator Sets	3	25	Generator/Welder
2265006010	Pumps	3	25	Generator/Welder
2265006015	Air Compressors	3	25	Generator/Welder
2265006025	Welders	3	25	Generator/Welder
2265006030	Pressure Washers	1	25	Generator/Welder
2265006035	Hydro Power Units	3	25	Generator/Welder
2265007010	Shredders > 6 HP	6	25	Chainsaw
2265007015	Forest Eqp - Feller/Bunch/Skidder	3	11	Forklift
2265008005	Airport Support Equipment	3	25	Forklift
2285004015	Railway Maintenance	1	25	ATV
22650010010	Other Oil Field Equipment	6	25	Generator/Welder