LCA Digital Commons Unit Process Data: agricultural self-propelled equipment

March 2014

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Cooper, J.S, M. Noon, E. Kahn, R. Johnson (2014) LCA Digital Commons Unit Process Data: agricultural self-propelled equipment, prepared for the United States Department of Agriculture National Agricultural Library under cooperative agreement Univ_Washington_SCA 6-29-10.

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Acknowledgements

This work was funded by a grant from the United States Department of Agriculture National Agricultural Library (cooperative agreement Univ_Washington_SCA 6-29-10). The authors thank Dr. Simon Liu, Susan McCarthy, Peter Arbuckle, and Gary Moore for their support and guidance and Chris Jones for his work on the development of operating temperature data.

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Executive Summary

This document describes the preparation of datasets for the *LCA Digital Commons* that represent unit process/ gate-to-gate operations for the production of work (in MJ) by agricultural self-propelled equipment and fleets of agricultural self-propelled equipment. The data cover 19 types of fleets and over 200 types of self-propelled equipment datasets, representing the potential to prepare thousands of unit-process datasets by varying the operating and model years, applicable power ranges, and operating temperatures.

The key information source used for datasets development is the documentation and supporting data developed for the US Environmental Protection Agency (USEPA) NONROAD2008a model. In addition to the data and mathematical relationships described in the NONROAD documentation, data from a range of sources are used to add lubricant use and management estimates; add equipment production and storage, spare parts production, and equipment retirement estimates; estimate specific air emissions and groupings of air emissions; and add variability and uncertainty estimates.

1. Background

1.1. Project background, goal, intended audience, and critical review

Life Cycle Assessment (LCA) is an accounting and evaluation of the inputs, outputs, and potential environmental impacts of a product system throughout its life cycle. Standardized by the International Standards Organization (ISO 2006a and 2006b), LCA describes the life cycle as consecutive and interlinked stages of a product system extending from the acquisition of raw materials (e.g., agriculture, mining, residuals management) through materials processing, technology manufacturing/ construction, technology use/maintenance/upgrade, and the technology retirement.

In an LCA, data are collected at the *unit process* level, intended to represent a single industrial activity such as the activities on a farm or in a crude oil refinery. Each single industrial activity (a) produces product (e.g., cotton lint or diesel fuel) and sometimes co-products[1] (e.g., cotton seeds or naphtha); (b) uses resources from the environment (e.g., carbon dioxide (CO_2) from the air, crude oil from the ground); (c) uses resources from other unit processes in the *technosphere* (a.k.a. the industrial sector) (e.g., ammonium nitrate produced at a fertilizer production plant or electricity generated in a power plant); and (d) generates emissions to the environment (e.g., ammonia (NH_3) emissions from fertilizer application or fuel combustion emissions). In an LCA, the inventory analysis combines unit process data for the life cycle and the impact assessment estimates the impact associated with activities and flows to and from the environment for the inventory.

The unit process data described here have been developed for the *LCA Digital Commons*[2]. The *LCA Digital Commons* is an open access database and toolset built by the United States Department of Agriculture (USDA) National Agricultural Library in response to a national need for data representing US operations for use in LCAs. The *LCA Digital Commons* database will ultimately be seeded with unit process data representing a wide range of industrial production practices and developed by researchers throughout the US at all stages of the life cycle. The tool set, being developed using the open source OpenLCA code[3], will then allow unit process data to be combined into life cycle inventories so that life cycle environmental impacts to be estimated.

Given this, the goal of this work is to develop a tool to generate unit process datasets representing agricultural self-propelled equipment for US field crop production data already in the *LCA Digital Commons* and described in Cooper, Kahn, and Noon (2012). The intended audiences are those interested in using the field crop data and those interested in building field crop production life cycle inventories.

Critical review of the datasets engaged one panel of subject area and LCA experts. The panel reviewed the technical content of the datasets with the panel members listed in Table 1.

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[1] The product of interest is called the reference product and any additional valuable products are called co-products. It is in the mathematical treatment of co-products in an LCA that manifests *credits* in attributional LCA and many of the indirect market responses studied in consequential LCA.

[2] See http://riley.nal.usda.gov/nal_display/index.php?info_center=8&tax_level=1&tax_subject=757

[3] See http://www.openlca.org/index.html

Table 1. Critical review panel

Panelist	Organization
Troy Hawkins (Panel Chair)	National Risk Management Research Laboratory, USEPA
Alberta Carpenter	National Renewable Energy Laboratory, USDOE
Wes Ingwersen	National Risk Management Research Laboratory, USEPA
Thomas Transue	Lockheed Martin Information Technology
Harvey Michaels	Office of Transportation and Air Quality, USEPA

1.2.Scope and dataset naming convention

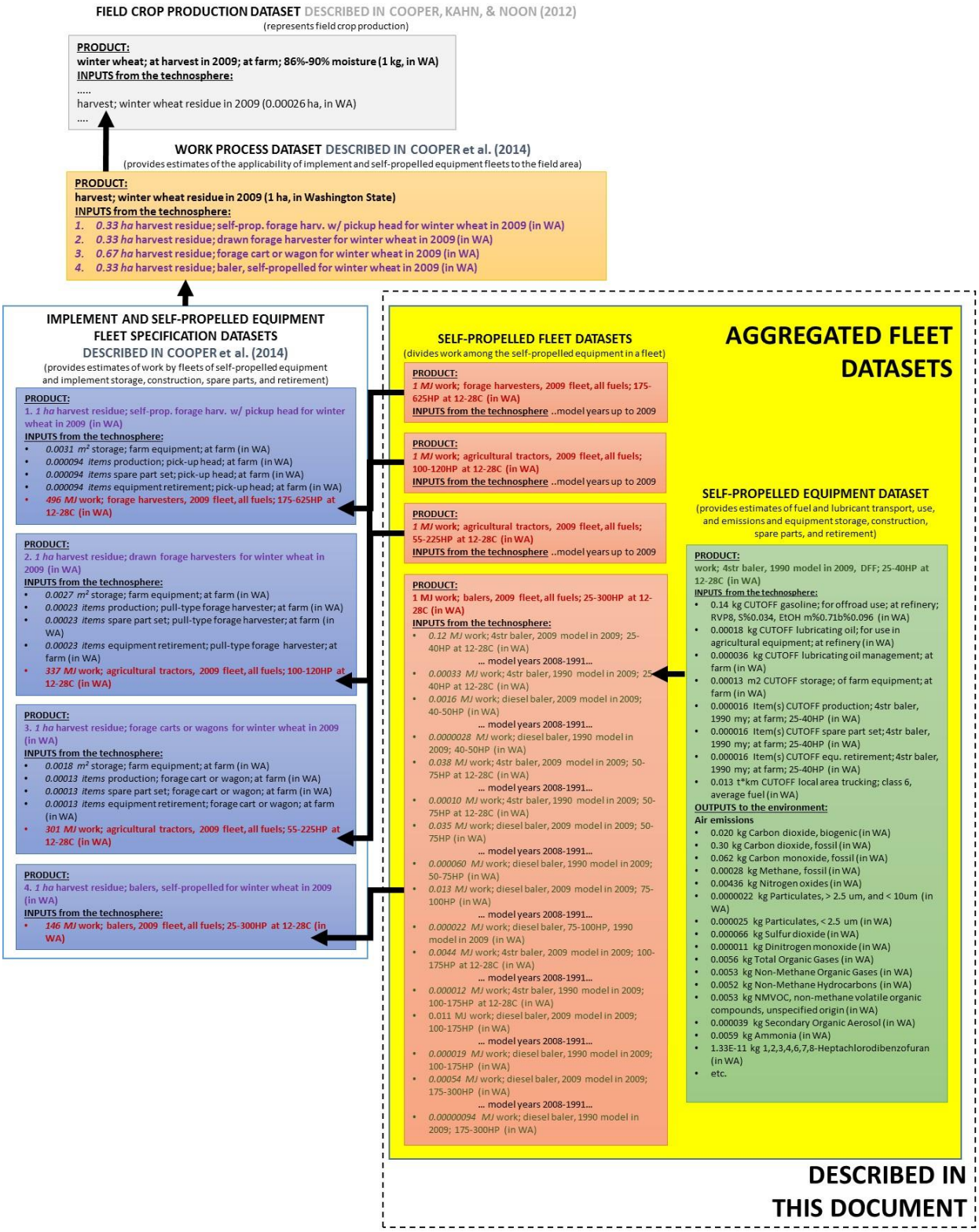
The datasets described in this document represent unit process/ gate-to-gate operations for the production of work (in MJ) by agricultural self-propelled equipment and fleets of agricultural self-propelled equipment. These are defined to include:

- **A reference product,** as 1 MJ of work (representing the SI conversion of the product of the equipment horsepower and the operating time in hours (i.e., 1 MJ ~ 0.372 HP-hr));
- **Flows from the technosphere (a.k.a. intermediate flows or industry flows),** which include fuel use, lubricating oil use and waste management, equipment storage, equipment production and retirement, and spare parts use;
- **Flows to the environment,** as air emissions e.g., CO_2 emissions related to fuel combustion.

An example of the relationships between the self-propelled fleet and equipment datasets and the field crop production data already available in the Commons is depicted in Figure 1. Starting at the top, there is a dataset representing the production of winter wheat in Washington State in 2009 already in the Commons. This dataset needs many inputs from the technosphere, one of which is a work process called "harvest; winter wheat residue in 2009." Harvest has four inputs from the technosphere, representing the applicability of farm implements and self-propelled equipment fleets for harvesting wheat. The related implement and self-propelled equipment specification datasets next provide the raw data and equations used to estimate of work by fleets of self-propelled equipment and implement storage, construction, spare parts, and retirement per hectare[4].

[4] Note that in Figure 1, the quantities of the storage space and the equipment construction, spare parts, and equipment retirement are quite small. This is because each considers the fraction of the life of the equipment that is used in operations related to harvesting just one hectare.

Figure 1 Example relationships between field crop production and self-propelled equipment datasets



The development of the work process and the implement and self-propelled equipment specification datasets will be described in Cooper, et al. (2014). Work process datasets cover soil preparation and planting (by crop and tillage type), fertilizer and pesticide applications, as well as harvest. Work estimates for implement/tractor combinations for soil preparation and planting are largely based on ASAE D497.7 from the American Society of Agricultural and Biological Engineers (ASABE). This standard provides representative values for farm machinery operation for use in estimating the performance of field machines (e.g., the estimation of the tractor power needed for a chisel plow of a specified width, using some number of chisels to plow to a specified depth, for a given soil compaction, etc.). Work estimates for equipment other than tractors and implement storage, construction, spare parts, and retirement needs are largely based on a review of field machine literature.

Next in Figure 1 are the datasets described in this document. First, ***self-propelled fleet datasets*** divide work among the equipment in a fleet. Specifically, Figure 1 depicts the use of fleets of self-propelled forage harvesters, two types of agricultural tractors (used with drawn forest harvester implements), and balers. Each self-propelled fleet dataset is identified by a name with 6 components that describe the fleet and its operating conditions:

1. **What is being produced** ("work")
2. **The type of equipment in the fleet** (e.g., "balers")
3. **The fleet operating year** (e.g., "2009 fleet")
4. **The fleet fuels** (e.g., "all fuels" and in contrast to e.g., "diesel fuel" for an all diesel-fleet)
5. **The fleet power range** (e.g., "25-300HP")
6. **The fleet operating temperature range** (e.g., "at 12-28C").

The fleet power ranges used are as presented in the USEPA's NONROAD documentation, described in Section 2.1. This means that irrespective of the HP of interest within the range, the fuel use and emissions for the work performed is the same for all equipment within the specified power range.

Second, ***self-propelled equipment datasets*** provide estimates of fuel and lubricant transport, use, and emissions and equipment storage, construction, spare parts, and retirement for the individual self-propelled equipment in a fleet. Each self-propelled equipment dataset is identified by a name with 5 or 6 components that describe the equipment and its operating conditions:

1. **What is being produced** ("work")
2. **The type of equipment in the fleet** (e.g., "4str baler" as an abbreviation for 4-stroke baler)
3. **The equipment model and operating years** (e.g., "1990 model in 2009")
4. **A designator representing the fuel used** (e.g., "DFF" standing for DeFault Fuel[5])
5. **The equipment power range** (e.g., "25-40HP")
6. **For gasoline powered equipment, the equipment operating temperature range** (e.g., "at 12-28C", with the temperatures used to estimate evaporative emissions for gasoline engines).

[5] DeFault Fuel is always used herein to indicate the use of the sulfur and ethanol contents and the Reid Vapor Pressure (RVP) described herein. The designator allows practitioners using the dataset generation tool to vary these parameters in their own versions of any of the datasets.

Third, ***aggregated fleet datasets*** combine self-propelled fleet and equipment datasets. These datasets provide estimates of fuel and lubricant transport, use, and emissions and equipment storage, construction, spare parts, and retirement for ALL of the self-propelled equipment in a fleet under the growing or harvest conditions for a given crop in a given state. Each self-propelled equipment dataset is identified by a name with 6 components that describe the equipment and its operating conditions:

1. **What is being produced** ("work")
2. **The type of equipment in the fleet** (e.g., "balers")
3. **The crop and timing of equipment use** (e.g., "for win wheat harvest," which ultimately dictates the operating temperatures)
4. **The operating year** (e.g., "2009")
5. **A designator representing the fuel used** (e.g., "all fuels" standing for all fuels covered by the underlying fleet datasets)
6. **The equipment power range** (e.g., "25-50HP")

It is the preparation of the self-propelled fleet, self-propelled equipment, and aggregate fleet datasets that are described in this document. Table 2 lists the types of self-propelled fleet and equipment considered herein: there are 19 types of fleet and over 200 types of equipment datasets using diesel, gasoline, compressed natural gas (CNG), and liquefied petroleum gas (LPG). However, there are thousands of datasets that can be developed by varying the operating conditions. Details such as what is included in datasets and how estimates are made follows.

Table 2 Self-propelled fleet and equipment datasets described in this document

The type of equipment in SELF-PROPELLED FLEETS	Count of SELF-PROPELLED EQUIPMENT types				Power range	
	Diesel	Gasoline	LPG	CNG	Min. HP	Max. HP
2-Wheel Tractors	2	2			3	16
Agricultural Mowers	1	4			3	100
Agricultural Tractors	10	4			11	750
Balers	5	3			25	300
Combines	4	3			50	600
Cotton Module Builders*	2	2	1	1	150	190
Cotton Pickers*	2	1			255	350
Cotton Strippers*	3	2	1	1	173	350
Dumpers/Tenders	8	5			3	175
Forage Harvesters*	2	1			175	625
Generator Sets	10	6	7	7	0	600
Irrigation Sets	9	7	1	6	3	600
Other Agricultural Equipment	11	9	1	1	3	1,000
Pumps	12	13	5	5	0	600
Skid Steer Loaders	8	5	3		6	175
Sprayers	8	10			0	600
Swathers	4	2			50	300
Tillers	3	2			3	600
Tractors/loaders/backhoes	8	5	3		6	300

* Note that these fleets are modeled as "Other Agricultural Equipment" with power ranges specified as described in Cooper et al (2014).

1.3.Key information sources

The key information source used for the development of the agricultural self-propelled equipment datasets is the documentation and supporting data developed for the US Environmental Protection Agency (USEPA) NONROAD2008a model[6] (NONROAD). This documentation describes procedures for the estimation of fuel use and select air emissions for a wide range of past, present, and future self-propelled equipment categories. Specifically, the fuel types are gasoline, diesel, CNG, and LPG and the air emissions are exhaust and evaporative hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM; as PM10 and PM2.5), sulfur dioxide (SO_2), and carbon dioxide (CO_2).

In addition to the data and mathematical relationships described in the NONROAD model documentation, data from a range of sources are used herein to:

- Modify ethanol market and volume fractions for gasoline engines;
- Add lubricant use and management estimates;
- Add equipment production and storage, spare parts production, and equipment retirement estimates;
- Estimate air emissions of nitrous oxide (N_2O), methane (CH_4), ammonia (NH_3), and select hazardous air pollutants (HAPs), metals, and dioxin/furans emissions as well as emissions groups (Total Organic Gases (TOG), Non-Methane Organic Gases (NMOG), Non-Methane Hydrocarbons (NMHC), Non-Methane Volatile Organic Compounds (NMVOC), and Secondary Organic Aerosols (SOA));
- Fix the CO_2 emissions and fuel use estimates for 0-75 HP gasoline equipment; and
- Add variability and uncertainty estimates.

The key information source used for the development of the self-propelled fleet datasets are also from the USEPA's series of NONROAD model documents: the NONROAD Engine Population Estimates (EPA-420-R-10-017 NR-006e July 2010) and Calculation of Age Distributions in the Nonroad Model: Growth and Scrappage (EPA420-R-05-018 NR-007c December 2005) [7]. NR-006e documents the engine population values used in EPA's final NONROAD 2008a emission inventory model and NR-007c documents calculations of equipment populations by age for given equipment types and scenario years to account for emissions deterioration, new emissions standards, technology changes, and changes in equipment populations from sales growth trends.

1.4.Data formats and meta data

The aggregated fleet data described here are available through the *LCA Digital Commons* in EcoSpold version 1[8] and International Reference Life Cycle Data System (ILCD)[9] data formats. The self-propelled equipment and fleet data described here can be generated in the ILCD format using the UWDFE Lab Agricultural Fleet and

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[6] See http://www.epa.gov/oms/nonrdmdl.htm

[7] Both NR-006e and NR-007c are available at http://www.epa.gov/oms/nonrdmdl.htm

[8] See http://www.ecoinvent.org/database/EcoSpold-data-format/

[9] Database websites: US LCI database: http://www.nrel.gov/lci/; ecoinvent: http://www.ecoinvent.ch/; and ILCD: http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm

Equipment Dataset Generator (VERSION 1, March 2014), available upon request at https://www.lcacommons.gov/discovery/contact. Both are data exchange formats are based on XML (eXtended Markup Language) and related technologies (XSL, XSLT, Schema), are ISO/TS 14048 compliant (International Standards Organization (ISO) 2002), and are usable by a range of LCA software tools. To ensure inter-format compatibility, flow names have sometimes been abbreviated in both formats to meet the 80-character limit in EcoSpold v1.

For all data formats, the meta data are described in Appendix A: Information included in the meta data. Note that datasets are assigned United Nations Standard Products and Services Codes[10] (UNSPSC), the North American Industry Classification System[11] (NAICS), and International Standard Industrial Classification (ISIC) codes that also identify datasets in select other databases (e.g., NAICS is used by the US LCI Database and by ecoinvent v2). Also, the NAICS codes make the data compatible with economic-input-output life cycle data (e.g., using Carnegie Mellon's Economic Input-Output Life Cycle Assessment[12] (EIOLCA), the Comprehensive Environmental Data Archive[13] (CEDA), and Ohio State's Ecologically-Based Life Cycle Assessment[14] (Eco-LCA)).

In the self-propelled equipment and fleet datasets delivered in the Commons in the ILCD format, the data are parameterized such that all raw data and formulas used are included in the dataset as described by Cooper, Noon, and Kahn (2012). The aggregated fleet and all EcoSpold v1 formatted datasets contain only the computed results. Because variability and uncertainty are estimated at the raw data level, this means that whereas the ILCD self-propelled equipment and fleet datasets users can evaluate variability and uncertainty in the data, EcoSpold v1 and aggregate fleet dataset users cannot. Example parameterizations of the self-propelled fleet and equipment datasets are presented in Appendices B and C.

1.5.Data variability and uncertainty

Variability (referring to natural variations in quantities) and uncertainty (referring to the degree of precision in quantities) data for the self-propelled equipment and fleet datasets are included for population estimates; fuel and lubricant consumption, carbon fractions, and sulfur and ethanol contents; equipment lifetime (hours of use), activity (hours per year), and load factor (average portion of rated power used during operation); zero hour emission factors; and the equipment storage space. The distributions used are log-normal, triangular, and uniform with the manner in which the data are presented being dictated by the ILCD data format. Specifically,

- **Log-normal distributions** are represented by a mean value, the geometric standard deviation, a minimum value calculated as the mean value divided by the geometric standard deviation, and a maximum value calculated as the mean value multiplied by the geometric standard deviation.
- **Triangular distributions** are represented by most likely, minimum, and maximum values.

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[10] See http://www..org

[11] See www.census.gov/

[12] See http://www.eiolca.net/

[13] See http://www.cedainformation.net

[14] See http://resilience.eng.ohio-state.edu/eco-lca/

- **Uniform distributions** are represented by a minimum value and a maximum value.

Again, variability and uncertainty data are not included in datasets using the aggregated fleet datasets or the EcoSpold v1 format.

1.6. Data quality

The 2-tiered data quality analysis method used by the Commons is described in Cooper and Kahn (Cooper and Kahn 2012) and presented in Table 3. The "2-tiers" define flow data as either meeting a minimum criteria (receiving a score of A) or not (receiving a score of B). In each dataset, scores are listed presented parenthetically in the order presented in Table 3 (as e.g., (A,B,B,A,A,B,B) intended to represent a score of A for reliability and reproducibility, a score of B for flow data completeness, and so on. The data quality results are presented in Section 6.

Table 3 LCA Digital Commons flow data quality scoring criteria

Category	Requirements for a data quality score of A
1. Reliability and reproducibility	The **flow data** were based on measurements using a specified and standardized measurement method **OR** the **flow data** were estimated using methods and data described in specified archival or other consistently publically available sources.
2. Flow data completeness	The **flow data** were collected over at least 3 years for agricultural (crop, livestock, forest, range) processes or other processes in which the data point varies for uncontrolled annual conditions (e.g., weather) **AND** the **flow data** balance the mass and energy in and out of the unit process.
3. Temporal coverage	The **flow data** represent operations that occurred between the unit process start and end dates without forecasting.
4. Geographical coverage	The **flow data** represent operations that occurred within the location of the unit process, including non-agricultural process data that have been adapted to reflect logistics and market shares for the unit process location.
5.Technological coverage	The **flow data** represent the process(es) and/or material(s) specified without surrogacy or aggregation with other technologies.
6. Uncertainty	The **flow data** either include estimates of the first quartile, mean, median, and third quartile values **OR** data or probability distribution from which these values can be estimated.
7. Precision	The relative standard error of the **flow data** is less than or equal to 25% **OR** the interquartile range divided by the median is less than or equal to 50% **OR** for a triangular distribution, the minimum **flow data** value is ≥ 75% and maximum **flow data** value is ≤125% of the most likely value **OR** For a uniform distribution, the minimum **flow data** value is ≥ 75% and maximum **flow data** value is ≤125% of the average of the minimum and maximum values.

2. Self-propelled equipment dataset development

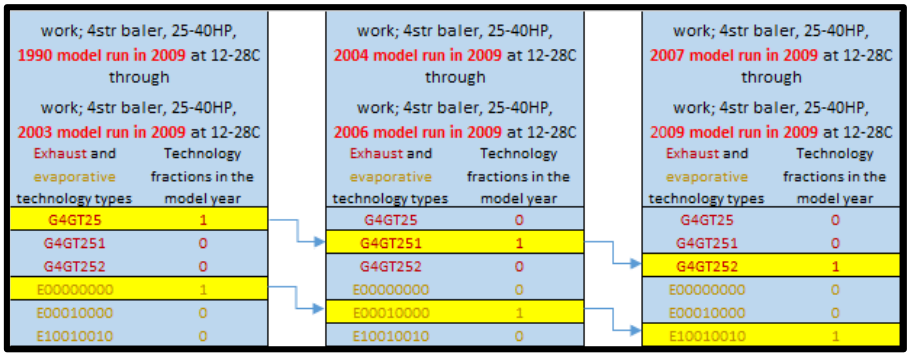
2.1. Use of the USEPA's NONROAD documentation and supporting data

See parameters P1-P491 in Appendix B: Example parameterization of self-propelled equipment datasets

The USEPA's NONROAD2008a model is described in 15 separate documents (USEPA 2004a-c, 2005a-e, and 2010a-g)[15] and are referred to herein by the NONROAD document code (e.g., NR-001c). Also, raw data files are available in the NONROAD Core Model and Data Files zip file[16] including e.g., fuel consumption and emission factors. Throughout the documentation and data files, equipment are organized using 10-digit source category codes (SCCs) which represent combinations of exhaust and evaporation technologies for a given type of equipment and power range. Fuel use and air emissions estimates are based on the combination of the exhaust and evaporation technologies for a given SCC.

As an example, Figure 2 depicts the exhaust and evaporation technologies for four-stroke balers from 25 to 40 HP operating in 2009 at 12-28C. As shown and as described in NR-009d and NR-012d, these gasoline balers are comprised of 3 types of exhaust technologies (G4GT25, G4GT251, and G4GT252) and 3 types of evaporative technologies (E00000000, E00010000, and E10010010) which are selectively applied in a given model year (e.g., the fraction of exhaust technologies used in 1990-2003 is estimated to be 100% G4GT25, 0% G4GT251, and 0% G4GT252).

Figure 2 Self-propelled equipment dataset technology representation example



An example parameterization representing 1990 model-year four-stroke 25 to 40 HP balers operating in 2009 at 12-28 C is presented in Appendix B: Example parameterization of self-propelled equipment datasets. Among the parameters listed, P1-P491 represent the raw data and formulas described in the NONROAD documentation (USEPA 2004a-c, 2005a-e, and 2010a-g) and can be directly compared to corresponding output from the NONROAD software, as presented in Table 4. Next, parameters P492-P864 represent the additions and modifications described in Section 2.2.

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[15] All of these documents are available at http://www.epa.gov/otaq/nonrdmdl.htm#techrept

[16] The core model and data files can be downloaded at http://www.epa.gov/otaq/models/nonrdmdl/nonrdmdl2005/nr2005.zip

Table 4 Comparison of parameters generated here to results generated using the NONROAD software (for a 4-stroke baler, 25-40HP, 1990 model run in 2009 at 12-28C in Washington State)

NONROAD software outputs*		NONROAD software (g/HP-hr)**	Based on the parameterization in Appendix B (g/HP-hr)***		% difference
Fuel consumption	FuelCons.	274	274	=FUELCONSUMPTION*1000*3600/1341	-0.0000036%
Exhaust emissions	THC-Exhaust	5.5	5.5	=EXHAUSTTHCG*3600/1341	0.25%
	CO-Exhaust	167	168	=EXHAUSTCO*3600/1341	0.36%
	NOx-Exhaust	12	12	=EXHAUSTNOX*3600/1341	-0.45%
	CO2-Exhaust	856	858	=NRCO2*1000*3600/1341	0.21%
	SO2-Exhaust	0.18	0.18	=EXHAUSTSULFUR*3600/1341	-0.039%
	PM-Exhaust	0.027	0.027	=EXHAUSTPM*3600/1341	0.000041%
Evaporative emissions	Crankcase	2.0	2.0	=CRANKCASETHC*3600/1341	0.000025%
	Hot-Soaks	0.051	0.051	=HOTSOAKTHC /(AVERAGEUSE*HP*LOADFAC)	0.000031%
	Diurnal	6.8	6.8	=DIURNALTHC /(AVERAGEUSE*HP*LOADFAC)	-0.088%
	Displacement	0.30	0.30	=DISPLACEMENTTHC*3600/1341	0.000026%
	Spillage	0.013	0.013	=SPILLAGETHCFAC1*3600/1341	0.000030%
	RunLoss	0.11	0.11	=RUNLOSSTHC /(AVERAGEUSE*HP*LOADFAC)	0.000017%
	TankPerm	0	0	=TANKTHC /(AVERAGEUSE*HP*LOADFAC)	0%
	HosePerm	0	0	=HOSETHC /(AVERAGEUSE*HP*LOADFAC)	0%

* NONROAD software BMX and BMV files were generated assuming a Reid Vapor Pressure (RVP) of 8 psi; a fuel oxygen weight of 2.44%; a gasoline sulfur of 0.0339%; minimum, average, and maximum temperatures of 54, 68, and 82 F respectively; an ethanol blend market of 71.4%; an ethanol volume of 9.6%; and using state-level estimates for Washington State.

** NONROAD software BMX and BMV file outputs are converted to g/HP-hr as sum(population*(tons/year)*907,185/(Activity*Load factor*HPAvg))

*** Values in the parameterization in Appendix B are converted to g/HP-hr assuming, among other conversions, that g/MJ *(3,600/1,341) = g/HP-hr

Variability and Uncertainty

Variability and uncertainty are not considered in the NONROAD documentation or supporting data. In the preparation of the self-propelled equipment data, variability and uncertainty estimates are added for:

- **Engine life, annual hours of activity, and load factor.** In NR-005d, it is noted that estimates of median life, annual hours of activity, and load factors are based on a 1998 database developed by Power Systems Research, Inc. (PSR, E.H. Pechan and Associates (1997)). Chi et al. (2004) elicited some rough estimates of uncertainty of different parameters from PSR. They estimated the uncertainty of the engine life to be +/-10%, annual hours of activity to be +/-5%, and load factor to be +/-4%. These values are used herein, as triangular distributions centered on the NONROAD documentation values.
- **Engine technology types.** The selection of technology types are described in NR-010f and NR-011d, with changes in sales fractions and emissions from the advent of emission standards or other changes managed within each SCC. SCC data development is described in NR-006e, which updates original

estimates provided by PSR. Concerning the PSR data, Chi et al. (2004) elicited rough estimates of uncertainty for the geographic distributions by state at +/-6% by engine type from PSR. Finding no estimates of uncertainty relating to the update of the PSR data, here triangular distributions are used for the exhaust and evaporative engine types, with the most likely value set to that in the NONROAD documentation and the minimum and maximum values set at +/-6%.

- **Fuel sulfur contents.** For diesel fuel, 2-value triangular distributions are assumed with the most likely and minimum values for the sulfur content of diesel (soxdsl) taken from the NONROAD documentation (specified by operating year in USEPA (2009)) and the maximums at the pre-2010 industry maximum of 5000 ppm[17] and the USEPA nonroad diesel standards of 500 ppm from 2010 to 2013, and 15 ppm for 2014 to 2020[18]. For gasoline, 2- value triangular distributions for the certification fuel sulfur weight percent (soxbas) are assumed with the most likely values taken from the NONROAD documentation (at 339 ppm) and the minimum or maximums set at the gasoline sulfur program industry maximums of 350 ppm[19] prior to 2004, 80 ppm[20] from 2004-2017, and 10 ppm for 2017-2020. Finally, for CNG and LPG, 2-value triangular distributions are assumed for the certification fuel sulfur weight percent (soxbas) with the most likely and maximum values taken from the NONROAD documentation (at 30 ppm) and the minimum values used in GREET (Argonne National Laboratory, 2012) as zero for LPG and 6 ppm for CNG.
- **Fuel carbon mass fractions.** Although the NONROAD documentation does not provide data for the carbon mass fraction of the fuels, the source code (specifically, the file nonrdprm.inc) does. The values given are 0.87 for gasoline and diesel, 0.817 for LPG, and 0.717 for CNG[21]. Using these values as the most likely values, the bounds of triangular distributions are as developed for GREET's stochastic analyses (Argonne National Laboratory, 2012) and as presented in Table 5.

Table 5. Data for carbon mass fraction

Fuel or lubricant	Distribution type	Minimum value	Most likely value	Maximum value
Diesel	Triangular	0.840	0.870	0.873
Gasoline		0.850	0.870	0.880
CNG		0.720	0.717	0.739
LPG		0.800	0.817	0.828

- **Zero-hour fuel consumption**, triangular distributions presented in Table 6 reflect the percent change from the most likely values to the minimum and maximum values presented in GREET's stochastic

[17] http://www.dieselnet.com/standards/us/nonroad.php

[18] http://www.clean-diesel.org/nonroad.html

[19] http://www.epa.gov/tier2/documents/420f05001.pdf

[20] http://www.epa.gov/OTAQ/fuels/gasolinefuels/index.htm

[21] Note that the value for CNG is less than that representing pure CH_4 (or 12/16=0.75), presumably accounting for constituents other than methane.

analysis data (Argonne National Laboratory, 2012) for the inverse of the lower heating value (1/LHV in gal/BTU) for each fuel and intended to reflect the uncertainty in the energy density of each fuel.

Table 6. Uncertainty data for fuel consumption

Fuel or lubricant	Distribution type	Minimum value	Most likely value	Maximum value
Diesel	Triangular	0.914*BSFCEF	BSFCEF	1.065*BSFCEF
Gasoline		0.940*BSFCEF	BSFCEF	1.075*BSFCEF
CNG		0.986*BSFCEF	BSFCEF	1.023*BSFCEF
LPG		0.982*BSFCEF	BSFCEF	1.058*BSFCEF

- **Zero hour emission factors.** Uncertainty estimates for EFs are based on the work of Pouliot et al. (2012) who estimate uncertainty ranges for the AP-42 A through E EF factor ratings for a range of sources and pollutants. In their study, uncertainty is defined for log-normally distributed EFs as the probability that a sample mean of a sample of size n will not be within 10% of the true mean, where n is 25, 10, 5, 3, and 1 for the AP-42 ratings of A, B, C, D, and E respectively.

  From the uncertainty data provided by Pouliot et al. (2012), relative standard error (RSE) can be estimated by pollutant, by fuel, and for all the data investigated. The RSEs are estimated as:

  $$RSE = 0.1/z(0.5p_{Pouliot}) \qquad \text{<equation 1>}$$

  where $z(0.5p_{Pouliot})$ is the z-score for ½ of the Pouliot et al. uncertainty, as a single tail representation of the normal distribution in which the sample mean is not within 10% of the true mean. Thus, the RSE values correspond to the normal distributions underlying the EF log-normal distributions described by the Pouliot et al. The results are presented in Table 7 based on compression ignition engine sample sizes for exhaust emissions are given in NR-009d: Appendix D (Certification Data for Nonroad Compression Ignition Engines) and assuming a sample size of 30 based on the Phase 2 Emissions Standards[22].

[22] http://www.gpo.gov/fdsys/pkg/FR-2000-04-25/pdf/00-7887.pdf

Table 7. NONROAD documentation EF sample sizes and RSEs

	Emission factor sample sizes				RSE for high value in uncertainty range			
	HC	NOx	CO	PM	HC	NOx	CO	PM
Exhaust EF for compression emission engines								
>0 to 11 HP	9	11	39	39	45%	10%	12%	20%
>11 to 25 HP	25	26	82	83	27%	6.8%	8.2%	14%
>25 to 50 HP	50	72	272	272	19%	4.1%	4.4%	7.6%
>50 to 100 HP	120	393	139	129	13%	1.8%	6.3%	11%
>100 to 175 HP	140	285	149	138	12%	2.1%	6.0%	11%
>175 to 300 HP	380	380	382	382	7.1%	1.8%	3.7%	6.4%
>300 to 600 HP	243	243	264	264	8.9%	2.2%	4.5%	7.7%
>600 to 750 HP	77	77	78	78	16%	4.0%	8.4%	14%
>750 HP	34	34	34	34	24%	6.0%	13%	21%
Exhaust EF for all other equipment & all evaporative EFs	30	30	30	30	25%	6.4%	14%	22%

Given these RSE values for the underlying normal EF distributions, the standard deviation ($\sigma_{\text{underlying normal}}$) of the underlying normal EF distribution is estimated as:

$$\sigma_{underlying\ normal} = \mu_{underlying\ normal}\ RSE\ \sqrt{n} \qquad \text{<equation 2>}$$

where $\mu_{\text{underlying normal}}$ is the mean value of the underlying normal distribution and n is the sample size assumed to be used in the estimation of the EF. This means that the lower and upper quartiles of the underlying normal EF distributions can be approximated as:

$$q_1 = \mu_{underlying\ normal} - 0.6745\sigma_{underlying\ normal} = \mu_{underlying\ normal}\ (1 - 0.6745\ RSE\ \sqrt{n}\ )$$
<equation 3>

$$q_2 = \mu_{underlying\ normal} + 0.6745\sigma_{underlying\ normal} = \mu_{underlying\ normal}\ (1 + 0.6745\ RSE\ \sqrt{n}\ )$$
<equation 4>

Given this, Limpert et al. (2001) note that an approximation of the standard deviation of the log-normal distribution ($\sigma_{\text{log-normal}}$) is found as:

$$\sigma_{log-normal} = \left(\frac{q_2}{q_1}\right)^{1/1.349} \qquad \text{<equation 5>}$$

such that by combining equations 6-8 an estimate of $\sigma_{\text{log-normal}}$ as a function of the RSE and sample size is:

$$\sigma_{log-normal} = \left(\frac{(1+0.6745\ RSE\ \sqrt{n}\ )}{(1-0.6745\ RSE\ \sqrt{n}\ )}\right)^{1/1.349} \qquad \text{<equation 6>}$$

such that $(\sigma_{\text{log-normal}})^2$ is reported in each dataset as the square of the geometric standard deviation for the log-normal EF distribution with the NONROAD documentation EF assumed to be the mean of the log-normal distribution.

Given this, the uncertainty considerations for the NONROAD documentation EFs are summarized in Table 8, making reference to the parameter names used in Appendix B: Example parameterization of self-propelled equipment datasets.

Table 8. Summary of NONROAD documentation EF uncertainty parameters

Equipment	Parameter name	Parameter description	Uncertainty (SDg^2)
Compression-ignition engines	EXHTHCEF1 through EXHTHCEF10	Exhaust THC EFs, by HP range	Estimated using equation 6 with n from NR-009d
	EXHPMEF1 through EXHPMEF10	Exhaust PM EFs, by HP range	
	EXHNOXEF1 through EXHNOXEF10	Exhaust NOx EFs, by HP range	
	EXHCOEF1 through EXHCOEF10	Exhaust CO EFs, by HP range	
Spark-ignition engines	EXHTHCEF1 through EXHTHCEF10	Exhaust THC EFs, by HP range	Estimated using equation 6 with n =30
	EXHPMEF1 through EXHPMEF10	Exhaust PM EFs, by HP range	
	EXHNOXEF1 through EXHNOXEF10	Exhaust NOx EFs, by HP range	
	EXHCOEF1 through EXHCOEF10	Exhaust CO EFs, by HP range	
All engines	VENTEF1 through VENTEF10	Vent evaporation EF	Estimated using equation 6 with n =30
	TANKEF1 through TANKEF10	Tank evaporation EF	
	SUPRETEF1 through SUPRETEF10	Supply/return evaporation EF	
	RUNLOSSEF1 through RUNLOSSEF10	Running loss evaporation EF	
	NECKEF1 through NECKEF10	Neck evaporation EF	
	HOTSOAKEF1 through HOTSOAKEF10	Hot soak evaporation EF	
	HOSEEF1 through HOSEEF10	Hose evaporation EF	
	DIURNALEF1 through DIURNALEF10	Diurnal evaporation EF	
	CRANKCASEMULT1 through CRANKCASEMULT10	Crankcase THC multiplier	
	REFUELINGSPILLAGE	Equipment spillage during refueling	

2.2. Modifications and additions to the USEPA's NONROAD documentation data and calculations

2.2.1. Modification of the gasoline ethanol contents

See parameters P6-P7 in Appendix B: Example parameterization of self-propelled equipment datasets

For gasoline-ethanol blends, data for the market percent and volume percent of ethanol for use with the NONROAD software presented in USEPA (2009) are updated and divided into Petroleum Administration for Defense Districts (PADD) regions using the methods described Radich and Hill (2011) and based on data from the US Energy Information[23] (EIA). Specifically, Radich and Hill provide 3 methods for the estimation of the blend ratio:

[23] EIA by PADD region representing the U.S. Supply and Disposition fuel and ethanol data are available at http://www.eia.gov/dnav/pet/pet_sum_snd_d_nus_mbbl_m_cur.htm. For conventional and reformulated gasolines, data representing

- Total refinery and blender net inputs of ethanol compared with net production of gasoline blended with ethanol;
- Ethanol consumption compared with total gasoline product supplied (implied gasoline consumption); and
- Ethanol consumption compared with total gasoline product supplied plus exports, which considers the fact that some ethanol may be included in exported gasoline.

Here, commensurate market data are prepared based on each method, such that for the first method, the market share is represented as the ratio of the refinery and blender net input of fuel ethanol to the sum of the refinery and blender net production of finished motor gasoline and the refinery and blender net input of fuel ethanol divided by the estimated blend ratio. Similarly for the second and third methods, the market share is estimated as the ratio of the ethanol consumption to the sum of the total gasoline product supplied (without or with exports) and the ethanol consumption divided by the blend ratio. Also, market share projections for 2014-2020 are based on EIA data representing the US Liquid Fuels Supply and Disposition[24].

Given these data and assuming that the minimum blend ratio value of 0.082 provided for use with the NONROAD model in USEPA (2009) is the most likely economically minimum value and that the E10 blend wall described by Radich and Hill will continue to apply to nonroad equipment through 2020[25], the blend ratio and market shares are estimated by operating year as described in Table 9 with the results depicted in Figure 3. As shown, whereas the blend ratio is estimated to closely track the USEPA (2009) data, the market shares used here display a less gradual rise from 2004-2010 when compare to the USEPA data (indicating a later and more rapid change in ethanol use in the US).

Table 9. Gasoline ethanol operating year assumptions

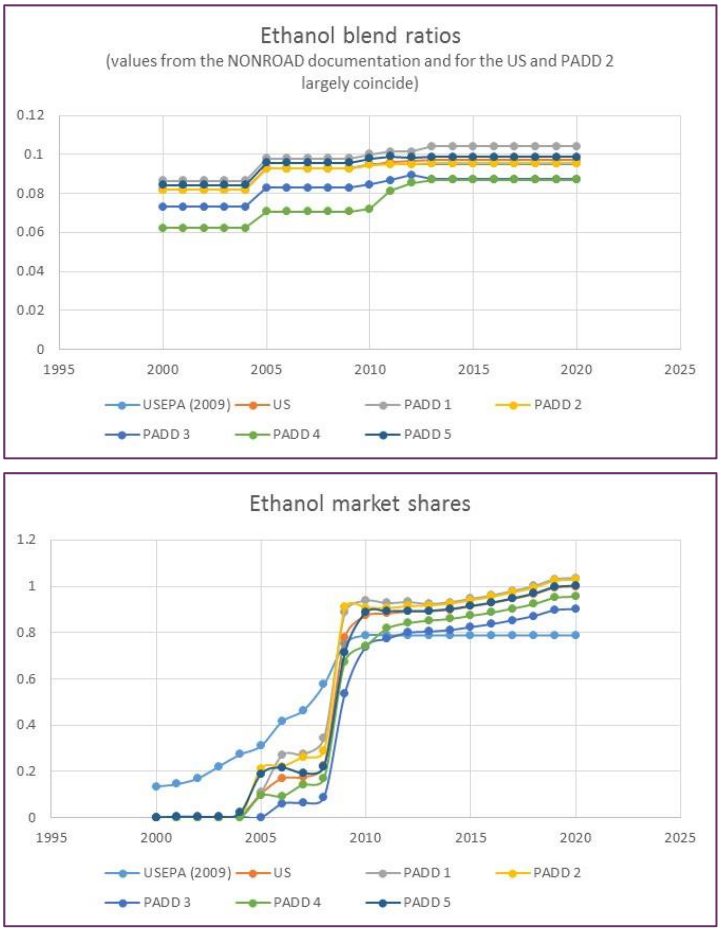
Blend ratios	2000-2004: 88% of the 2005 values from Radich and Hill (2011) are used, with 88% representing the ratio of the values given in USEPA (2009)
	2005-2009: 98% of the 2010 values from Radich and Hill (2011) are used, with 98% representing the ratio of the values given in USEPA (2009)
	2010-2013: a triangular distribution is established based on the average, minimum (or zero), and maximum for the market share of the 3 Radich and Hill (2011) methods
	2014+: the 2013 values are assumed to remain constant, as approximately E10 and intended to be representative of the blend wall described by Radich and Hill (2011) and not using E15 in farm equipment
Market shares	1996-1999: as in USEPA (2009), ethanol use is assumed to be zero
	2000-2013: a triangular distribution is established based on the average, minimum (or zero), and maximum (or 1) for the market share of the 3 Radich and Hill (2011) methods
	2014+: based on forecast data from EIA on Liquid Fuels Supply and Disposition. Year-to year ratios are used, representing (EtOH supply-0.85*E85 consumption)/(Motor gasoline consumption + the EtOH supply) The most likely values are the average of the EIA reference and AEO2012 cases. The minimum and the maximum values are either the EIA or the EIO2012 case, with the max case bounded at 1.

refinery and blender net production with fuel ethanol are at http://www.eia.gov/dnav/pet/pet_pnp_refp_a_epm0ca_ypr_mbbl_m.htm and http://www.eia.gov/dnav/pet/pet_pnp_refp_a_epm0ra_ypr_mbbl_m.htm respectively.

[24] At http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2013ER&subject=0-AEO2013ER&table=11-AEO2013ER&region=0-0&cases=full2012-d020112c,early2013-d102312a

[25] Note also that recent EPA actions to facilitate the dissemination of E15 are not intended for use in nonroad equipment as noted at http://www.epa.gov/otaq/regs/fuels/additive/e15/e15-regs.htm.

Figure 3 Ethanol blend ratios and market shares



2.3.2. Addition of lubricating oil consumption and waste management

See parameters P14-P15 and P496-P579 in Appendix B: Example parameterization of self-propelled equipment datasets

Although the NONROAD documentation does not make mention of the consumption of lubricating oils, inspection of the PM emission factors in Tables 6-8 of NR-010f (Exhaust Emission Factors for Nonroad Engine Modeling- Spark Ignition) reveals emission factors for 2-stroke engine technologies (at least an order of magnitude higher than others) that likely include the combustion of lubricating oil mixed with the fuel. A second indication that lubricating oil emissions are included is the emission factors for PM, which also likely come from the use of lubricating oils (see Carroll et al., 2011 for a related discussion). Assuming the emission estimates in NONROAD documentation and data consistently include lubricating oil emissions within the estimated emissions (i.e., that during testing lubricating oil is used), lubricating oil consumption and waste management estimates are added here.

For 4-stroke gasoline, diesel, and LPG engines, the methods and data provided by the American Society of Agricultural and Biological Engineers (2011) in ASAE D497.7 are used. For CNG engines, Leugner (2005) notes

that typical oil consumption rates for Waukesha natural gas engines are 0.0002 to 0.002 lb/HP-hr, at an average value of 0.0011 lb/HP-hr. Given these consumption estimates, based on Delucchi (2003) it is assumed that 80% of the lubricant used oxidizes during use, leaving 20% as waste oil for further management. For 2-stroke gasoline engines, lubricating oil use is based on an average fuel contribution to the volumetric fuel to oil ratio of 50 (representing a 50:1 fuel to oil mix) and assuming no waste oil is left to be managed.

Variation and uncertainty

For CNG engines, Leugner (2005) notes that typical oil consumption rates for Waukesha natural gas engines are 0.0002 to 0.002 lb/HP-hr. This equates to a variation of +/-82%, which is applied to CNG as well as 4-stroke gasoline, diesel, and LPG engines using a uniform distribution while noting that the resulting magnitude of CNG oil consumption is higher, as expected and as noted by Leugner. For the 2-stroke fuel-oil mixes, Wills (1998) mentions volumetric fuel to oil mixes ranging from 12:1 to 100:1. Although a review of similar literature on the subject revealed strong recommendations that engine manufacturer specifications by model year be followed, the search did not reveal a database of manufacturer mix specifications. Given the review, a triangular distribution at a most likely value of 50 and minimum and maximum values of 12 and 100 are used here.

2.3.3. Modification of fuel consumption and CO2 emissions estimates for 0-75 HP gasoline engines

See parameters P535-P578 in Appendix B: Example parameterization of self-propelled equipment datasets

The NONROAD documentation presents relationships to estimate "CO_2" emissions by balancing the carbon in the fuel with that in the exhaust THC emissions[26]. Thus, the values reported as CO_2 emissions by the NONROAD software and as described in the NONROAD documentation are the actual CO_2 emissions plus that which would be formed from the complete oxidation of carbon in the CO, evaporative hydrocarbon, and particulate emissions. Assuming the CO emissions dominate the unaccounted carbon, the actual CO_2 emissions can be estimated as:

$$CO_{2\text{-actual}} = CO_{2\text{-NONROAD}} - CO*44/28 \qquad \text{<equation 7>}$$

where:

$CO_{2\text{-actual}}$ = the CO2 emissions leaving the engines (g/HP-hr)

$CO_{2\text{-NONROAD}}$ = the CO_2 emissions estimated in the NONROAD documentation and reported by the NONROAD software (g/HP-hr)

CO = the CO emissions estimated in the NONROAD documentation and reported by the NONROAD software (g/HP-hr)

[26] For example for spark ignition engines, see http://www.epa.gov/oms/models/nonrdmdl/nonrdmdl2010/420r10019.pdf page 17 and for compression ignition engines, see http://www.epa.gov/oms/models/nonrdmdl/nonrdmdl2010/420r10018.pdf page 24.

For some gasoline technology types, when equation 7 is applied the carbon in the CO emissions exceeds that in $CO_{2\text{-NONROAD}}$ such that the estimated $CO_{2\text{-actual}}$ emissions are less than zero. For some other gasoline technology types, although the estimate of the CO_2 emissions is not less than zero for the associated $CO_{2\text{-NONROAD}}$ and CO emissions, the $CO_{2\text{-actual}}$ estimates are less than zero if the carbon in evaporative hydrocarbons and particulate matter are considered.

Given these issues, certification data (at http://www.epa.gov/otaq/certdata.htm) for 2 and 4-stroke gasoline engine performance were reviewed. Specifically, "Nonroad Small Spark-Ignition Engine Certification Data" include data for CO, HC-NOx (as a combined measure of hydrocarbons and NOx) and most importantly CO_2 emissions. These data contain 176 unique 2-stroke and 374 unique 4-stroke engines operating on "Gasoline (as defined in 1065.710)" and with emission factor data for CO, HC-NOx, and CO_2. The 2-stroke engines were produced from 2011-2013 with the maximum power ranging from 0.57 to 7.8 HP (or 0.42 to 5.8 kW) and the 4-stroke engines were produced from 2011-2014 with the maximum power ranging from 0.71 to 41 HP (or 0.52 to 30 kW).

The certification data are depicted in Figures 4 and 5, in each case sorted by the magnitude of the CO emissions. Also depicted in Figures 4 and 5 are the NONROAD software results for 2 and 4-stroke technology types for gasoline balers operating in 2009. For the NONROAD 2-stroke technology types depicted in Figure 4, $CO_{2\text{-actual}}$ for some technology types (specifically, G2H3C2 and G2H4C2 and largely G2H41 and G2H4C1) trend well with the certification data. However, the remaining NONROAD 2-stroke technology types (specifically, G2H31, G2H3C1, G2GT25, and G2N2) either do not trend well or are estimated to have negative $CO_{2\text{-actual}}$ emissions. Similarly for the NONROAD 4-stroke technology types depicted in Figure 5, some technology types trend well with the certification data and others do not/ are estimated to have negative $CO_{2\text{-actual}}$ emissions.

Figure 4 2-stroke engine emissions data

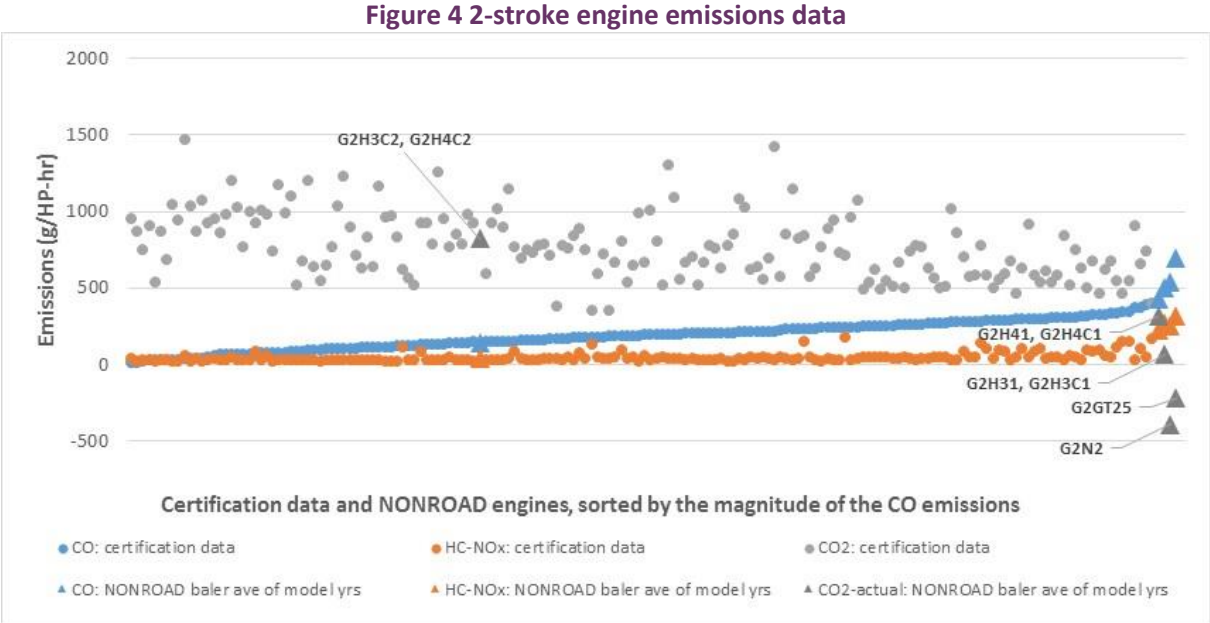
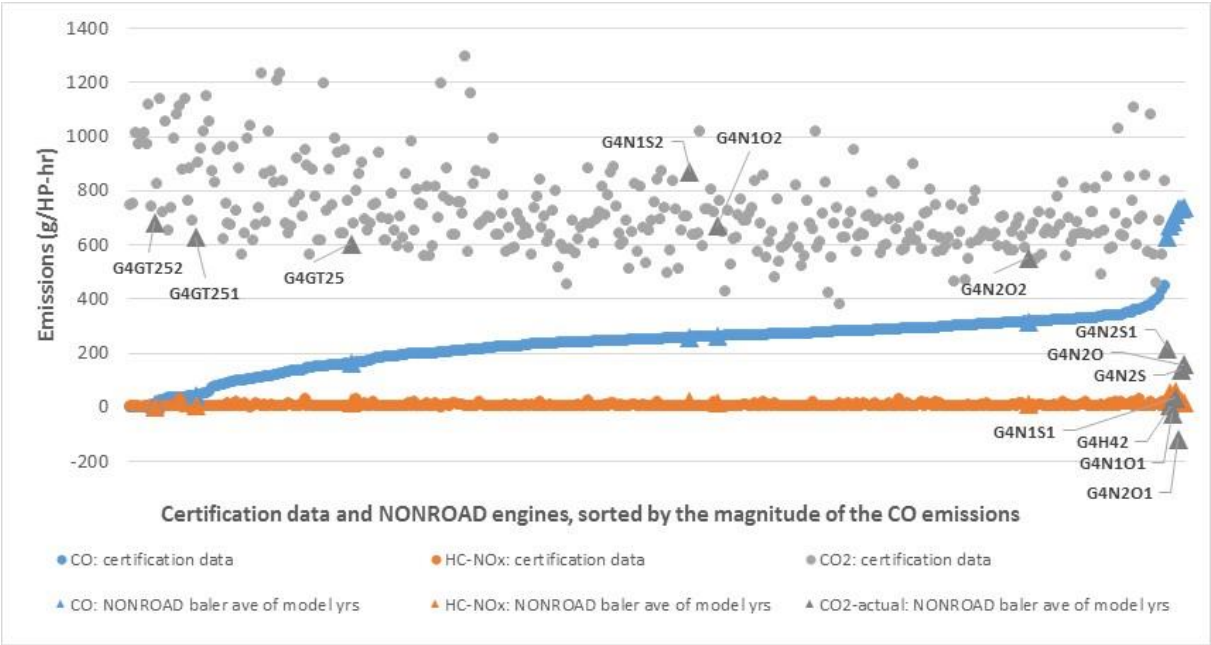


Figure 5 4-stroke engine emissions data



Assuming the NONROAD emissions and deterioration factors for CO, hydrocarbons, and NOx are correct, investigation of a range of models to estimate $CO_{2\text{-actual}}$ as a function of CO, HC-NOX, and/or HP [27] concluded with the choice of the following relationships, largely based on an interest in models which are reasonably simple at a meaningful relative standard error (RSE):

For ALL 2-stroke engines: $CO_{2\text{-actual}} = 1600\ CO^{-0.15}$ <equation 8>

For 4-stroke engines from 0-75HP: $CO_{2\text{-actual}} = 1170\ CO^{-0.095}$ <equation 9>

The resulting models are presented in Figures 6 and 7. Comparing the results of equations 8 and 9 to the certification data reveals RSEs of 26% and 19% respectively.

[27] Functions investigated included linear relationships (which had larger RSE values than the power relationships chosen) as well as a range of relationships for CO_2=f(CO, HC-NOX, HP) using Eureka (a mathematical software tool used to determine mathematical equations that describe sets of data in their simplest form available at http://www.nutonian.com/products/eureqa/).

Figure 6 Model for the estimation of $CO_{2\text{-actual}}$ for 2-stroke engines

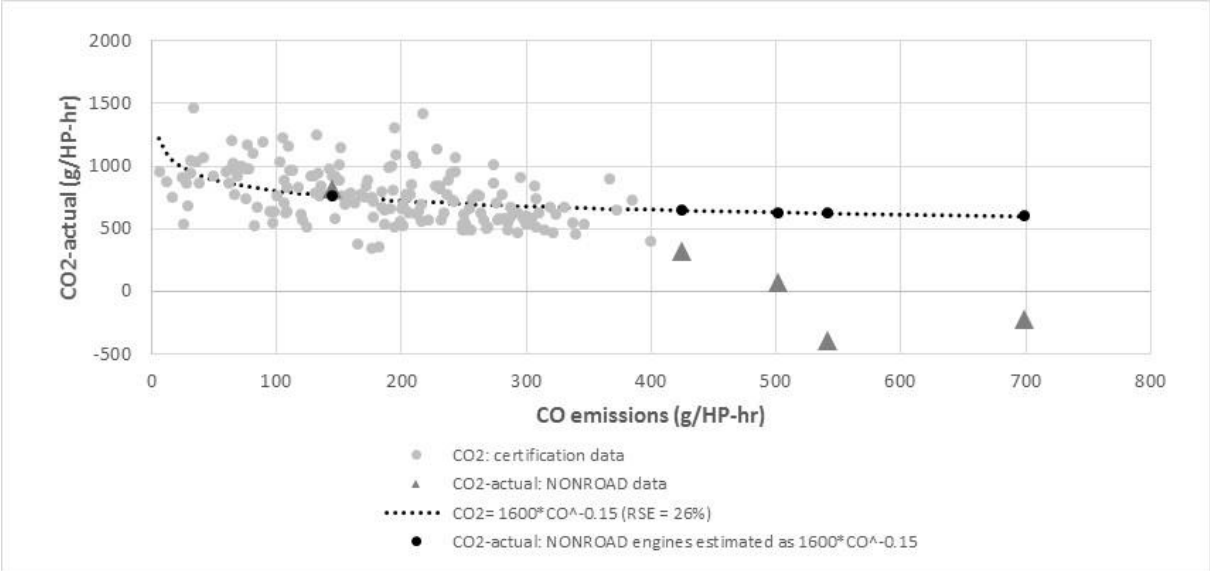
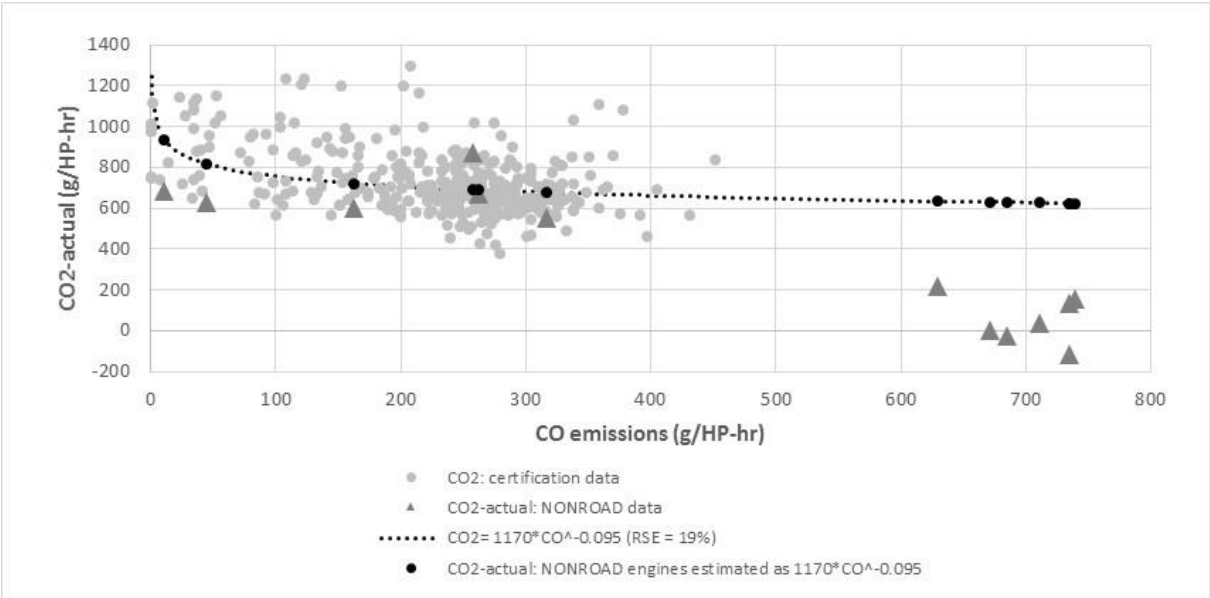


Figure 7 Model for the estimation of $CO_{2\text{-actual}}$ for 4-stroke engines



For the engines covered in the Commons, CO_2 emissions are as estimated using equations 8 and 9 for the deteriorated CO emissions estimated using the data and equations presented in the NONROAD documentation for all 2-stroke engines and for 4-stroke engines less than or equal to 75HP. The largest 2-stroke increase in the estimated CO_2 emissions is from -160 to 600 g/HP-hr (or -0.057 to 0.22 KG/MJ) for 0-3 HP generators, pumping units, and sprayers and the largest 4-stroke increase is from 2.4 to 620 g/HP-hr (or near zero to 0.23 KG/MJ) for 6-11 HP pumps.

Also, the fuel-oil mix consumption for 2-stroke engines and the fuel consumption for 4-stroke engines are subsequently estimated as enough to cover the carbon in the CO_2 emissions, the exhaust THC emissions, the evaporative THC, the CO, and the PM emissions. Note that these calculations require consideration of the carbon in the lubricating oil used and an assumption for the carbon content of the PM emissions. The carbon content in the lubricating oil is assumed to be 0.86 as specified for residual oil in GREET (Argonne National Laboratory, 2012) with the estimation of lubricating oil consumption is described in Section 2.3.2. The carbon content of the PM and is based on the PM constituents identified in the USEPA's National Mobile Inventory Model (NMIM, as described in EPA420-R-05-024 and used herein in Section 2.3.6) and assuming the fraction of the PM not speciated in NMIM has a carbon fraction similar to that of the fraction that is speciated. Overall, this equates to a 52-59% increase in the fuel consumption by 2-stroke SCCs and a 0.78-68% increase in fuel consumption for 4-stroke SCCs as compared to the weighted BSFC estimated using the data and equations presented in the NONROAD documentation.

Note that the certification data coverage is not ideal within the context of the NONROAD engines of interest:

- The certification data are limited to engines produced in 2011-2014, as these were the only data representing 2 and 4-stroke engines operating on "Gasoline (as defined in 1065.710)." Thus, their representativeness of the range of model years is unknown.
- Certification data for 2 and 4-stroke engines are limited to engines with a maximum HP from 0.57 to 7.8 HP (or 0.42 to 5.8 kW) and from 0.71 to 41 HP (or 0.52 to 30 kW) respectively, again as the only data with emission factors for CO, HC-NOX, and CO_2. Alternatively, the impacted 2 and 4-stroke technology types in the Commons equipment are from 0-75 HP.
- The certification data contain no 2-stroke engines and only 1 4-stroke engine that include CO, HC-NOX, and CO_2 emissions using gasoline mixed with ethanol. Thus, the impact of mixing the fuel with ethanol is not considered here.

As such, an opportunity exists to further investigate representative 2 and 4-stroke engine models within the context of NONROAD equipment.

Variability and uncertainty

Sources of variability and uncertainty in the final fuel consumption estimates propagate from variability and uncertainty in the zero hour BSFC, emission factors, and the fuel carbon contents as described in Section 2.1). In addition, the carbon mass fraction of lube as a triangular distribution from 0.86 to 0.868 to 0.875 as developed for residual oil in GREET's stochastic analyses (Argonne National Laboratory, 2012).

2.3.4. Addition of fuel and lubricant transport

See parameters P583-P588 in Appendix B: Example parameterization of self-propelled equipment datasets

Data representing fuel and lubricant transport distances are from the Commodity Flow Survey (CFS)[28]. The CFS is a shipper-based survey conducted as part of the Economic Census. It provides a modal picture of national freight flows, and represents the only publicly available source of commodity flow data for the highway mode. Although the CFS was conducted in 1993, 1997, 2002, and most recently in 2007, the method for transportation distance estimation in CFS changed in 2007. Specifically, in 2007 the GeoMiller[29] tool was used. GeoMiller uses algorithms to find the "best path" over spatial representations of the U.S. highway, railway, waterway, and airway networks.

Assuming the GeoMiller estimates are preferred over those developed using previous methods, the 2007 CFS transport distance data are used here for all self-propelled equipment operating years. Assuming the mode of transport from central fuel stations to the point-of-use is by private truck (i.e., trucks operated by a temporary or permanent employee of an establishment or the buyer/receiver of the shipment), diesel and lubricant transport distances correspond to the CSF commodity “fuel oil,” gasoline to “gasoline and aviation turbine fuel,” and CNG and LPG as “coal and petroleum products, not elsewhere classified.” Ultimately, fuel and lubricant transport are estimated in kg-km, representing the product of the mass moved and the distance traveled. The results are presented in Table 10.

Variability and Uncertainty

Again, data representing fuel and lubricant transport distances are from the Commodity Flow Survey (CFS)[30] and are based on the 2007 application of the GeoMiller tool. The CFS data are accompanied by estimates of standard error, intended to represent sampling error. However, information on sample sizes for commodity and transport mode strata or for uncertainty estimation procedures specific to the development of the GeoMiller data were not found, except for note that the minimum sample size is two establishments. Thus, here a uniform distribution is used to represent fuel and transport distances, based on the 95% upper and lower confidence limits as described in the CFS documentation. For non-sampling error and specifically for highway routing, the GeoMiller tool has been shown to produce slightly higher (an average of about 3%) mileages on highway shipments of distances less than 483 km (300 miles)[31]. Because the average transport distances of fuels and lubricants by private truck range from 37-63 km (23-39 miles), the upper bound of the uniform distribution is extended by 3%. Again the results are presented in Table 10.

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[28] See http://www.bts.gov/publications/commodity_flow_survey/

[29] See http://www.bts.gov/publications/bts_technical_report/2007_07_13/index.html

[30] See http://www.bts.gov/publications/commodity_flow_survey/

[31] See http://www.bts.gov/publications/commodity_flow_survey/methodology/index.html

Table 10. Transport distances

	Average distance (miles)	standard error	relative standard error	95% lower confidence limit	95% upper confidence limit
Diesel and lubricating oil	23	5.1	22	13	34
CNG	39	4.8	12	30	50
LPG	39	4.8	12	30	50
Gasoline	35	6.1	17	23	48

2.3.5. Addition of equipment production, storage, spare parts, and retirement

See parameters P480 and P492-P495 in Appendix B: Example parameterization of self-propelled equipment datasets

In all datasets, equipment and spare parts production and the treatment of used equipment are estimated in "units" representing the fraction of a single piece of equipment needed to produce 1 MJ of work over the equipment life. Specifically, the estimate relies on NONROAD parameters:

$$LIFEFRAC = \frac{1}{(LIFE*HORSEPOWER*LOADFACTOR*3600/1341)} \qquad \text{<equation 10>}$$

where LIFE represents the expected equipment lifetime (hours of use); HORSEPOWER is the equipment horsepower (HP) rating; LOADFACTOR is variable representing the equipment load factor (fraction of the rated power); and 3600/1341 converts HP to MJ. This means that details concerning equipment and spare parts production and the treatment of used equipment are provided in pending datasets representing equipment and spare parts production and the treatment of used equipment.

For equipment storage, Gay and Grisso (2009) note that building dimensions must account for adequate machinery clearance, with careful consideration given to the estimated floor space (e.g., considering fold-up configurations). They recommend the total storage area use the actual area dimensions for equipment multiplied by 1.15 to account for space between equipment and an eave height of 4.3 m.

To estimate the storage areas needed for all datasets, data have been adapted from the equipment dimensions provided by Gay and Grisso (2009) and Lazarus (2012). Noting that equipment design can vary greatly (e.g., among manufacturers, with equipment features, etc.), data were organized by equipment groups and summarized as approximately linear relationships relating HP and the storage area (in m^2). The resulting data are provided in Table 11 and are used to approximate the storage space, assuming an eave height of 4.3 m is required for all storage facilities.

Table 11. Relationships used to estimate storage area and height

	Storage area (m^2)	Storage area (m^2 = m*HP+b)		Areas (m^2)	Data description
		Slope (m)	Intercept (b)		
Tractors, loaders, and backhoes; 0-200 HP		0.072	5.1	5.5-25	Storage area and HP data were obtained from Lazarus (2012) for 7 tractors. The slope and intercept were estimated with an RSQ of 0.90. The range of storage heights is adapted from Gay and Grisso (2009).
Tractors, loaders, and backhoes; >200 HP	22-25			22-25	Adapted from data representing 6 tractors listed in Lazarus (2012) and 2 in Gay and Grisso (2009).
Skid steer loaders		0.099	1.2	1.8-18	Storage area, height, and HP data were obtained from Gay and Grisso (2009) for 6 skid steer loaders. The slope and intercept were estimated with an RSQ of 0.89.
Combines		0.086	19	23-70	Storage area and HP data from Lazarus (2012) were combined with the minimum and maximum storage areas from Gay and Grisso (2009) matched to the minimum and maximum HPs listed in the NONROAD documentation for a total of 5 combines. The slope and intercept were estimated with an RSQ of 0.93. The range of storage heights is adapted from Gay and Grisso (2009).
Swathers		0.20	2.2	10-61	Storage area, height, and HP data were obtained from Gay and Grisso (2009) for 3 swathers. The slope and intercept were estimated with an RSQ of 0.86.
Balers		0.072	5.1	6.9-27	The minimum and maximum storage areas from Gay and Grisso (2009) were matched to the minimum and maximum HPs listed in the NONROAD documentation for a total of 2 balers. The range of storage heights is adapted from Gay and Grisso (2009).
Sprayers		0.045	1.8	1.8-29	Equipment dimensions for boom 21-42 ft boom lengths from Gay and Grisso (2009) were matched with HP data from John Deere for self-propelled sprayers, noting that each model supports a range of boom lengths and that the extremes were considered, for a total of 8 Deere sprayers.[32]
Pumps	0			0	Pumps are assumed not to be stored indoors.
Irrigation sets	0			0	Irrigation sets are assumed not to be stored indoors.
Other self-propelled equipment		0.088	3.5	3.7-96	All of the data presented above were summarized (31 data points). The slope and intercept were estimated with an RSQ of 0.77.

Variability

Uncertainty in the equipment production and storage, spare parts production and the treatment of used equipment is estimated as the estimated storage space times the fraction of the equipment life consumed. The storage space is presented here assuming a triangular distribution as +/- 15% of the slope and intercept, intended to represent uncertainty in the space between equipment. For equipment production, spare parts,

[32] See models 4630, 4730, 4830, and 4940 at http://www.deere.com/wps/dcp,/en_US/products/equipment/self-propelled_sprayers. Interestingly, the John Deere specifications did not include the overall equipment dimensions.

and used equipment management, all are estimated as the fraction of equipment lifetime consumed (in units/MJ) which propagates uncertainty from that in the load factor.

2.3.6. Disaggregation of emissions based on NMIM

See parameters P589-P862 in Appendix B: Example parameterization of self-propelled equipment datasets

Emissions are disaggregated based on data within the USEPA's National Mobile Inventory Model (NMIM, as described in EPA420-R-05-024). The NMIM software is a front-end to the NONROAD software, with an underlying database. Specifically, from estimates of fuel consumption, THC, and PM10 developed using the NONROAD documentation and data, NMIM emission relationships presented in the SCCToxics and SCC tables are used to disaggregate emissions to represent specific quantities for methane, ammonia, and select hazardous air pollutants (HAPs), metals, and dioxin/furans emissions as well as emissions groups (Total Organic Gases (TOG), Non-Methane Organic Gases (NMOG), Non-Methane Hydrocarbons (NMHC), Non-Methane Volatile Organic Compounds (NMVOC), and Secondary Organic Aerosols (SOA)).

The NMIM emissions estimation data used here are presented in Appendix D: NMIM emissions relationships. As shown, NMIM data are presented as factors to be multiplied by one of 7 bases for the estimation of emissions:

- **Gal fuel:** factors to be multiplied by the fuel consumption
- **exhaust or evap THC:** factors to be multiplied by the exhaust or evaporative THC emissions
- **exhaust or evap NMVOC:** factors to be multiplied by the exhaust or evaporative NMVOC emissions
- **exhaust PM10:** factors to be multiplied by the exhaust PM10 emissions
- **all NMVOC:** a factor for the estimation of Secondary Organic Aerosol to be multiplied by the NMIM estimates combining both the exhaust and evaporative NMVOCs.

Separate ratios are used for evaporative and exhaust emissions for each of the following four categories of gasoline blends:

1. Baseline Gasoline. All cases that do not fall into categories 2-4 below. Ratios are in variables "ExhBaseGas" and "EvapBaseGas" in the SCCToxics table.
2. WO (Winter Oxygenate) Gasoline / Ethanol or ETBE- Used where the fuel contains ethanol which is greater than or equal to 5% by volume or ETBE greater than or equal to 5% by volume. Ratios are in variables "ExhEthGas" and "EvapEthGas" in the SCCToxics table.

The estimates made here deviate from the NMIM methods in three ways. First, **whereas NMIM presents emission factors by SCC, NONROAD estimates fuel use and emission factors by technology group within an SCC.** Although the SCCToxics and SCC tables in NMIM are organized by SCC, this appears to be incompatible with the NONROAD documentation and data construct for gasoline engines. As explained in NR-006e, 2- and 4-stroke spark-ignition equipment under 25 HP are combined in NONROAD into one SCC to handle expected shifts in market share. Note also that inspection of all gasoline engines in NR-010f reveals similar instances over 25 HP (e.g., emissions factors for G4GT251). Thus, in NONROAD the distinction between 2- and 4-stroke gasoline engine emission factors is maintained using the technology groups but not in the SCC name. Inspection of the

NMIM data reveals consistency among 2-stroke and 4-stroke emission factors but not between them. As a result of these findings, the NMIM 2-stroke emission factors here are assigned to 2-stroke technology groups and 4-stroke emission factors to 4-stroke technology groups instead of to the SCC in the equipment name.

Second, **although NMIM presents emission factors using NONROAD PM evaporative emissions as a basis, NONROAD does not estimate PM evaporative emissions.** For example, although NMIM provides emission factors for naphthalene based on evaporative PM emissions for gasoline and ethanol fuels, with no commensurate NONROAD data to support the estimation of naphthalene emissions.

Third, **although the NMIM documentation mentions emission factors for evaporative TOG for CNG engines, NONROAD does not estimate evaporative emissions for CNG engines.** Specifically, whereas the NMIM documentation notes that for evaporative CNG emissions TOG = THC and NMOG = NMHC = VOC = 0, NR-012d notes that equipment fueled with CNG, LPG, and diesel fuel are assumed to have no significant evaporative emissions and as a result all evaporative emissions calculated by NONROAD are from gasoline-fueled equipment.

2.3.7. Addition of nitrous oxide emissions

See parameters P863-P864 in Appendix B: Example parameterization of self-propelled equipment datasets

N_2O emissions for diesel and gasoline self-propelled equipment are estimated based on data from the USEPA's national GHG inventory (US Environmental Protection Agency, 2012) as 0.080 g N_2O/ kg fuel. N_2O emissions for LPG and CNG self-propelled equipment are assumed to be 0.108 and 0.104 g N_2O/ kg fuel respectively and based on LPG and CNG passenger vehicles as presented in GREET (Argonne National Laboratory, 2012) in the absence of data for nonroad vehicles.

3. Self-propelled fleet dataset development

See the parameterization in Appendix C: Example parameterization of self-propelled fleet datasets

Again the key information source used for the development of the self-propelled fleet datasets are the NONROAD Engine Population Estimates (EPA-420-R-10-017 NR-006e July 2010) and Calculation of Age Distributions in the Nonroad Model: Growth and Scrappage (EPA420-R-05-018 NR-007c December 2005) [33]. NR-006e documents the engine population values used in EPA's final NONROAD 2008a emission inventory model and NR-007c documents calculations of equipment populations by age for given equipment types and scenario years to account for emissions deterioration, new emissions standards, technology changes, and changes in equipment populations from sales growth trends.

Related to Figure 2, Figure 8 depicts the self-propelled equipment in the **self-propelled fleet dataset** representing 25-300 HP balers operating in 2009 at 12-28 C. As shown, the fleet is composed of the four-stroke

[33] Both NR-006e and NR-007c are available at http://www.epa.gov/oms/nonrdmdl.htm

balers depicted in Figure 2 as well as 40-50 HP diesel balers, 50-75 HP four-stroke balers, 50-75 HP diesel balers, 75-100 HP diesel balers, 100-175 HP four-stroke balers, 100-175 HP diesel balers, and 175-300 HP diesel balers. In the self-propelled fleet dataset, work is divided among the self-propelled equipment in the fleet as described in NR-006e and NR-007c. For the equipment considered here (listed in Table 2), whereas fleets of 2-wheel tractors from 3-16 HP require 42 types of self-propelled equipment in a single operating year (as 4 fuel and HP combinations each covering multiple model years), fleets of pumps from 0-600 HP require 608 types of self-propelled equipment in a single operating year (as 35 fuel and HP combinations each covering multiple model years).

Figure 8 Self-propelled fleet dataset technology representation example

For the fleet datasets, the only deviation from the computational methods and data presented in NR-007c is the execution of the "Default Scrappage Curve." Whereas NR-007a presents a table of values to 4 decimal places for the "Age/Median Life" for values of 0-100 for the "Cumulative Percent Scrapped" (see Table 1 in NR-007a specifically), herein instead of extrapolating between values in the table, a mathematical formula is used to represent the default scrappage curve. The default scrappage curve formula was found by entering the tabulated data into Eureka (a mathematical software tool used to determine mathematical equations that describe sets of data in their simplest form[34]) to obtain the age/median life as a function of the cumulative percent scrapped (p_c):

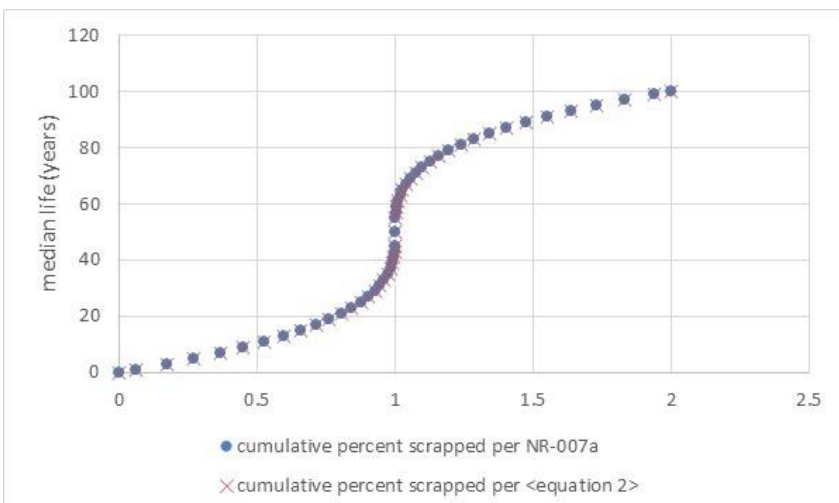
$$median\ life\ (years) = m_l = \frac{{p_c}^3 - 150{p_c}^2 + 7500p_c}{125000} \qquad \text{<equation 11>}$$

Given this relationship, the inverse function was found using the Wolfram Alpha Inverse Function Calculator[35] as:

$$cumulative\ \%\ scrapped = \ p_c = 50 - \left(125000(1 - m_l)\right)^{\frac{1}{3}} \qquad \text{<equation 12>}$$

As shown in Figure 9, the data from NR-007a match well with that estimated using equation 13.

Figure 9 Example relationships between field crop production and self-propelled equipment datasets



Note that forage harvesters, cotton pickers, cotton module builders, and cotton strippers are modeled as "other agricultural equipment." The power ranges used are the result of a review of equipment literatures, as described in Cooper et al. (2014)

[34] Available at http://www.nutonian.com/products/eureqa/

[35] Available at http://www.wolframalpha.com/widgets/gallery/?query=inverse+function+calculator

Variability and Uncertainty

The development of population estimates are described in NR-006e, providing updates the previous version with a focus on phase-in of new emission standards and other unique aspects of emissions or allocations by application, fuel type, or power level. The previous equipment population estimates were provided by Power Systems Research (PSR), an independent marketing research firm. Chi et al. (2004) elicited some rough estimates of uncertainty of different parameters from PSR. They estimated the uncertainty for the geographic distributions by state at +/-4% by horsepower grouping and +/-7% by application. Finding no estimates of uncertainty relating to the update of the PSR data, here triangular distributions are used, with the most likely value set to that in the NONROAD documentation and the minimum and maximum values set at -10.7% and +11.3% (with the lower bound at 1-(1-0.04)*(1-0.07) and the upper bound at (1+0.04)*(1+0.07)-1) to represent the combination of the horsepower grouping and application spread.

4. Aggregated fleet dataset development

Again, the aggregated fleet datasets combine self-propelled fleet and equipment datasets. This means that self-propelled equipment datasets results are combined in the operating-model year proportions for the specified fleet. Thus and like the self-propelled equipment datasets, the aggregated fleet datasets provide estimates of fuel and lubricant transport, use, and emissions and equipment storage, construction, spare parts, and retirement for ALL of the self-propelled equipment in a fleet.

To make the link to the crop production data already in the Commons (as in Figure 1), operating temperatures are specified by indicating whether the aggregated fleet is to be used during growing or harvest of the crop of interest in the state of interest. This accounts for differences in operating temperature when, e.g., using a tractor for harvesting corn in North Dakota at an average temperature of 4.5 ^{o}C (34 ^{o}F, during October and November) and harvesting corn in Georgia at an average temperature of 6.2 ^{o}C (76 ^{o}F, during August and September).

The temperatures dataset was compiled using the National Aeronautics and Space Administration (NASA) Prediction of Worldwide Energy Resource (POWER) Climatology Resource for Agroclimatology web interface[36]. Noting that the field crop data span 1996-2009, daily data for the "air temperature at 2m above the surface of the earth" from 1983 to 2007 on a 1 degree by 1 degree grid cover the US and represent the longest consecutive period of data derived from unchanging data sources. These data were masked over cropland on a 1/8 degree grid using data from the NASA's masked with land use classification data from the National Aeronautics and Space Administration (NASA) Land Data Assimilation System Vegetation Class/Mask[37] representing US crop

[36] See http://power.larc.nasa.gov/cgi-bin/cgiwrap/solar/agro.cgi?email=agroclim@larc.nasa.gov

[37] See http://ldas.gsfc.nasa.gov/nldas/NLDASvegetation.php

production from 1992-1993 as the latest available data. Finally, the temperatures were summarized based on the crop- and state specific dates in the USDA's Field Crops Usual Planting and Harvesting Dates[38].

Although operating temperature effects only evaporative emissions from gasoline fueled equipment, because the aggregated fleets cover multiple fuels the growing or harvest designation is used for all aggregated fleet datasets. Also, evaluation of methods of generating climatology data for use in the Commons continues, including considerations of updates to the underlying temperature data, updates to the cropland mask, and evaluation of the discretization method.

5. Mass balance

In all datasets, although an overall mass balance is not achieved, the carbon in the fuel and lubricating oil is balanced to the air emissions. The overall balance is not achieved because the emissions estimates based on NMIM are based on aggregated groups of constituents (e.g., TOG, NMVOCs) that combine fuel and lubricating oil constituents with the air consumed during combustion. For these groups, the specific emissions identified in NMIM are only a portion of the basis (i.e., the breakdown of NMVOCs does not equal all of the NMVOCs). Without estimates of the chemical formulas for the un-specified portions, there is no way to balance the mass. Should a comprehensive and reliable constituent breakdown of exhaust and evaporative emissions become available, the parameterization should be reworked to include the estimation of the air consumed such that mass balance can be achieved (such that the fuel + lubricant + air into each engine equals the emissions + the waste lubricant out of each engine).

6. Data quality results

At the dataset level, the self-propelled equipment datasets are incomplete because the air from the environment used in combustion has not been quantified and fluids other than lubricating oil (e.g., refrigerants, transmission fluids) have not been quantified (see Table 12). For the fleet datasets, because work is divided among the self-propelled equipment that represent 100% of the fleet, the datasets are complete.

Table 12 Self-propelled equipment inclusion of flow groups

Products and co-products	• Work performed
Flows from the environment	• Air (e.g., used in combustion) ***is not included***
Technosphere/ intermediate flows	• Fuel use • Lubricating oil use and waste management • Other operating fluids (e.g., refrigerants, transmission fluids) ***are not included*** • Transport/ distribution of fuel and lubricating oil • Equipment production, spare parts, and retirement • Equipment facility use (for equipment storage)
Flows to the environment	• Operating emissions including air emissions from fuel and lubricating oil use

[38] See http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1251

All datasets have been prepared as complete based on the types of flows listed in Table 12. For technosphere flows and flows to and from the environment, data quality scores based on the criteria presented in Table 3 are presented in Table 13 and Table 14.

Table 13. Self-propelled dataset flow data quality scores

Category	**Data quality = (A,B,B,A,AorB,AorB,AorB)**
1. Reliability and reproducibility	A: Flow data were estimated using methods and data described in specified archival or other consistently publically available sources, as described in this document.
2. Flow data completeness	B: The mass in and out of the unit process does not balance. However, the carbon in the incoming fuel and lubricating oil has been balanced to select among the air emissions, assuming the THC carbon fraction is equal to the fuel carbon fraction and the un-speciated PM fraction is equivalent to the speciated fraction.
3. Temporal coverage	B: All data in the NONROAD documentation are forecasted. Although select among the EF are measured, e.g., deterioration and other adjustments make this assumption.
4. Geographical coverage	A: The flow data represent operations that occurred within the location of the unit process.
5.Technological coverage	A: The flow data represent the processes and/or materials specified without surrogacy or aggregation with other technologies. **EXCEPTIONS** B: N_2O emissions for LPG and CNG equipment (these data are based on EFs representing passenger vehicles as opposed to non-road equipment). B: Air emissions presented in aggregate: nitrogen oxides (NOx), particulates, total organic gases (TOG), non-methane organic gases (NMOG), non-methane hydrocarbons (NMHC), non-methane volatile organic compounds (NMVOC), secondary organic aerosol (SOA), arsenic & compounds, mercury (particulate), and dioxins, measured as 2,3,7,8-tetrachlorodibenzo-p-dioxin.
6. Uncertainty	A: The flow data propagate uncertainty using probability distributions assigned to underlying parameters. **EXCEPTIONS** B: All flows in the aggregated fleet datasets and all those presented In the EcoSpold v1 format (the EcoSpold v1 data format does not support parameterization and all uncertainty data are described here for the parameterized raw data)
7. Precision	A: Flow data propagate precision to the stated criteria. **EXCEPTIONS** B: The exception in the Uncertainty Data Quality Category. B: All flows for which the minimum flow data value is ≥ 75% and maximum flow data value is ≤125% of the average of the minimum and maximum values. B: Lubricant management (imprecision in the fraction of lubricant oxidized propagates lower data quality through the estimate).

Table 14. Fleet dataset flow data quality scores

Category	
1. Reliability and reproducibility	A: Flow data were estimated using methods and data described in specified archival or other consistently publically available sources, as described in this document.
2. Flow data completeness	A: The flow data consider ambient temperature variations by state and balance the mass and energy in and out of the unit process.
3. Temporal coverage	A: The flow data represent operations that occurred between the unit process start and end dates without forecasting for operating years before 2009. This assumes that data from the USEPA's 2008 NONROAD documentation are only forecast for operating years after 2008. B: The flow data are forecast for all operating years after 2008.
4. Geographical coverage	A: The flow data represent operations that occurred within the location of the unit process.
5.Technological coverage	A: The flow data represent the processes and/or materials specified without surrogacy or aggregation with other technologies. **EXCEPTIONS** B: Datasets representing 0-3HP 2-stroke generator sets, pumps, and sprayers have been omitted from the respective fleet datasets due to missing emission factors (i.e., the related emission factors were not found in any of the USEPA NONROAD documentation) and un-applicability of the lubricant emission factors employed.
6. Uncertainty	B: All flows in the fleet datasets are presented without the quantification of uncertainty.
7. Precision	B: All flows in the fleet datasets are presented without the quantification of precision.

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Appendix A: Information included in the meta data

Base name	Provides a general descriptive name of the product produced using technical language. If the product is waste management, include the phrase "waste management" or something similar.	For both the self-propelled equipment and fleet datasets, the base name is "work".
Treatment standards, routes	Provides qualitative information on the product produced: treatment received, standard fulfilled, product quality, use information, production route name, educt name, primary / secondary etc. separated by commas.	For the self-propelled equipment datasets, this field names the equipment (e.g., 4-stroke baler), the model and operating years (e.g., 1990 model in 2009), and the fuel (e.g., DFF for DeFault Fuel). For the self-propelled fleet datasets, this field names the equipment (e.g., balers), the operating year (e.g., 2009 fleet) and the fuel.
Location type	Describes the location type of availability (such as e.g. "to consumer" or "at plant").	This field is not used for the self-propelled equipment and fleet datasets.
Mix type	Provides specifying information on being a production mix or consumption mix if applicable.	This field is not used for the self-propelled equipment and fleet datasets.
Quantitative flow properties	Provides quantitative specifying information on the reference flow if applicable: qualifying constituent contents, energy-content per unit, etc. separated by commas.	For the self-propelled equipment and fleet datasets, this field specifies the applicable horsepower range (e.g., 25-40HP) and the operating temperature range (e.g., at 12-28C).
ISIC code	Provides the 4-digit ISIC rev 4 code and the ISIC name from http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27	For example, 0161 represents "Support activities for crop production".
NAIC code	Provides the 6-digit NAIC code from http://www.naics.com/search.htm	For example, 115110 represents "Support Activities for Crop Production".
UNSPSC code	Provides the 8-digit UNSPSC code from http://www.unspsc.org/search-code	For example, 21101709 represents a "Baler".
Process description	Describes the process and the technical scope (e.g. gate-to-gate or cradle-to-grave) and any aggregation used. Define the technology being used, its operating conditions, and the temporal and geographic representativeness. Name any coproducts and note how they are accounted, noting that unallocated datasets are preferred.	For the self-propelled equipment and fleet datasets, this field notes that each dataset is a unit process/ gate-to-gate dataset represents the production of 1 MJ of work in the operating year and location specified. For the self-propelled equipment datasets, the equipment power and fuel are named, the sulfur content is noted, and the ethanol contents and the Reid Vapor Pressure are provided for gas fueled equipment. Also, it is stated that "The process technologies represented are an aggregation of the exhaust and evaporation technologies and control technologies described in the USEPA's NONROAD model documentation (available at http://www.epa.gov/otaq/nonrdmdl.htm). For the self-propelled fleet datasets this field notes that the fuels used have been named ''DFF'' (for DeFault Fuel) as described in this document and that the division of process technologies are described in the USEPA's documents NONROAD Engine Population Estimates (EPA-420-R-10-017 NR-006e July 2010) and Calculation of Age Distributions in the Nonroad Model: Growth and Scrappage (EPA420-R-05-018 NR-007c December 2005) (available at http://www.epa.gov/otaq/nonrdmdl.htm).

Unit name/ flow property name	Provides the unit and flow property names as defined by the ILCD format.	Such as “MJ/Energy” or “kg*km/ Goods transport (mass*distance)”.
Start date	Provides the start date for the period of time which the data represent.	Such as 01/01/2009
End date	Provides the end date for the period of time which the data represent.	Such as 12/31/2009
Temporal representatives comment	Describes the temporal characteristics of the data including the period of time for which they refer and are valid and any temporal aggregation and temporal incongruence of supporting data.	For the self-propelled equipment and fleet datasets, start and end dates match the equipment operating year.
Location	Provides the location code according to ISO 3166-2 Sub-division/State Code.	For the self-propelled equipment and fleet datasets, a US State is indicated by “US-“ and the 2-letter state abbreviation.
Geographic representativeness comment	Describes the geographical representativeness of the data including the geographic area over which the data are valid and any geographic aggregations.	For the self-propelled equipment and fleet datasets, the US State of operation is noted.
Technology description	Provides a short general description of the technology to inform users about the technical relevance of the data. Include a list of processes/ activities (anthropogenic or natural) included in the dataset, such as a description of any fate and transport modeling used.	For the self-propelled equipment datasets, the exhaust and evaporative technologies, operating temperatures, fuel characteristics, and included processes (fuel transport, consumption, and combustion; lubricant transport, use, and waste management; equipment and spare part set production; equipment retirement; and equipment storage) are listed. For the self-propelled fleet datasets, it is noted that the process technologies represent the mix of gas, diesel, LPG, and CNG self-propelled equipment in the fleet by model year as described in the USEPA's NONROAD model documentation (available at http://www.epa.gov/otaq/nonrdmdl.htm). The minimum, average, and maximum operating temperatures are 12, 20, and 28 degrees C respectively. The fuel sulfur contents and gasoline ethanol content and Reid Vapor Pressures are dependent on the operating year as described herein.
Intended applications	Describes the intended application for the data including the larger context within which the data were developed and the objectives of the research. The intended application may differ due to project scope or system boundaries, data aggregation methods, and/or data gaps.	These data are intended for use in LCAs covering a wide range of impacts for private or public use and/or for product comparisons.
Data generator	Identifies the person responsible for developing the data including their affiliations, telephone number, address, email address, and website as applicable.	For the self-propelled equipment and fleet datasets, the data generator is Joyce Cooper, University of Washington, Associate Professor of Mechanical Engineering, (206) 616-3270 University of Washington Department of Mechanical Engineering, Seattle, USA, 98195, cooperjs@u.washington.edu, http://faculty.washington.edu/cooperjs/DFE_Website/University_of_Washington_DFE_Lab.html
Project	Includes information about the project through which the data were generated. Include project name, funding institutions/organizations and grant/contract name and numbers where applicable.	For the self-propelled equipment and fleet datasets, data were prepared by the University of Washington Design for Environment Laboratory for the United States Department of Agriculture National Agricultural Library under cooperative agreement number 58-8201-0-149.

Access and use restrictions	Provides a clear statement about how the data and metadata may be released outside of the Commons if applicable.	For the self-propelled equipment and fleet datasets, there are no access and use restrictions.
Copyright (true/false)	Indicates true if the data are copyrighted and false if they are not copyrighted.	The self-propelled equipment and fleet datasets are not copyrighted.
Process type	Indicates whether the data represent a unit or system process, where a system process is an LCI result.	For the self-propelled equipment and fleet datasets are unit process data.
Allocation methods	Specifies the allocation method used as none, causal allocation, economic allocation, and/or physical allocation. For data submitted to the Commons, the preference is not to allocate (e.g., responding "none").	For the self-propelled equipment and fleet datasets, no allocation has been used.
Treatment of missing flow data	Lists and describes methods for accounting missing data (e.g., cut off rules, use of service processes) and/or intended omissions. As applicable, for biomass production include mention of missing data on: a. Coproduction b. Flows from the environment (occupied area, transformed area, water withdrawal, nutrients from air and soil (in crops, co-products, and above and belowground residues)) c. Technosphere/ intermediate flows (field residue burning, residue management, soil preparation, planting or sowing, seed or feed use and storage, irrigation, fertilizer application, liming material application, secondary materials application, pesticide application, application materials storage, transport/ distribution, harvest) d. Flows to the environment (residue burning emissions, residue left on the field (above and below ground), water (in irrigation, with manure applications, in sewage sludge applied), substances applied in fertilizers, manures, secondary applications, and pesticides) As applicable, for equipment operation include mention of missing data on: a. Coproduction b. Flows from the environment (water withdrawal, air used in combustion, other directly extracted resources) c. Technosphere/ intermediate flows (energy use, product materials use, ancillary materials use, transport/ distribution, equipment construction and retirement, spare parts, facility use) d. Flows to the environment (operating emissions including unrecovered product and ancillary materials)	Fluids other than fuel and lubricating oil (e.g., refrigerants) have not been accounted. Also, further disaggregation of air emissions is possible, but has been left for future work.
Unsubmitted intermediate flow datasets	When intermediate flows are specified in datasets being submitted but the associated "upstream" or "downstream" datasets are not simultaneously being submitted to the Commons: a. Lists the intermediate flows that are cutoff (when the upstream or downstream data sets to not yet exist) and/or	For the self-propelled equipment datasets, cutoff flows represent the life cycles of fuel and lubricant production; equipment production, spare parts, storage, and retirement; and local area trucking. For the self-propelled fleet datasets, all supporting datasets are available in the Commons except the life cycles of electric irrigation equipment.

	b. Lists the intermediate flows and the associated database(s) in which the upstream or downstream data sets can be found (e.g., in the SimaPro or GaBi software, in ecoinvent, in ELCD, etc.).	
Mass balance	Either: a. Quantifies and describes the mass imbalance or b. Describes the mass balance as unknown	For the self-propelled equipment datasets, although an overall mass balance is not achieved, the carbon in the fuel and lubricating oil is balanced to relevant air emissions for gasoline and diesel equipment. For all fuels, an overall mass balance is not achieved because the emissions estimates based on NMIM are based on aggregated groups of constituents (e.g., TOG, NMVOCs) that combine fuel and lubricating oil constituents with the air consumed during combustion. For these groups, the specific emissions identified in NMIM are only a portion of the basis (i.e., the breakdown of NMVOCs does not equal all of the NMVOCs). No mass is exchanged in the self-propelled fleet datasets.
Data treatment	Provides a detailed description of the methods and assumptions used to transform primary and secondary data into flow quantities through recalculating, reformatting, aggregation, or proxy data. It is also noted that use of the method presented herein is preferred.	For the self-propelled equipment and fleet datasets, Data development is demonstrated by parameterization (explicitly presents all raw and uncertainty data and all calculations). Flow data quality is presented according to the LCA Digital Commons convention as described in Cooper, J.S., E. Kahn, Commentary on issues in data quality analysis in life cycle assessment. International Journal of Life Cycle Assessment 17(4) 499-503 (2012).
Boundary conditions and sampling procedures	Provides a detailed description of how boundary conditions were defined, how data were collected, and how variability and uncertainty are estimated.	For the self-propelled equipment datasets, boundary conditions are defined to represent equipment operation, maintenance, production, storage, and retirement for a specific equipment life and pattern of use (i.e., hours/year). Representations of uncertainty cover fuel carbon mass fraction, fuel consumption, and CO2 emissions; load factors; fuel sulfur and ethanol contents; air emissions and waste management; and fuel and lubricant transport as described herein. For the self-propelled fleet datasets, it is stated that the boundary conditions are defined to represent the population of self-propelled equipment of model years up to the operating year and that uncertainty is not considered.
Data collection period	Describes the period of time within which the data were collected.	For the self-propelled equipment and fleet datasets, unit process data were compiled in 2013 based on the USEPA's NONROAD model version 2008a, available at http://www.epa.gov/otaq/nonrdmdl.htm.
Reviewer	Names the peer review chair or lead reviewer as appropriate, their affiliations, telephone number, address, email address, and website as applicable.	For the self-propelled equipment and fleet datasets, the review committee is described herein and named the LCA Digital Commons Agricultural Equipment Peer Review Panel.
Review description	Describes how the data were reviewed as: no review, dependent internal review, independent external review, panel review, independent internal review, or other. Add a description as appropriate; including a list of reviewers beyond the peer review chair.	For the self-propelled equipment and fleet datasets, the review panel convened during March of 2013 and January of 2014 to review data preparation methods. The panel members were Troy Hawkins (National Risk Management Research Laboratory, USEPA), Alberta Carpenter (National Renewable Energy Laboratory,

		USDOE), Thomas Transue (Lockheed Martin Information Technology), Wes Ingwersen (National Risk Management Research Laboratory, USEPA), and Harvey Michaels (Office of Transportation and Air Quality, USEPA).

Appendix B: Example parameterization of self-propelled equipment datasets

Data represent the dataset "work; 4str baler, 1990 model in 2009, DFF; 25-40HP at 12-28C." Note that numbered parameters are used in the mathematical relations to ensure the text limit in OpenLCA is met.

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Equipment production year	MODELYEAR	P1		1990
Equipment operating year	CURRENTYEAR	P2		2009
Minimum ambient temperature (Degrees F)	TMIN	P3		54
Maximum ambient temperature (Degrees F)	TMAX	P4		82
Average ambient temperature (Degrees F)	TAVG	P5		68
Ethanol blend market percent	ETOHMARKET	P6		0.713776
Ethanol blend volume percent	ETOHVOL	P7		0.095685
Episodic fuel sulfur weight percent (soxdsl)	SOXDSL	P8		0
Default certification fuel sulfur weight percent (soxbas)	SOXBAS	P9		0.0339
Reid vapor pressure	RVP	P10		8
Diurnal Correction Factor	DIURNALCORRECTION	P11		0.78
Base fuel density (G/GAL)	BASEFUELDEN	P12		2798.712
Base fuel carbon fraction	BASEFUELCFRAC	P13		0.87
Lubricating oil density (G/GAL)	DENLUBE	P14		3311.28
Lubricating oil carbon mass fraction	LUBECRATIO	P15		0.868
Parts gas in the 2-stroke volumetric gas to lubricating oil ratio	RVOLGAS	P16		50
4 digit SCC	SCC4	P17		2265
Equipment horsepower rating (HP)	HORSEPOWER	P18		34.57
Fuel type is diesel	DIESEL	P19		0
Fuel type is gasoline	GAS	P20		1
Fuel type is LPG	LPG	P21		0
Fuel type is CNG	CNG	P22		0
Expected equipment lifetime (hours of use) (HR)	LIFE	P23		1054
Annual hours of activity (HR/YR)	AVERAGEUSE	P24		68
Equipment load factor	LOADFAC	P25		0.62
Ratio of PM2.5 to PM10	PMCONVRATIO	P26		0.92
Diesel refueling multiplier	DIESELREFUEL	P27		1
Exhaust HC oxygen correction factor	HCOCF	P28		-0.045
Exhaust NOx oxygen correction factor	NOXOCF	P29		0.115
Exhaust CO oxygen correction factor	COOCF	P30		-0.062
Equipment spillage during refuelling (G/REFUEL)	REFUELINGSPILLAGE	P31		3.6
Equipment spillage tank size (GAL)	TANKSIZE	P32		28
Equipment spillage tank fill fraction	FILLFRAC	P33		0.5

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Equipment spillage tank metal fraction	METALFRAC	P34		1
Equipment spillage NonRecMarine hose length (M)	NRMHOSELENGTH	P35		0.1
Equipment spillage NonRecMarine hose diameter (M)	NRMHOSEDIAM	P36		0.006354
Equipment spillage NonRecMarine hose metal fraction	NRMHOSEMETALFRAC	P37		1
Equipment spillage hot soak (SOAKS/HR)	HOTSOAK	P38		0.25
Equipment spillage diurnal portable plastic	PORTABLEPLASTIC	P39		1
Equipment spillage E10 permeation adjustment nonmetal tank	E10ADJNONMETAL	P40		1.1
Equipment spillage E10 permeation adjustment NonRecMarine hose	E10ADJNRMHOSE	P41		1.82
Exhaust tech type 1 is 2-stroke	TT1STROKE	P42		0
Exhaust tech type 2 is 2-stroke	TT2STROKE	P43		0
Exhaust tech type 3 is 2-stroke	TT3STROKE	P44		0
Exhaust tech type 4 is 2-stroke	TT4STROKE	P45		0
Exhaust tech type 5 is 2-stroke	TT5STROKE	P46		0
Exhaust tech type 6 is 2-stroke	TT6STROKE	P47		0
Exhaust tech type 7 is 2-stroke	TT7STROKE	P48		0
Exhaust tech type 8 is 2-stroke	TT8STROKE	P49		0
Exhaust tech type 9 is 2-stroke	TT9STROKE	P50		0
Exhaust tech type 10 is 2-stroke	TT10STROKE	P51		0
Exhaust THC emission factor for tech type 1 (G/(HP*HR))	EXHTHCEF1	P52		5.01
Exhaust THC emission factor for tech type 2 (G/(HP*HR))	EXHTHCEF2	P53		1.003
Exhaust THC emission factor for tech type 3 (G/(HP*HR))	EXHTHCEF3	P54		0.27
Exhaust THC emission factor for tech type 4 (G/(HP*HR))	EXHTHCEF4	P55		0
Exhaust THC emission factor for tech type 5 (G/(HP*HR))	EXHTHCEF5	P56		0
Exhaust THC emission factor for tech type 6 (G/(HP*HR))	EXHTHCEF6	P57		0
Exhaust THC emission factor for tech type 7 (G/(HP*HR))	EXHTHCEF7	P58		0
Exhaust THC emission factor for tech type 8 (G/(HP*HR))	EXHTHCEF8	P59		0
Exhaust THC emission factor for tech type 9 (G/(HP*HR))	EXHTHCEF9	P60		0
Exhaust THC emission factor for tech type 10 (G/(HP*HR))	EXHTHCEF10	P61		0
Exhaust PM emission factor for tech type 1 (G/(HP*HR))	EXHPMEF1	P62		0.06
Exhaust PM emission factor for tech type 2 (G/(HP*HR))	EXHPMEF2	P63		0.06
Exhaust PM emission factor for tech type 3 (G/(HP*HR))	EXHPMEF3	P64		0.06
Exhaust PM emission factor for tech type 4 (G/(HP*HR))	EXHPMEF4	P65		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Exhaust PM emission factor for tech type 5 (G/(HP*HR))	EXHPMEF5	P66		0
Exhaust PM emission factor for tech type 6 (G/(HP*HR))	EXHPMEF6	P67		0
Exhaust PM emission factor for tech type 7 (G/(HP*HR))	EXHPMEF7	P68		0
Exhaust PM emission factor for tech type 8 (G/(HP*HR))	EXHPMEF8	P69		0
Exhaust PM emission factor for tech type 9 (G/(HP*HR))	EXHPMEF9	P70		0
Exhaust PM emission factor for tech type 10 (G/(HP*HR))	EXHPMEF10	P71		0
Exhaust NOX emission factor for tech type 1 (G/(HP*HR))	EXHNOXEF1	P72		8.43
Exhaust NOX emission factor for tech type 2 (G/(HP*HR))	EXHNOXEF2	P73		2.114
Exhaust NOX emission factor for tech type 3 (G/(HP*HR))	EXHNOXEF3	P74		0.69
Exhaust NOX emission factor for tech type 4 (G/(HP*HR))	EXHNOXEF4	P75		0
Exhaust NOX emission factor for tech type 5 (G/(HP*HR))	EXHNOXEF5	P76		0
Exhaust NOX emission factor for tech type 6 (G/(HP*HR))	EXHNOXEF6	P77		0
Exhaust NOX emission factor for tech type 7 (G/(HP*HR))	EXHNOXEF7	P78		0
Exhaust NOX emission factor for tech type 8 (G/(HP*HR))	EXHNOXEF8	P79		0
Exhaust NOX emission factor for tech type 9 (G/(HP*HR))	EXHNOXEF9	P80		0
Exhaust NOX emission factor for tech type 10 (G/(HP*HR))	EXHNOXEF10	P81		0
Exhaust CO emission factor for tech type 1 (G/(HP*HR))	EXHCOEF1	P82		155.5
Exhaust CO emission factor for tech type 2 (G/(HP*HR))	EXHCOEF2	P83		50.76
Exhaust CO emission factor for tech type 3 (G/(HP*HR))	EXHCOEF3	P84		11.94
Exhaust CO emission factor for tech type 4 (G/(HP*HR))	EXHCOEF4	P85		0
Exhaust CO emission factor for tech type 5 (G/(HP*HR))	EXHCOEF5	P86		0
Exhaust CO emission factor for tech type 6 (G/(HP*HR))	EXHCOEF6	P87		0
Exhaust CO emission factor for tech type 7 (G/(HP*HR))	EXHCOEF7	P88		0
Exhaust CO emission factor for tech type 8 (G/(HP*HR))	EXHCOEF8	P89		0
Exhaust CO emission factor for tech type 9 (G/(HP*HR))	EXHCOEF9	P90		0
Exhaust CO emission factor for tech type 10 (G/(HP*HR))	EXHCOEF10	P91		0
Crankcase THC emission multiplier 1	CRANKCASEMULT1	P92		0.33
Crankcase THC emission multiplier 2	CRANKCASEMULT2	P93		0
Crankcase THC emission multiplier 3	CRANKCASEMULT3	P94		0
Crankcase THC emission multiplier 4	CRANKCASEMULT4	P95		0
Crankcase THC emission multiplier 5	CRANKCASEMULT5	P96		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Crankcase THC emission multiplier 6	CRANKCASEMULT6	P97		0
Crankcase THC emission multiplier 7	CRANKCASEMULT7	P98		0
Crankcase THC emission multiplier 8	CRANKCASEMULT8	P99		0
Crankcase THC emission multiplier 9	CRANKCASEMULT9	P100		0
Crankcase THC emission multiplier 10	CRANKCASEMULT10	P101		0
Brake specific fuel consumption 1 (LB/(HP*HR))	BSFCEF1	P102		0.605
Brake specific fuel consumption 2 (LB/(HP*HR))	BSFCEF2	P103		0.484
Brake specific fuel consumption 3 (LB/(HP*HR))	BSFCEF3	P104		0.484
Brake specific fuel consumption 4 (LB/(HP*HR))	BSFCEF4	P105		0
Brake specific fuel consumption 5 (LB/(HP*HR))	BSFCEF5	P106		0
Brake specific fuel consumption 6 (LB/(HP*HR))	BSFCEF6	P107		0
Brake specific fuel consumption 7 (LB/(HP*HR))	BSFCEF7	P108		0
Brake specific fuel consumption 8 (LB/(HP*HR))	BSFCEF8	P109		0
Brake specific fuel consumption 9 (LB/(HP*HR))	BSFCEF9	P110		0
Brake specific fuel consumption 10 (LB/(HP*HR))	BSFCEF10	P111		0
THC deterioration coefficient A, tech type 1	THCDETA1	P112		0.26
THC deterioration coefficient A, tech type 2	THCDETA2	P113		0.64
THC deterioration coefficient A, tech type 3	THCDETA3	P114		0.64
THC deterioration coefficient A, tech type 4	THCDETA4	P115		0
THC deterioration coefficient A, tech type 5	THCDETA5	P116		0
THC deterioration coefficient A, tech type 6	THCDETA6	P117		0
THC deterioration coefficient A, tech type 7	THCDETA7	P118		0
THC deterioration coefficient A, tech type 8	THCDETA8	P119		0
THC deterioration coefficient A, tech type 9	THCDETA9	P120		0
THC deterioration coefficient A, tech type 10	THCDETA10	P121		0
THC deterioration coefficient b, tech type 1	THCDETB1	P122		1
THC deterioration coefficient b, tech type 2	THCDETB2	P123		1
THC deterioration coefficient b, tech type 3	THCDETB3	P124		1
THC deterioration coefficient b, tech type 4	THCDETB4	P125		0
THC deterioration coefficient b, tech type 5	THCDETB5	P126		0
THC deterioration coefficient b, tech type 6	THCDETB6	P127		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
THC deterioration coefficient b, tech type 7	THCDETB7	P128		0
THC deterioration coefficient b, tech type 8	THCDETB8	P129		0
THC deterioration coefficient b, tech type 9	THCDETB9	P130		0
THC deterioration coefficient b, tech type 10	THCDETB10	P131		0
THC deterioration cap, tech type 1 (MEDIAN LIFE)	THCDETCAP1	P132		1
THC deterioration cap, tech type 2 (MEDIAN LIFE)	THCDETCAP2	P133		1
THC deterioration cap, tech type 3 (MEDIAN LIFE)	THCDETCAP3	P134		1
THC deterioration cap, tech type 4 (MEDIAN LIFE)	THCDETCAP4	P135		0
THC deterioration cap, tech type 5 (MEDIAN LIFE)	THCDETCAP5	P136		0
THC deterioration cap, tech type 6 (MEDIAN LIFE)	THCDETCAP6	P137		0
THC deterioration cap, tech type 7 (MEDIAN LIFE)	THCDETCAP7	P138		0
THC deterioration cap, tech type 8 (MEDIAN LIFE)	THCDETCAP8	P139		0
THC deterioration cap, tech type 9 (MEDIAN LIFE)	THCDETCAP9	P140		0
THC deterioration cap, tech type 10 (MEDIAN LIFE)	THCDETCAP10	P141		0
PM deterioration coefficient A, tech type 1	PMDETA1	P142		0.26
PM deterioration coefficient A, tech type 2	PMDETA2	P143		0.26
PM deterioration coefficient A, tech type 3	PMDETA3	P144		0.26
PM deterioration coefficient A, tech type 4	PMDETA4	P145		0
PM deterioration coefficient A, tech type 5	PMDETA5	P146		0
PM deterioration coefficient A, tech type 6	PMDETA6	P147		0
PM deterioration coefficient A, tech type 7	PMDETA7	P148		0
PM deterioration coefficient A, tech type 8	PMDETA8	P149		0
PM deterioration coefficient A, tech type 9	PMDETA9	P150		0
PM deterioration coefficient A, tech type 10	PMDETA10	P151		0
PM deterioration coefficient b, tech type 1	PMDETB1	P152		1
PM deterioration coefficient b, tech type 2	PMDETB2	P153		1
PM deterioration coefficient b, tech type 3	PMDETB3	P154		1
PM deterioration coefficient b, tech type 4	PMDETB4	P155		0
PM deterioration coefficient b, tech type 5	PMDETB5	P156		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
PM deterioration coefficient b, tech type 6	PMDETB6	P157		0
PM deterioration coefficient b, tech type 7	PMDETB7	P158		0
PM deterioration coefficient b, tech type 8	PMDETB8	P159		0
PM deterioration coefficient b, tech type 9	PMDETB9	P160		0
PM deterioration coefficient b, tech type 10	PMDETB10	P161		0
PM deterioration cap, tech type 1 (MEDIAN LIFE)	PMDETCAP1	P162		1
PM deterioration cap, tech type 2 (MEDIAN LIFE)	PMDETCAP2	P163		1
PM deterioration cap, tech type 3 (MEDIAN LIFE)	PMDETCAP3	P164		1
PM deterioration cap, tech type 4 (MEDIAN LIFE)	PMDETCAP4	P165		0
PM deterioration cap, tech type 5 (MEDIAN LIFE)	PMDETCAP5	P166		0
PM deterioration cap, tech type 6 (MEDIAN LIFE)	PMDETCAP6	P167		0
PM deterioration cap, tech type 7 (MEDIAN LIFE)	PMDETCAP7	P168		0
PM deterioration cap, tech type 8 (MEDIAN LIFE)	PMDETCAP8	P169		0
PM deterioration cap, tech type 9 (MEDIAN LIFE)	PMDETCAP9	P170		0
PM deterioration cap, tech type 10 (MEDIAN LIFE)	PMDETCAP10	P171		0
NOX deterioration coefficient A, tech type 1	NOXDETA1	P172		0.03
NOX deterioration coefficient A, tech type 2	NOXDETA2	P173		0.15
NOX deterioration coefficient A, tech type 3	NOXDETA3	P174		0.15
NOX deterioration coefficient A, tech type 4	NOXDETA4	P175		0
NOX deterioration coefficient A, tech type 5	NOXDETA5	P176		0
NOX deterioration coefficient A, tech type 6	NOXDETA6	P177		0
NOX deterioration coefficient A, tech type 7	NOXDETA7	P178		0
NOX deterioration coefficient A, tech type 8	NOXDETA8	P179		0
NOX deterioration coefficient A, tech type 9	NOXDETA9	P180		0
NOX deterioration coefficient A, tech type 10	NOXDETA10	P181		0
NOX deterioration coefficient b, tech type 1	NOXDETB1	P182		1
NOX deterioration coefficient b, tech type 2	NOXDETB2	P183		1
NOX deterioration coefficient b, tech type 3	NOXDETB3	P184		1
NOX deterioration coefficient b, tech type 4	NOXDETB4	P185		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
NOX deterioration coefficient b, tech type 5	NOXDETB5	P186		0
NOX deterioration coefficient b, tech type 6	NOXDETB6	P187		0
NOX deterioration coefficient b, tech type 7	NOXDETB7	P188		0
NOX deterioration coefficient b, tech type 8	NOXDETB8	P189		0
NOX deterioration coefficient b, tech type 9	NOXDETB9	P190		0
NOX deterioration coefficient b, tech type 10	NOXDETB10	P191		0
NOX deterioration cap, tech type 1 (MEDIAN LIFE)	NOXDETCAP1	P192		1
NOX deterioration cap, tech type 2 (MEDIAN LIFE)	NOXDETCAP2	P193		1
NOX deterioration cap, tech type 3 (MEDIAN LIFE)	NOXDETCAP3	P194		1
NOX deterioration cap, tech type 4 (MEDIAN LIFE)	NOXDETCAP4	P195		0
NOX deterioration cap, tech type 5 (MEDIAN LIFE)	NOXDETCAP5	P196		0
NOX deterioration cap, tech type 6 (MEDIAN LIFE)	NOXDETCAP6	P197		0
NOX deterioration cap, tech type 7 (MEDIAN LIFE)	NOXDETCAP7	P198		0
NOX deterioration cap, tech type 8 (MEDIAN LIFE)	NOXDETCAP8	P199		0
NOX deterioration cap, tech type 9 (MEDIAN LIFE)	NOXDETCAP9	P200		0
NOX deterioration cap, tech type 10 (MEDIAN LIFE)	NOXDETCAP10	P201		0
CO deterioration coefficient A, tech type 1	CODETA1	P202		0.35
CO deterioration coefficient A, tech type 2	CODETA2	P203		0.36
CO deterioration coefficient A, tech type 3	CODETA3	P204		0.36
CO deterioration coefficient A, tech type 4	CODETA4	P205		0
CO deterioration coefficient A, tech type 5	CODETA5	P206		0
CO deterioration coefficient A, tech type 6	CODETA6	P207		0
CO deterioration coefficient A, tech type 7	CODETA7	P208		0
CO deterioration coefficient A, tech type 8	CODETA8	P209		0
CO deterioration coefficient A, tech type 9	CODETA9	P210		0
CO deterioration coefficient A, tech type 10	CODETA10	P211		0
CO deterioration coefficient b, tech type 1	CODETB1	P212		1
CO deterioration coefficient b, tech type 2	CODETB2	P213		1
CO deterioration coefficient b, tech type 3	CODETB3	P214		1

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
CO deterioration coefficient b, tech type 4	CODETB4	P215		0
CO deterioration coefficient b, tech type 5	CODETB5	P216		0
CO deterioration coefficient b, tech type 6	CODETB6	P217		0
CO deterioration coefficient b, tech type 7	CODETB7	P218		0
CO deterioration coefficient b, tech type 8	CODETB8	P219		0
CO deterioration coefficient b, tech type 9	CODETB9	P220		0
CO deterioration coefficient b, tech type 10	CODETB10	P221		0
CO deterioration cap, tech type 1 (MEDIAN LIFE)	CODETCAP1	P222		1
CO deterioration cap, tech type 2 (MEDIAN LIFE)	CODETCAP2	P223		1
CO deterioration cap, tech type 3 (MEDIAN LIFE)	CODETCAP3	P224		1
CO deterioration cap, tech type 4 (MEDIAN LIFE)	CODETCAP4	P225		0
CO deterioration cap, tech type 5 (MEDIAN LIFE)	CODETCAP5	P226		0
CO deterioration cap, tech type 6 (MEDIAN LIFE)	CODETCAP6	P227		0
CO deterioration cap, tech type 7 (MEDIAN LIFE)	CODETCAP7	P228		0
CO deterioration cap, tech type 8 (MEDIAN LIFE)	CODETCAP8	P229		0
CO deterioration cap, tech type 9 (MEDIAN LIFE)	CODETCAP9	P230		0
CO deterioration cap, tech type 10 (MEDIAN LIFE)	CODETCAP10	P231		0
Sulfur PM to fuel sulfur ratio 1 (soxcnv)	SOXCNV1	P232		0.03
Sulfur PM to fuel sulfur ratio 2 (soxcnv)	SOXCNV2	P233		0.03
Sulfur PM to fuel sulfur ratio 3 (soxcnv)	SOXCNV3	P234		0.03
Sulfur PM to fuel sulfur ratio 4 (soxcnv)	SOXCNV4	P235		0.03
Sulfur PM to fuel sulfur ratio 5 (soxcnv)	SOXCNV5	P236		0.03
Sulfur PM to fuel sulfur ratio 6 (soxcnv)	SOXCNV6	P237		0.03
Sulfur PM to fuel sulfur ratio 7 (soxcnv)	SOXCNV7	P238		0.03
Sulfur PM to fuel sulfur ratio 8 (soxcnv)	SOXCNV8	P239		0.03
Sulfur PM to fuel sulfur ratio 9 (soxcnv)	SOXCNV9	P240		0.03
Sulfur PM to fuel sulfur ratio 10 (soxcnv)	SOXCNV10	P241		0.03
Exhaust tech type 1 fraction (with variability)	EXHTT1FRACTIONv	P242u		1
Exhaust tech type 2 fraction (with variability)	EXHTT2FRACTIONv	P243u		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Exhaust tech type 3 fraction (with variability)	EXHTT3FRACTIONv	P244u		0
Exhaust tech type 4 fraction (with variability)	EXHTT4FRACTIONv	P245u		0
Exhaust tech type 5 fraction (with variability)	EXHTT5FRACTIONv	P246u		0
Exhaust tech type 6 fraction (with variability)	EXHTT6FRACTIONv	P247u		0
Exhaust tech type 7 fraction (with variability)	EXHTT7FRACTIONv	P248u		0
Exhaust tech type 8 fraction (with variability)	EXHTT8FRACTIONv	P249u		0
Exhaust tech type 9 fraction (with variability)	EXHTT9FRACTIONv	P250u		0
Exhaust tech type 10 fraction (with variability)	EXHTT10FRACTIONv	P251u		0
Exhaust tech type 1 fraction	EXHTT1FRACTION	P242	P242u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	1
Exhaust tech type 2 fraction	EXHTT2FRACTION	P243	P243u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 3 fraction	EXHTT3FRACTION	P244	P244u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 4 fraction	EXHTT4FRACTION	P245	P245u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 5 fraction	EXHTT5FRACTION	P246	P246u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 6 fraction	EXHTT6FRACTION	P247	P247u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 7 fraction	EXHTT7FRACTION	P248	P248u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 8 fraction	EXHTT8FRACTION	P249	P249u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 9 fraction	EXHTT9FRACTION	P250	P250u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Exhaust tech type 10 fraction	EXHTT10FRACTION	P251	P251u/(P242u+P243u+P244u+P245u+P246u+P247u+P248u+P249u+P250u+P251u)	0
Evap tech type 2 tank control technology is 0	EVAPTANK2	P252		1
Evap tech type 3 tank control technology is 0	EVAPTANK3	P253		1
Evap tech type 4 tank control technology is 0	EVAPTANK4	P254		1
Evap tech type 5 tank control technology is 0	EVAPTANK5	P255		1
Evap tech type 2 hose control technology is 0	EVAPHOSE2	P256		1
Evap tech type 3 hose control technology is 0	EVAPHOSE3	P257		1
Evap tech type 4 hose control technology is 0	EVAPHOSE4	P258		1
Evap tech type 5 hose control technology is 0	EVAPHOSE5	P259		1
Tank evaporation emission factor, tech type 1 (G/(M^2*DAY))	TANKEF1	P260		0
Tank evaporation emission factor, tech type 2 (G/(M^2*DAY))	TANKEF2	P261		0
Tank evaporation emission factor, tech type 3 (G/(M^2*DAY))	TANKEF3	P262		0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Tank evaporation emission factor, tech type 4 (G/(M^2*DAY))	TANKEF4	P263		0
Tank evaporation emission factor, tech type 5 (G/(M^2*DAY))	TANKEF5	P264		0
Running loss evaporation emission factor, tech type 1 (G/HR)	RUNLOSSEF1	P265		2.41
Running loss evaporation emission factor, tech type 2 (G/HR)	RUNLOSSEF2	P266		2.41
Running loss evaporation emission factor, tech type 3 (G/HR)	RUNLOSSEF3	P267		0.241
Running loss evaporation emission factor, tech type 4 (G/HR)	RUNLOSSEF4	P268		0
Running loss evaporation emission factor, tech type 5 (G/HR)	RUNLOSSEF5	P269		0
Hot soak evaporation emission factor, tech type 1 (G/START)	HOTSOAKEF1	P270		4.34
Hot soak evaporation emission factor, tech type 2 (G/START)	HOTSOAKEF2	P271		0.43
Hot soak evaporation emission factor, tech type 3 (G/START)	HOTSOAKEF3	P272		0.43
Hot soak evaporation emission factor, tech type 4 (G/START)	HOTSOAKEF4	P273		0
Hot soak evaporation emission factor, tech type 5 (G/START)	HOTSOAKEF5	P274		0
Hose evaporation emission factor, tech type 1 (G/(M^2*DAY))	HOSEEF1	P275		0
Hose evaporation emission factor, tech type 2 (G/(M^2*DAY))	HOSEEF2	P276		0
Hose evaporation emission factor, tech type 3 (G/(M^2*DAY))	HOSEEF3	P277		0
Hose evaporation emission factor, tech type 4 (G/(M^2*DAY))	HOSEEF4	P278		0
Hose evaporation emission factor, tech type 5 (G/(M^2*DAY))	HOSEEF5	P279		0
Diurnal evaporation emission factor, tech type 1	DIURNALEF1	P280		1.46
Diurnal evaporation emission factor, tech type 2	DIURNALEF2	P281		1.46
Diurnal evaporation emission factor, tech type 3	DIURNALEF3	P282		0.1
Diurnal evaporation emission factor, tech type 4	DIURNALEF4	P283		0
Diurnal evaporation emission factor, tech type 5	DIURNALEF5	P284		0
Evap tech type 1 fraction (with uncertainty)	EVPTT1FRACTIONu	P285u		1
Evap tech type 2 fraction (with uncertainty)	EVPTT2FRACTIONu	P286u		0
Evap tech type 3 fraction (with uncertainty)	EVPTT3FRACTIONu	P287u		0
Evap tech type 4 fraction (with uncertainty)	EVPTT4FRACTIONu	P288u		0
Evap tech type 5 fraction (with uncertainty)	EVPTT5FRACTIONu	P289u		0
Evap tech type 1 fraction	EVPTT1FRACTION	P285	P285u/(P285u+P286u+P287u+P288u+P289u)	1
Evap tech type 2 fraction	EVPTT2FRACTION	P286	P286u/(P285u+P286u+P287u+P288u+P289u)	0
Evap tech type 3 fraction	EVPTT3FRACTION	P287	P287u/(P285u+P286u+P287u+P288u+P289u)	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Evap tech type 4 fraction	EVPTT4FRACTION	P288	P288u/(P285u+P286u+P287u+P288u+P289u)	0
Evap tech type 5 fraction	EVPTT5FRACTION	P289	P289u/(P285u+P286u+P287u+P288u+P289u)	0
Exhaust THC emission factor sample size	EXHTHCEFSS	P290		30
Exhaust THC emission factor RSE	EXHTHCEFRSE	P291		0.250565
Exhaust PM emission factor sample size	EXHPMEFSS	P292		30
Exhaust PM emission factor RSE	EXHPMEFRSE	P293		0.22276
Exhaust NOX emission factor sample size	EXHNOXEFSS	P294		30
Exhaust NOX emission factor RSE	EXHNOXEFRSE	P295		0.063583
Exhaust CO emission factor sample size	EXHCOEFSS	P296		30
Exhaust CO emission factor RSE	EXHCOEFRSE	P297		0.137442
Ethanol volume fraction in gasoline	ETOHVOLFRAC	P298	P6*P7	0.068298
Ethanol mass fraction in gasoline	ETOHMASSFRAC	P299	P298*2988/P12	0.072917
THC deterioration factor 1	THCDF1	P300	IF(P132=0,0,IF(P24*(P2+1-P1)*P25/P23<=P132,1+P112*(P24*(P2+1-P1)*P25/P23)^P122,1+P112*(P132)^P122))	1.208
THC deterioration factor 2	THCDF2	P301	IF(P133=0,0,IF(P24*(P2+1-P1)*P25/P23<=P133,1+P113*(P24*(P2+1-P1)*P25/P23)^P123,1+P113*(P133)^P123))	1.512
THC deterioration factor 3	THCDF3	P302	IF(P134=0,0,IF(P24*(P2+1-P1)*P25/P23<=P134,1+P114*(P24*(P2+1-P1)*P25/P23)^P124,1+P114*(P134)^P124))	1.512
THC deterioration factor 4	THCDF4	P303	IF(P135=0,0,IF(P24*(P2+1-P1)*P25/P23<=P135,1+P115*(P24*(P2+1-P1)*P25/P23)^P125,1+P115*(P135)^P125))	0
THC deterioration factor 5	THCDF5	P304	IF(P136=0,0,IF(P24*(P2+1-P1)*P25/P23<=P136,1+P116*(P24*(P2+1-P1)*P25/P23)^P126,1+P116*(P136)^P126))	0
THC deterioration factor 6	THCDF6	P305	IF(P137=0,0,IF(P24*(P2+1-P1)*P25/P23<=P137,1+P117*(P24*(P2+1-P1)*P25/P23)^P127,1+P117*(P137)^P127))	0
THC deterioration factor 7	THCDF7	P306	IF(P138=0,0,IF(P24*(P2+1-P1)*P25/P23<=P138,1+P118*(P24*(P2+1-P1)*P25/P23)^P128,1+P118*(P138)^P128))	0
THC deterioration factor 8	THCDF8	P307	IF(P139=0,0,IF(P24*(P2+1-P1)*P25/P23<=P139,1+P119*(P24*(P2+1-P1)*P25/P23)^P129,1+P119*(P139)^P129))	0
THC deterioration factor 9	THCDF9	P308	IF(P140=0,0,IF(P24*(P2+1-P1)*P25/P23<=P140,1+P120*(P24*(P2+1-P1)*P25/P23)^P130,1+P120*(P140)^P130))	0
THC deterioration factor 10	THCDF10	P309	IF(P141=0,0,IF(P24*(P2+1-P1)*P25/P23<=P141,1+P121*(P24*(P2+1-P1)*P25/P23)^P131,1+P121*(P141)^P131))	0
PM deterioration factor 1	PMDF1	P310	IF(P162=0,0,IF(P24*(P2+1-P1)*P25/P23<=P162,1+P142*(P24*(P2+1-P1)*P25/P23)^P152,1+P142*(P162)^P152))	1.208
PM deterioration factor 2	PMDF2	P311	IF(P163=0,0,IF(P24*(P2+1-P1)*P25/P23<=P163,1+P143*(P24*(P2+1-P1)*P25/P23)^P153,1+P143*(P163)^P153))	1.208
PM deterioration factor 3	PMDF3	P312	IF(P164=0,0,IF(P24*(P2+1-P1)*P25/P23<=P164,1+P144*(P24*(P2+1-P1)*P25/P23)^P154,1+P144*(P164)^P154))	1.208

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
PM deterioration factor 4	PMDF4	P313	IF(P165=0,0,IF(P24*(P2+1-P1)*P25/P23<=P165,1+P145*(P24*(P2+1-P1)*P25/P23)^P155,1+P145*(P165)^P155))	0
PM deterioration factor 5	PMDF5	P314	IF(P166=0,0,IF(P24*(P2+1-P1)*P25/P23<=P166,1+P146*(P24*(P2+1-P1)*P25/P23)^P156,1+P146*(P166)^P156))	0
PM deterioration factor 6	PMDF6	P315	IF(P167=0,0,IF(P24*(P2+1-P1)*P25/P23<=P167,1+P147*(P24*(P2+1-P1)*P25/P23)^P157,1+P147*(P167)^P157))	0
PM deterioration factor 7	PMDF7	P316	IF(P168=0,0,IF(P24*(P2+1-P1)*P25/P23<=P168,1+P148*(P24*(P2+1-P1)*P25/P23)^P158,1+P148*(P168)^P158))	0
PM deterioration factor 8	PMDF8	P317	IF(P169=0,0,IF(P24*(P2+1-P1)*P25/P23<=P169,1+P149*(P24*(P2+1-P1)*P25/P23)^P159,1+P149*(P169)^P159))	0
PM deterioration factor 9	PMDF9	P318	IF(P170=0,0,IF(P24*(P2+1-P1)*P25/P23<=P170,1+P150*(P24*(P2+1-P1)*P25/P23)^P160,1+P150*(P170)^P160))	0
PM deterioration factor 10	PMDF10	P319	IF(P171=0,0,IF(P24*(P2+1-P1)*P25/P23<=P171,1+P151*(P24*(P2+1-P1)*P25/P23)^P161,1+P151*(P171)^P161))	0
NOX deterioration factor 1	NOXDF1	P320	IF(P192=0,0,IF(P24*(P2+1-P1)*P25/P23<=P192,1+P172*(P24*(P2+1-P1)*P25/P23)^P182,1+P172*(P192)^P182))	1.024
NOX deterioration factor 2	NOXDF2	P321	IF(P193=0,0,IF(P24*(P2+1-P1)*P25/P23<=P193,1+P173*(P24*(P2+1-P1)*P25/P23)^P183,1+P173*(P193)^P183))	1.12
NOX deterioration factor 3	NOXDF3	P322	IF(P194=0,0,IF(P24*(P2+1-P1)*P25/P23<=P194,1+P174*(P24*(P2+1-P1)*P25/P23)^P184,1+P174*(P194)^P184))	1.12
NOX deterioration factor 4	NOXDF4	P323	IF(P195=0,0,IF(P24*(P2+1-P1)*P25/P23<=P195,1+P175*(P24*(P2+1-P1)*P25/P23)^P185,1+P175*(P195)^P185))	0
NOX deterioration factor 5	NOXDF5	P324	IF(P196=0,0,IF(P24*(P2+1-P1)*P25/P23<=P196,1+P176*(P24*(P2+1-P1)*P25/P23)^P186,1+P176*(P196)^P186))	0
NOX deterioration factor 6	NOXDF6	P325	IF(P197=0,0,IF(P24*(P2+1-P1)*P25/P23<=P197,1+P177*(P24*(P2+1-P1)*P25/P23)^P187,1+P177*(P197)^P187))	0
NOX deterioration factor 7	NOXDF7	P326	IF(P198=0,0,IF(P24*(P2+1-P1)*P25/P23<=P198,1+P178*(P24*(P2+1-P1)*P25/P23)^P188,1+P178*(P198)^P188))	0
NOX deterioration factor 8	NOXDF8	P327	IF(P199=0,0,IF(P24*(P2+1-P1)*P25/P23<=P199,1+P179*(P24*(P2+1-P1)*P25/P23)^P189,1+P179*(P199)^P189))	0
NOX deterioration factor 9	NOXDF9	P328	IF(P200=0,0,IF(P24*(P2+1-P1)*P25/P23<=P200,1+P180*(P24*(P2+1-P1)*P25/P23)^P190,1+P180*(P200)^P190))	0
NOX deterioration factor 10	NOXDF10	P329	IF(P201=0,0,IF(P24*(P2+1-P1)*P25/P23<=P201,1+P181*(P24*(P2+1-P1)*P25/P23)^P191,1+P181*(P201)^P191))	0
CO deterioration factor 1	CODF1	P330	IF(P222=0,0,IF(P24*(P2+1-P1)*P25/P23<=P222,1+P202*(P24*(P2+1-P1)*P25/P23)^P212,1+P202*P222^P212))	1.28
CO deterioration factor 2	CODF2	P331	IF(P223=0,0,IF(P24*(P2+1-P1)*P25/P23<=P223,1+P203*(P24*(P2+1-P1)*P25/P23)^P213,1+P203*P223^P213))	1.288
CO deterioration factor 3	CODF3	P332	IF(P224=0,0,IF(P24*(P2+1-P1)*P25/P23<=P224,1+P204*(P24*(P2+1-P1)*P25/P23)^P214,1+P204*P224^P214))	1.288

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
CO deterioration factor 4	CODF4	P333	IF(P225=0,0,IF(P24*(P2+1-P1)*P25/P23<=P225,1+P205*(P24*(P2+1-P1)*P25/P23)^P215,1+P205*P225^P215))	0
CO deterioration factor 5	CODF5	P334	IF(P226=0,0,IF(P24*(P2+1-P1)*P25/P23<=P226,1+P206*(P24*(P2+1-P1)*P25/P23)^P216,1+P206*P226^P216))	0
CO deterioration factor 6	CODF6	P335	IF(P227=0,0,IF(P24*(P2+1-P1)*P25/P23<=P227,1+P207*(P24*(P2+1-P1)*P25/P23)^P217,1+P207*P227^P217))	0
CO deterioration factor 7	CODF7	P336	IF(P228=0,0,IF(P24*(P2+1-P1)*P25/P23<=P228,1+P208*(P24*(P2+1-P1)*P25/P23)^P218,1+P208*P228^P218))	0
CO deterioration factor 8	CODF8	P337	IF(P229=0,0,IF(P24*(P2+1-P1)*P25/P23<=P229,1+P209*(P24*(P2+1-P1)*P25/P23)^P219,1+P209*P229^P219))	0
CO deterioration factor 9	CODF9	P338	IF(P230=0,0,IF(P24*(P2+1-P1)*P25/P23<=P230,1+P210*(P24*(P2+1-P1)*P25/P23)^P220,1+P210*P230^P220))	0
CO deterioration factor 10	CODF10	P339	IF(P231=0,0,IF(P24*(P2+1-P1)*P25/P23<=P231,1+P211*(P24*(P2+1-P1)*P25/P23)^P221,1+P211*P231^P221))	0
Four stroke multiplicative THC temperature correction factor	4STRTHCMTCF	P340	IF(P5<75,EXP(-0.0024*(P5-75)),EXP(0.00132*(P5-75)))	1.016942
Exhaust THC adjusted emission factor 1 (G/(HP*HR))	EXTHCADJUSTED1	P341	IF(AND(P20=1,P42=0),P340*P52*P300,P52*P300)	6.154614
Exhaust THC adjusted emission factor 2 (G/(HP*HR))	EXTHCADJUSTED2	P342	IF(AND(P20=1,P43=0),P340*P53*P301,P53*P301)	1.542229
Exhaust THC adjusted emission factor 3 (G/(HP*HR))	EXTHCADJUSTED3	P343	IF(AND(P20=1,P44=0),P340*P54*P302,P54*P302)	0.415156
Exhaust THC adjusted emission factor 4 (G/(HP*HR))	EXTHCADJUSTED4	P344	IF(AND(P20=1,P45=0),P340*P55*P303,P55*P303)	0
Exhaust THC adjusted emission factor 5 (G/(HP*HR))	EXTHCADJUSTED5	P345	IF(AND(P20=1,P46=0),P340*P56*P304,P56*P304)	0
Exhaust THC adjusted emission factor 6 (G/(HP*HR))	EXTHCADJUSTED6	P346	IF(AND(P20=1,P47=0),P340*P57*P305,P57*P305)	0
Exhaust THC adjusted emission factor 7 (G/(HP*HR))	EXTHCADJUSTED7	P347	IF(AND(P20=1,P48=0),P340*P58*P306,P58*P306)	0
Exhaust THC adjusted emission factor 8 (G/(HP*HR))	EXTHCADJUSTED8	P348	IF(AND(P20=1,P49=0),P340*P59*P307,P59*P307)	0
Exhaust THC adjusted emission factor 9 (G/(HP*HR))	EXTHCADJUSTED9	P349	IF(AND(P20=1,P50=0),P340*P60*P308,P60*P308)	0
Exhaust THC adjusted emission factor 10 (G/(HP*HR))	EXTHCADJUSTED10	P350	IF(AND(P20=1,P51=0),P340*P61*P309,P61*P309)	0
Total exhaust HC emissions (G/MJ)	EXHAUSTTHCG	P351	(P341*P242+P342*P243+P343*P244+P344*P245+P345*P246+P346*P247+P347*P248+P348*P249+P349*P250+P350*P251)*((1+P28*P298*35)*1341/3600)	2.045983
Four stroke multiplicative NOX temperature correction factor	4STRNOXMTCF	P352	IF(P5<75,EXP(-0.00892*(P5-75)),EXP(-0.00873*(P5-75)))	1.064431
Exhaust NOX adjusted emission factor 1 (G/(HP*HR))	EXNOXADJUSTED1	P353	IF(AND(P20=1,P42=0),P352*P72*P320,P72*P320)	9.188505
Exhaust NOX adjusted emission factor 2 (G/(HP*HR))	EXNOXADJUSTED2	P354	IF(AND(P20=1,P43=0),P352*P73*P321,P73*P321)	2.520231
Exhaust NOX adjusted emission factor 3 (G/(HP*HR))	EXNOXADJUSTED3	P355	IF(AND(P20=1,P44=0),P352*P74*P322,P74*P322)	0.822592
Exhaust NOX adjusted emission factor 4 (G/(HP*HR))	EXNOXADJUSTED4	P356	IF(AND(P20=1,P45=0),P352*P75*P323,P75*P323)	0
Exhaust NOX adjusted emission factor 5 (G/(HP*HR))	EXNOXADJUSTED5	P357	IF(AND(P20=1,P46=0),P352*P76*P324,P76*P324)	0
Exhaust NOX adjusted emission factor 6 (G/(HP*HR))	EXNOXADJUSTED6	P358	IF(AND(P20=1,P47=0),P352*P77*P325,P77*P325)	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Exhaust NOX adjusted emission factor 7 (G/(HP*HR))	EXNOXADJUSTED7	P359	IF(AND(P20=1,P48=0),P352*P78*P326,P78*P326)	0
Exhaust NOX adjusted emission factor 8 (G/(HP*HR))	EXNOXADJUSTED8	P360	IF(AND(P20=1,P49=0),P352*P79*P327,P79*P327)	0
Exhaust NOX adjusted emission factor 9 (G/(HP*HR))	EXNOXADJUSTED9	P361	IF(AND(P20=1,P50=0),P352*P80*P328,P80*P328)	0
Exhaust NOX adjusted emission factor 10 (G/(HP*HR))	EXNOXADJUSTED10	P362	IF(AND(P20=1,P51=0),P352*P81*P329,P81*P329)	0
Total exhaust NOX emissions (G/MJ)	EXHAUSTNOX	P363	(P353*P242+P354*P243+P355*P244+P356*P245+P357*P246+P358*P247+P359*P248+P360*P249+P361*P250+P362*P251)*((1+P29*P298*35)*1341/3600)	4.363615
Four stroke multiplicative CO temperature correction factor	4STRCOMTCF	P364	IF(P5<75,EXP(0.00158*(P5-75)),EXP(0.00375*(P5-75)))	0.989001
Exhaust CO adjusted emission factor 1 (G/(HP*HR))	EXCOADJUSTED1	P365	IF(AND(P20=1,P42=0),P364*P82*P330,P82*P330)	196.8507
Exhaust CO adjusted emission factor 2 (G/(HP*HR))	EXCOADJUSTED2	P366	IF(AND(P20=1,P43=0),P364*P83*P331,P83*P331)	64.65977
Exhaust CO adjusted emission factor 3 (G/(HP*HR))	EXCOADJUSTED3	P367	IF(AND(P20=1,P44=0),P364*P84*P332,P84*P332)	15.20957
Exhaust CO adjusted emission factor 4 (G/(HP*HR))	EXCOADJUSTED4	P368	IF(AND(P20=1,P45=0),P364*P85*P333,P85*P333)	0
Exhaust CO adjusted emission factor 5 (G/(HP*HR))	EXCOADJUSTED5	P369	IF(AND(P20=1,P46=0),P364*P86*P334,P86*P334)	0
Exhaust CO adjusted emission factor 6 (G/(HP*HR))	EXCOADJUSTED6	P370	IF(AND(P20=1,P47=0),P364*P87*P335,P87*P335)	0
Exhaust CO adjusted emission factor 7 (G/(HP*HR))	EXCOADJUSTED7	P371	IF(AND(P20=1,P48=0),P364*P88*P336,P88*P336)	0
Exhaust CO adjusted emission factor 8 (G/(HP*HR))	EXCOADJUSTED8	P372	IF(AND(P20=1,P49=0),P364*P89*P337,P89*P337)	0
Exhaust CO adjusted emission factor 9 (G/(HP*HR))	EXCOADJUSTED9	P373	IF(AND(P20=1,P50=0),P364*P90*P338,P90*P338)	0
Exhaust CO adjusted emission factor 10 (G/(HP*HR))	EXCOADJUSTED10	P374	IF(AND(P20=1,P51=0),P364*P91*P339,P91*P339)	0
Total exhaust CO emissions (G/MJ)	EXHAUSTCO	P375	(P365*P242+P366*P243+P367*P244+P368*P245+P369*P246+P370*P247+P371*P248+P372*P249+P373*P250+P374*P251)*((1+P30*P298*35)*1341/3600)	62.45944
Sulfur PM adjustment factor 1	SULFURPMADJUSTMENT1	P376	IF(P19=1,P102*453.6*7*P232*0.01*(P9-P8),0)	0
Sulfur PM adjustment factor 2	SULFURPMADJUSTMENT2	P377	IF(P19=1,P103*453.6*7*P233*0.01*(P9-P8),0)	0
Sulfur PM adjustment factor 3	SULFURPMADJUSTMENT3	P378	IF(P19=1,P104*453.6*7*P234*0.01*(P9-P8),0)	0
Sulfur PM adjustment factor 4	SULFURPMADJUSTMENT4	P379	IF(P19=1,P105*453.6*7*P235*0.01*(0.035-P8),0)	0
Sulfur PM adjustment factor 5	SULFURPMADJUSTMENT5	P380	IF(P19=1,P106*453.6*7*P236*0.01*(0.2-P8),0)	0
Sulfur PM adjustment factor 6	SULFURPMADJUSTMENT6	P381	IF(P19=1,P107*453.6*7*P237*0.01*(0.05-P8),0)	0
Sulfur PM adjustment factor 7	SULFURPMADJUSTMENT7	P382	IF(P19=1,P108*453.6*7*P238*0.01*(0.05-P8),0)	0
Sulfur PM adjustment factor 8	SULFURPMADJUSTMENT8	P383	IF(P19=1,P109*453.6*7*P239*0.01*(0.0015-P8),0)	0
Sulfur PM adjustment factor 9	SULFURPMADJUSTMENT9	P384	IF(P19=1,P110*453.6*7*P240*0.01*(0.0015-P8),0)	0
Sulfur PM adjustment factor 10	SULFURPMADJUSTMENT10	P385	IF(P19=1,P111*453.6*7*P241*0.01*(0.0015-P8),0)	0
Exhaust PM adjusted emission factor 1 (G/(HP*HR))	EXPMADJUSTED1	P386	MAX(0,P62*P310-P376)	0.07248

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Exhaust PM adjusted emission factor 2 (G/(HP*HR))	EXPMADJUSTED2	P387	MAX(0,P63*P311-P377)	0.07248
Exhaust PM adjusted emission factor 3 (G/(HP*HR))	EXPMADJUSTED3	P388	MAX(0,P64*P312-P378)	0.07248
Exhaust PM adjusted emission factor 4 (G/(HP*HR))	EXPMADJUSTED4	P389	MAX(0,P65*P313-P379)	0
Exhaust PM adjusted emission factor 5 (G/(HP*HR))	EXPMADJUSTED5	P390	MAX(0,P66*P314-P380)	0
Exhaust PM adjusted emission factor 6 (G/(HP*HR))	EXPMADJUSTED6	P391	MAX(0,P67*P315-P381)	0
Exhaust PM adjusted emission factor 7 (G/(HP*HR))	EXPMADJUSTED7	P392	MAX(0,P68*P316-P382)	0
Exhaust PM adjusted emission factor 8 (G/(HP*HR))	EXPMADJUSTED8	P393	MAX(0,P69*P317-P383)	0
Exhaust PM adjusted emission factor 9 (G/(HP*HR))	EXPMADJUSTED9	P394	MAX(0,P70*P318-P384)	0
Exhaust PM adjusted emission factor 10 (G/(HP*HR))	EXPMADJUSTED10	P395	MAX(0,P71*P319-P385)	0
Total exhaust PM (G/MJ)	EXHAUSTPM	P396	(P386*P242+P387*P243+P388*P244+P389*P245+P390*P246+P391*P247+P392*P248+P393*P249+P394*P250+P395*P251)*(1341/3600)	0.026999
Exhaust SO2 emission factor 1 (G/(HP*HR))	EXSO2FAC1	P397	MAX(IF(P19=1,(P102*453.6*(1-P232)-P341)*0.01*P8*2,(P102*453.6*(1-P232)-P341)*0.01*P9*2),0)	0.176307
Exhaust SO2 emission factor 2 (G/(HP*HR))	EXSO2FAC2	P398	MAX(IF(P19=1,(P103*453.6*(1-P233)-P342)*0.01*P8*2,(P103*453.6*(1-P233)-P342)*0.01*P9*2),0)	0.143339
Exhaust SO2 emission factor 3 (G/(HP*HR))	EXSO2FAC3	P399	MAX(IF(P19=1,(P104*453.6*(1-P234)-P343)*0.01*P8*2,(P104*453.6*(1-P234)-P343)*0.01*P9*2),0)	0.144103
Exhaust SO2 emission factor 4 (G/(HP*HR))	EXSO2FAC4	P400	MAX(IF(P19=1,(P105*453.6*(1-P235)-P344)*0.01*P8*2,(P105*453.6*(1-P235)-P344)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 5 (G/(HP*HR))	EXSO2FAC5	P401	MAX(IF(P19=1,(P106*453.6*(1-P236)-P345)*0.01*P8*2,(P106*453.6*(1-P236)-P345)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 6 (G/(HP*HR))	EXSO2FAC6	P402	MAX(IF(P19=1,(P107*453.6*(1-P237)-P346)*0.01*P8*2,(P107*453.6*(1-P237)-P346)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 7 (G/(HP*HR))	EXSO2FAC7	P403	MAX(IF(P19=1,(P108*453.6*(1-P238)-P347)*0.01*P8*2,(P108*453.6*(1-P238)-P347)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 8 (G/(HP*HR))	EXSO2FAC8	P404	MAX(IF(P19=1,(P109*453.6*(1-P239)-P348)*0.01*P8*2,(P109*453.6*(1-P239)-P348)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 9 (G/(HP*HR))	EXSO2FAC9	P405	MAX(IF(P19=1,(P110*453.6*(1-P240)-P349)*0.01*P8*2,(P110*453.6*(1-P240)-P349)*0.01*P9*2),0)	0
Exhaust SO2 emission factor 10 (G/(HP*HR))	EXSO2FAC10	P406	MAX(IF(P19=1,(P111*453.6*(1-P241)-P350)*0.01*P8*2,(P111*453.6*(1-P241)-P350)*0.01*P9*2),0)	0
Total exhaust SO2 emissions (G/MJ)	EXHAUSTSULFUR	P407	(P397*P242+P398*P243+P399*P244+P400*P245+P401*P246+P402*P247+P403*P248+P404*P249+P405*P250+P406*P251)*(1341/3600)	0.065675
Crankcase THC emission factor 1 (G/(HP*HR))	CRANKTHCFAC1	P408	P92*P341/P340	1.997186
Crankcase THC emission factor 2 (G/(HP*HR))	CRANKTHCFAC2	P409	P93*P342/P340	0
Crankcase THC emission factor 3 (G/(HP*HR))	CRANKTHCFAC3	P410	P94*P343/P340	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Crankcase THC emission factor 4 (G/(HP*HR))	CRANKTHCFAC4	P411	P95*P344/P340	0
Crankcase THC emission factor 5 (G/(HP*HR))	CRANKTHCFAC5	P412	P96*P345/P340	0
Crankcase THC emission factor 6 (G/(HP*HR))	CRANKTHCFAC6	P413	P97*P346/P340	0
Crankcase THC emission factor 7 (G/(HP*HR))	CRANKTHCFAC7	P414	P98*P347/P340	0
Crankcase THC emission factor 8 (G/(HP*HR))	CRANKTHCFAC8	P415	P99*P348/P340	0
Crankcase THC emission factor 9 (G/(HP*HR))	CRANKTHCFAC9	P416	P100*P349/P340	0
Crankcase THC emission factor 10 (G/(HP*HR))	CRANKTHCFAC10	P417	P101*P350/P340	0
Total Crankcase THC emissions (G/MJ)	CRANKCASETHC	P418	(P408*P242+P409*P243+P410*P244+P411*P245+P412*P246+P413*P247+P414*P248+P415*P249+P416*P250+P417*P251)*(1341/3600)	0.743952
Weighted BSFC (LB/(HP*HR))	WEIGHTEDBSFC	P419	P102*P242+P103*P243+P104*P244+P105*P245+P106*P246+P107*P247+P108*P248+P109*P249+P110*P250+P111*P251	0.605
Fuel consumption (G/MJ)	FUELUSE	P420	MAX(P419*453.6*(1341/3600),P351)	102.2244
Refueling spillage THC emission factor (G/MJ)	SPILLAGETHCFAC1	P421	P31*P420/P12/P32	0.004696
Dispensed fuel temperature (DEG F)	TD	P422	62+0.6*(P5-62)	65.6
Fuel displacement THC emission factor (G/MJ)	DISPLACEMENTTHC	P423	EXP(-1.2798-0.0049*(P422-P5)+0.0203*P422+0.1315*P10)*P420/P12*P27	0.111458
Wade Calculation Tmin (DEG F)	WADETMIN	P424	IF(P3>40,P3,40)	54
Wade Calculation Tmax (DEG F)	WADETMAX	P425	(P4-P3)*0.992+P3	81.776
Wade Vapor space (FT^3)	VAPORSPACE	P426	((1-P33)*P32+0.15*P32)/7.841	2.321133
Wade V100: vapor pressure at 100 deg F (PSI)	WADEV100	P427	1.0223*P10+(0.0119*3*P10)/(1-0.0368*P10)	8.583162
Wade E100: percent of fuel evaporated at 100 deg F	WADEE100	P428	66.401-12.718*P427+1.3067*P427^2-0.077934*P427^3+0.0018407*P427^4	14.21617
Wade Dmin: distillation percent at min temp	WADEDMIN	P429	P428+((262/((P428/6)+560))-0.0113)*(100-P3)	35.12713
Wade Dmax: distillation percent at max temp	WADEDMAX	P430	P428+((262/((P428/6)+560))-0.0113)*(100-P425)	22.50055
Wade PI (PSI)	WADEPI	P431	14.697-0.53089*P429+0.0077215*P429^2-0.000055631*P429^3+0.0000001769*P429^4	3.434109
Wade PF (PSI)	WADEPF	P432	14.697-0.53089*P430+0.0077215*P430^2-0.000055631*P430^3+0.0000001769*P430^4	6.072508
Wade density (LB/GAL)	WADEDENSITY	P433	6.386 - 0.0186 * P10	6.2372
Wade molecular weight (LB/MOLE)	WADEMW	P434	(73.23-1.274*P10)+(((P3+P425)/2)-60)*0.059	63.50339
Wade diurnal emission factor (G/DAY)	WADEDIURNALEF	P435	P426*453.6*P433*(520/(690-4*P434))*((P431/(14.7-P431)+P432/(14.7-P432))/2)*(((14.7-P431)/(P3+460))-((14.7-P432)/(P425+460)))	23.67581
Diurnal yearly emission 1 (G/YR)	DIURNALTHC1	P436	P435*P11*P280*P285*365	9841.133
Diurnal yearly emission 2 (G/YR)	DIURNALTHC2	P437	P435*P11*P281*P286*365	0
Diurnal yearly emission 3 (G/YR)	DIURNALTHC3	P438	P435*P11*P282*P287*365	0
Diurnal yearly emission 4 (G/YR)	DIURNALTHC4	P439	P435*P11*P283*P288*365	0
Diurnal yearly emission 5 (G/YR)	DIURNALTHC5	P440	P435*P11*P284*P289*365	0
Total Diurnal Emissions (G/YR)	DIURNALTHC	P441	P436+P437+P438+P439+P440	9841.133

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Fuel tank temperature correction factor	TANKTCF	P442	0.03788519*EXP(0.03850818*P5)	0.51963
Fuel tank inside surface area (M^2)	TANKSURFACEAREA	P443	0.15*SQRT((((P32+2)^2)/4)-1)	2.244994
Equipment spillage E10 permeation adjustment nonmetal tank for tech type 1	E10ADJNONMETAL1	P444	P40	1.1
Equipment spillage E10 permeation adjustment nonmetal tank for tech type 2	E10ADJNONMETAL2	P445	IF(OR(P252=1,P18>25),P40,2)	1.1
Equipment spillage E10 permeation adjustment nonmetal tank for tech type 3	E10ADJNONMETAL3	P446	IF(OR(P253=1,P18>25),P40,2)	1.1
Equipment spillage E10 permeation adjustment nonmetal tank for tech type 4	E10ADJNONMETAL4	P447	IF(OR(P254=1,P18>25),P40,2)	1.1
Equipment spillage E10 permeation adjustment nonmetal tank for tech type 5	E10ADJNONMETAL5	P448	IF(OR(P255=1,P18>25),P40,2)	1.1
Equipment spillage E10 permeation adjustment NonRecMarine hose for tech type 1	E10ADJNRMHOSE1	P449	P41	1.82
Equipment spillage E10 permeation adjustment NonRecMarine hose for tech type 2	E10ADJNRMHOSE2	P450	IF(OR(P256=1,P18>25),P41,2)	1.82
Equipment spillage E10 permeation adjustment NonRecMarine hose for tech type 3	E10ADJNRMHOSE3	P451	IF(OR(P257=1,P18>25),P41,2)	1.82
Equipment spillage E10 permeation adjustment NonRecMarine hose for tech type 4	E10ADJNRMHOSE4	P452	IF(OR(P258=1,P18>25),P41,2)	1.82
Equipment spillage E10 permeation adjustment NonRecMarine hose for tech type 5	E10ADJNRMHOSE5	P453	IF(OR(P259=1,P18>25),P41,2)	1.82
Tank permeation THC emission 1 (G/YR)	TANKPERMTHC1	P454	IF(P7<=0.2,P285*365*((((P260+P260*(P444-1)*((P7/0.1)^0.4))*P6)+(P260*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74,P285*365*((((P260*(1+(P444-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P260*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74)	0
Tank permeation THC emission 2 (G/YR)	TANKPERMTHC2	P455	IF(P7<=0.2,P286*365*((((P261+P261*(P445-1)*((P7/0.1)^0.4))*P6)+(P261*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74,P286*365*((((P261*(1+(P445-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P261*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74)	0
Tank permeation THC emission 3 (G/YR)	TANKPERMTHC3	P456	IF(P7<=0.2,P287*365*((((P262+P262*(P446-1)*((P7/0.1)^0.4))*P6)+(P262*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74,P287*365*((((P262*(1+(P446-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P262*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74)	0
Tank permeation THC emission 4 (G/YR)	TANKPERMTHC4	P457	IF(P7<=0.2,P288*365*((((P263+P263*(P447-1)*((P7/0.1)^0.4))*P6)+(P263*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
			P34))*P442*907184.74,P288*365*((((P263*(1+(P447-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P263*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74)	
Tank permeation THC emission 5 (G/YR)	TANKPERMTHC5	P458	IF(P7<=0.2,P289*365*((((P264+P264*(P448-1)*((P7/0.1)^0.4))*P6)+(P264*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74,P289*365*((((P264*(1+(P448-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P264*(1-P6)))*P443*(1/453.6)*(1/2000)*(1-P34))*P442*907184.74)	0
Total tank permeation THC (G/YR)	TANKTHC	P459	P454+P455+P456+P457+P458	0
Hose surface area (M^2)	HOSESURFACEAREA	P460	PI()*P35*P36	0.001996
Hose temperature correction factor	HOSETCF	P461	0.06013899*EXP(0.03850818*P5)	0.824861
Hose permeation THC emission 1 (G/YR)	HOSEPERMTHC1	P462	IF(P7<=0.2,P285*365*((((P275+P275*(P449-1)*((P7/0.1)^0.4))*P6)+(P275*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P37))*P461*907184.74,P285*365*((((P275*(1+(P449-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P275*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P34))*P461*907184.74)	0
Hose permeation THC emission 2 (G/YR)	HOSEPERMTHC2	P463	IF(P7<=0.2,P286*365*((((P276+P276*(P450-1)*((P7/0.1)^0.4))*P6)+(P276*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P37))*P461*907184.74,P286*365*((((P276*(1+(P450-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P276*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P34))*P461*907184.74)	0
Hose permeation THC emission 3 (G/YR)	HOSEPERMTHC3	P464	IF(P7<=0.2,P287*365*((((P277+P277*(P451-1)*((P7/0.1)^0.4))*P6)+(P277*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P37))*P461*907184.74,P287*365*((((P277*(1+(P451-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P277*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P34))*P461*907184.74)	0
Hose permeation THC emission 4 (G/YR)	HOSEPERMTHC4	P465	IF(P7<=0.2,P288*365*((((P278+P278*(P452-1)*((P7/0.1)^0.4))*P6)+(P278*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P37))*P461*907184.74,P288*365*((((P278*(1+(P452-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P278*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P34))*P461*907184.74)	0
Hose permeation THC emission 5 (G/YR)	HOSEPERMTHC5	P466	IF(P7<=0.2,P289*365*((((P279+P279*(P453-1)*((P7/0.1)^0.4))*P6)+(P279*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P37))*P461*907184.74,P289*365*((((P279*(1+(P453-1)*((20/10)^0.4))*(1-((MIN(P7,0.85)-0.2)/0.8)^(1/0.4)))*P6)+(P279*(1-P6)))*P460*(1/453.6)*(1/2000)*(1-P34))*P461*907184.74)	0
Total hose permeation THC (G/YR)	HOSETHC	P467	P462+P463+P464+P465+P466	0
Running loss THC emission 1 (G/YR)	RUNLOSSTHC1	P468	P285*P265*P24	163.88

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Running loss THC emission 2 (G/YR)	RUNLOSSTHC2	P469	P286*P266*P24	0
Running loss THC emission 3 (G/YR)	RUNLOSSTHC3	P470	P287*P267*P24	0
Running loss THC emission 4 (G/YR)	RUNLOSSTHC4	P471	P288*P268*P24	0
Running loss THC emission 5 (G/YR)	RUNLOSSTHC5	P472	P289*P269*P24	0
Total running loss THC (G/YR)	RUNLOSSTHC	P473	P468+P469+P470+P471+P472	163.88
Hot soak THC emission 1 (G/YR)	HOTSOAKTHC1	P474	P285*P270*P38*P24	73.78
Hot soak THC emission 2 (G/YR)	HOTSOAKTHC2	P475	P286*P271*P38*P24	0
Hot soak THC emission 3 (G/YR)	HOTSOAKTHC3	P476	P287*P272*P38*P24	0
Hot soak THC emission 4 (G/YR)	HOTSOAKTHC4	P477	P288*P273*P38*P24	0
Hot soak THC emission 5 (G/YR)	HOTSOAKTHC5	P478	P289*P274*P38*P24	0
Total hot soak THC emissions (G/YR)	HOTSOAKTHC	P479	P474+P475+P476+P477+P478	73.78
Fraction of equipment lifetime consumed (UNITS/MJ)	LIFEFRAC	P480	1/(P23*P18*P25*3600/1341)	1.65E-05
NONROAD estimated equipment fuel consumption (KG/MJ)	FUELCONSUMPTION	P481	P420/1000	0.102224
Equipment CO emissions (KG/MJ)	CO	P482	P375/1000	0.062459
Equipment NOx emissions (KG/MJ)	NOX	P483	P363/1000	0.004364
Equipment PM10 emissions, as <10 microns as in NONROAD (KG/MJ)	PM10	P484	P396/1000	2.7E-05
Equipment PM2.5 emissions, as <2.5 microns (KG/MJ)	PM25	P485	P484*P26	2.48E-05
Equipment PM emissions, as > 2.5 microns and < 10 microns (KG/MJ)	PM25TO10	P486	P484-P485	2.16E-06
Equipment exhaust THC emissions (KG/MJ)	EXHAUSTTHC	P487	P351/1000	0.002046
Equipment evaporative THC emissions (KG/MJ)	EVAPTHC	P488	((P441+P459+P467+P473+P479)/(P24*P18*P25)*1341/3600+P418+P421+P423)/1000	0.003436
Equipment total THC emissions (KG/MJ)	TOTALTHC	P489	P487+P488	0.005482
NONROAD estimated CO2 emissions accounting carbon in both CO2 and CO (KG/MJ)	NRCO2	P490	(P481-P489)*P13*44/12	0.319569
Equipment SO2 emissions (KG/MJ)	SO2	P491	P407/1000	6.57E-05
Equipment storage slope	STORAGESLOPE	P492		0.071873
Equipment storage intercept	STORAGEINTERCEPT	P493		5.147671
Storage space per unit (M2/UNIT)	STORAGEM2	P494	P492*P18+P493	7.632325
Equipment storage space (M2/MJ)	STORAGEM2PERMJ	P495	P494*P480	0.000126
Parts gas in the 2-stroke mass gas to lubricating oil ratio	RMASSGAS	P496	P16*P12/P14	42.26027
2-stroke gas-oil mix carbon mass fraction	FUELCRATIO2STROKE	P497	P496*P13/(P496+1)+P15/(P496+1)	0.869954
Fuel carbon mass fraction tech type 1	FUELCRATIOTT1	P498	IF(P42=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 2	FUELCRATIOTT2	P499	IF(P43=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 3	FUELCRATIOTT3	P500	IF(P44=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 4	FUELCRATIOTT4	P501	IF(P45=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 5	FUELCRATIOTT5	P502	IF(P46=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 6	FUELCRATIOTT6	P503	IF(P47=1,P497,P13)	0.87

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Fuel carbon mass fraction tech type 7	FUELCRATIOTT7	P504	IF(P48=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 8	FUELCRATIOTT8	P505	IF(P49=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 9	FUELCRATIOTT9	P506	IF(P50=1,P497,P13)	0.87
Fuel carbon mass fraction tech type 10	FUELCRATIOTT10	P507	IF(P51=1,P497,P13)	0.87
Fuel carbon mass fraction	FUELCRATIO	P508	P498*P242+P499*P243+P500*P244+P501*P245+P502*P246+P503*P247+P504*P248+P505*P249+P506*P250+P507*P251	0.87
2-stroke gas-oil mix density (G/GAL)	FUELDEN2STROKE	P509	P496*P12/(P496+1)+P14/(P496+1)	2810.56
Fuel density tech type 1 (G/GAL)	FUELDENTT1	P510	IF(P42=1,P509,P12)	2798.712
Fuel density tech type 2 (G/GAL)	FUELDENTT2	P511	IF(P43=1,P509,P12)	2798.712
Fuel density tech type 3 (G/GAL)	FUELDENTT3	P512	IF(P44=1,P509,P12)	2798.712
Fuel density tech type 4 (G/GAL)	FUELDENTT4	P513	IF(P45=1,P509,P12)	2798.712
Fuel density tech type 5 (G/GAL)	FUELDENTT5	P514	IF(P46=1,P509,P12)	2798.712
Fuel density tech type 6 (G/GAL)	FUELDENTT6	P515	IF(P47=1,P509,P12)	2798.712
Fuel density tech type 7 (G/GAL)	FUELDENTT7	P516	IF(P48=1,P509,P12)	2798.712
Fuel density tech type 8 (G/GAL)	FUELDENTT8	P517	IF(P49=1,P509,P12)	2798.712
Fuel density tech type 9 (G/GAL)	FUELDENTT9	P518	IF(P50=1,P509,P12)	2798.712
Fuel density tech type 10 (G/GAL)	FUELDENTT10	P519	IF(P51=1,P509,P12)	2798.712
Fuel density (G/GAL)	FUELDEN	P520	P510*P242+P511*P243+P512*P244+P513*P245+P514*P246+P515*P247+P516*P248+P517*P249+P518*P250+P519*P251	2798.712
CNG lubricating oil consumption rate	LUBECONSUMERATE	P521		0.0011
Base other lubricating oil consumption slope	BASEOTHERLUBESLOPE	P522a		0.00011
Base other lubricating oil consumption intercept	BASEOTHERLUBEINTERCEPT	P522b		0.00657
Base other lubricating oil consumption (GAL/HR)	BASEOTHERLUBEGAL	P522	IF(P22=1,P521*P18/7.3,P522a*P18+P522b)	0.010373
Base other lubricating oil consumption (KG/MJ)	BASEOTHERLUBEKG	P523	(P522)/(P18*P25)*(1341/3600)	0.00018
Other lubricating oil consumption tech type 1 (KG/MJ)	OTHERLUBEKGTT1	P524	P242*IF(P42=1,0,P523)	0.00018
Other lubricating oil consumption tech type 2 (KG/MJ)	OTHERLUBEKGTT2	P525	P243*IF(P43=1,0,P523)	0
Other lubricating oil consumption tech type 3 (KG/MJ)	OTHERLUBEKGTT3	P526	P244*IF(P44=1,0,P523)	0
Other lubricating oil consumption tech type 4 (KG/MJ)	OTHERLUBEKGTT4	P527	P245*IF(P45=1,0,P523)	0
Other lubricating oil consumption tech type 5 (KG/MJ)	OTHERLUBEKGTT5	P528	P246*IF(P46=1,0,P523)	0
Other lubricating oil consumption tech type 6 (KG/MJ)	OTHERLUBEKGTT6	P529	P247*IF(P47=1,0,P523)	0
Other lubricating oil consumption tech type 7 (KG/MJ)	OTHERLUBEKGTT7	P530	P248*IF(P48=1,0,P523)	0
Other lubricating oil consumption tech type 8 (KG/MJ)	OTHERLUBEKGTT8	P531	P249*IF(P49=1,0,P523)	0
Other lubricating oil consumption tech type 9 (KG/MJ)	OTHERLUBEKGTT9	P532	P250*IF(P50=1,0,P523)	0
Other lubricating oil consumption tech type 10 (KG/MJ)	OTHERLUBEKGTT10	P533	P251*IF(P51=1,0,P523)	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Other lubricating oil consumption (KG/MJ)	OTHERLUBEKG	P534	P524*P242+P525*P243+P526*P244+P527*P245+P528*P246+P529*P247+P530*P248+P531*P249+P532*P250+P533*P251	0.00018
Exhaust + crankcase THC tech type 1 (KG/MJ)	EXHANDCCTHCTT1	P535	((P341*P242)*((1+P28*P298*35)*1341/3600)+(P408*P242)*(1341/3600))/1000	0.00279
Exhaust + crankcase THC tech type 2 (KG/MJ)	EXHANDCCTHCTT2	P536	((P342*P243)*((1+P28*P298*35)*1341/3600)+(P409*P243)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 3 (KG/MJ)	EXHANDCCTHCTT3	P537	((P343*P244)*((1+P28*P298*35)*1341/3600)+(P410*P244)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 4 (KG/MJ)	EXHANDCCTHCTT4	P538	((P344*P245)*((1+P28*P298*35)*1341/3600)+(P411*P245)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 5 (KG/MJ)	EXHANDCCTHCTT5	P539	((P345*P246)*((1+P28*P298*35)*1341/3600)+(P412*P246)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 6 (KG/MJ)	EXHANDCCTHCTT6	P540	((P346*P247)*((1+P28*P298*35)*1341/3600)+(P413*P247)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 7 (KG/MJ)	EXHANDCCTHCTT7	P541	((P347*P248)*((1+P28*P298*35)*1341/3600)+(P414*P248)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 8 (KG/MJ)	EXHANDCCTHCTT8	P542	((P348*P249)*((1+P28*P298*35)*1341/3600)+(P415*P249)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 9 (KG/MJ)	EXHANDCCTHCTT9	P543	((P349*P250)*((1+P28*P298*35)*1341/3600)+(P416*P250)*(1341/3600))/1000	0
Exhaust + crankcase THC tech type 10 (KG/MJ)	EXHANDCCTHCTT10	P544	((P350*P251)*((1+P28*P298*35)*1341/3600)+(P417*P251)*(1341/3600))/1000	0
Total exhaust + crankcase THC emissions (KG/MJ)	TOTEXHANDCCTHC	P545	P535+P536+P537+P538+P539+P540+P541+P542+P543+P544	0.00279
PM10 carbon fraction tech type 1	PM10CFTT1	P546		0.937739
PM10 carbon fraction tech type 2	PM10CFTT2	P547		0.937739
PM10 carbon fraction tech type 3	PM10CFTT3	P548		0.937739
PM10 carbon fraction tech type 4	PM10CFTT4	P549		0.937739
PM10 carbon fraction tech type 5	PM10CFTT5	P550		0.937739
PM10 carbon fraction tech type 6	PM10CFTT6	P551		0.937739
PM10 carbon fraction tech type 7	PM10CFTT7	P552		0.937739
PM10 carbon fraction tech type 8	PM10CFTT8	P553		0.937739
PM10 carbon fraction tech type 9	PM10CFTT9	P554		0.937739
PM10 carbon fraction tech type 10	PM10CFTT10	P555		0.937739
Carbon fraction of CO	COCFRAC	P556	12/28	0.428571
Total non-crankcase evap THC (KG/MJ)	NCCEVAPTHC	P557	(((P441+P459+P467+P473+P479)/(P24*P18*P25)*1341/3600+P421+P423)/1000)	0.002692
Total non-crankcase evap carbon (KG/MJ)	TOTEVAPC	P558	P508*P557	0.002342
Total exhaust + crankcase emitted carbon tech type 1 (KG/MJ)	TOTCTT1	P559	P242*((P365*P556+P386*P546)*1341/(1000*3600))+P535*P498	0.033878
Total exhaust + crankcase emitted carbon tech type 2 (KG/MJ)	TOTCTT2	P560	P243*((P366*P556+P387*P547)*1341/(1000*3600))+P536*P499	0
Total exhaust + crankcase emitted carbon tech type 3 (KG/MJ)	TOTCTT3	P561	P244*((P367*P556+P388*P548)*1341/(1000*3600))+P537*P500	0
Total exhaust + crankcase emitted carbon tech type 4 (KG/MJ)	TOTCTT4	P562	P245*((P368*P556+P389*P549)*1341/(1000*3600))+P538*P501	0
Total exhaust + crankcase emitted carbon tech type 5 (KG/MJ)	TOTCTT5	P563	P246*((P369*P556+P390*P550)*1341/(1000*3600))+P539*P502	0
Total exhaust + crankcase emitted carbon tech type 6 (KG/MJ)	TOTCTT6	P564	P247*((P370*P556+P391*P551)*1341/(1000*3600))+P540*P503	0
Total exhaust + crankcase emitted carbon tech type 7 (KG/MJ)	TOTCTT7	P565	P248*((P371*P556+P392*P552)*1341/(1000*3600))+P541*P504	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
Total exhaust + crankcase emitted carbon tech type 8 (KG/MJ)	TOTCTT8	P566	P249*((P372*P556+P393*P553)*1341/(1000*3600))+P542*P505	0
Total exhaust + crankcase emitted carbon tech type 9 (KG/MJ)	TOTCTT9	P567	P250*((P373*P556+P394*P554)*1341/(1000*3600))+P543*P506	0
Total exhaust + crankcase emitted carbon tech type 10 (KG/MJ)	TOTCTT10	P568	P251*((P374*P556+P395*P555)*1341/(1000*3600))+P544*P507	0
CO2 emissions tech type 1 (KG/MJ)	CO2TT1	P490a	MAX(0,IF(AND(P242>0,P42=1),(P242*1600*(P365*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P242>0,P20=1,P18<=75),(P242*1170*(P365*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P242*((P102*453.6-P341)*P498-P365*P556)*44/12*1341/(1000*3600))))	0.267909
CO2 emissions tech type 2 (KG/MJ)	CO2TT2	P490b	MAX(0,IF(AND(P243>0,P43=1),(P243*1600*(P366*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P243>0,P20=1,P18<=75),(P243*1170*(P366*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P243*((P103*453.6-P342)*P499-P366*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 3 (KG/MJ)	CO2TT3	P490c	MAX(0,IF(AND(P244>0,P44=1),(P244*1600*(P367*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P244>0,P20=1,P18<=75),(P244*1170*(P367*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P244*((P104*453.6-P343)*P500-P367*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 4 (KG/MJ)	CO2TT4	P490d	MAX(0,IF(AND(P245>0,P45=1),(P245*1600*(P368*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P245>0,P20=1,P18<=75),(P245*1170*(P368*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P245*((P105*453.6-P344)*P501-P368*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 5 (KG/MJ)	CO2TT5	P490e	MAX(0,IF(AND(P246>0,P46=1),(P246*1600*(P369*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P246>0,P20=1,P18<=75),(P246*1170*(P369*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P246*((P106*453.6-P345)*P502-P369*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 6 (KG/MJ)	CO2TT6	P490f	MAX(0,IF(AND(P247>0,P47=1),(P247*1600*(P370*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P247>0,P20=1,P18<=75),(P247*1170*(P370*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P247*((P107*453.6-P346)*P503-P370*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 7 (KG/MJ)	CO2TT7	P490g	MAX(0,IF(AND(P248>0,P48=1),(P248*1600*(P371*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P248>0,P20=1,P18<=75),(P248*1170*(P371*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P248*((P108*453.6-P347)*P504-P371*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 8 (KG/MJ)	CO2TT8	P490h	MAX(0,IF(AND(P249>0,P49=1),(P249*1600*(P372*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P249>0,P20=1,P18<=75),(P249*1170*(P372*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P249*((P109*453.6-P348)*P505-P372*P556)*44/12*1341/(1000*3600))))	0
CO2 emissions tech type 9 (KG/MJ)	CO2TT9	P490i	MAX(0,IF(AND(P250>0,P50=1),(P250*1600*(P373*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P250>0,P20=1,P18<=75),(P250*1170*(P373*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P250*((P110*453.6-P349)*P506-P373*P556)*44/12*1341/(1000*3600))))	0

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
CO2 emissions tech type 10 (KG/MJ)	CO2TT10	P490j	MAX(0,IF(AND(P251>0,P51=1),(P251*1600*(P374*(1+P30*P298*35))^-0.15)*1341/(3600*1000),IF(AND(P251>0,P20=1,P18<=75),(P251*1170*(P374*(1+P30*P298*35))^-0.095)*1341/(3600*1000),P251*((P111*453.6-P350)*P507-P374*P556)*44/12*1341/(1000*3600))))	0
Total CO2 emissions (KG/MJ)	TOTCO2	P490k	P490a+P490b+P490c+P490d+P490e+P490f+P490g+P490h+P490i+P490j	0.267909
Total carbon emitted (KG/MJ)	TOTC	P569	P490k*(12/44)+P558+P559+P560+P561+P562+P563+P564+P565+P566+P567+P568	0.109287
2 stroke carbon balanced fuel consumption (KG/MJ)	2STRBALBSFCKG	P570	(P591*(P557+P490k*12/44)+P559*P42+P560*P43+P561*P44+P562*P45+P563*P46+P564*P47+P565*P48+P566*P49+P567*P50+P568*P51)/P497	0
Non-2-stroke carbon balanced fuel consumption (KG/MJ)	N2STRBALBSFCKG	P571	((1-P591)*(P557+P490k*12/44)+P559*(1-P42)+P560*(1-P43)+P561*(1-P44)+P562*(1-P45)+P563*(1-P46)+P564*(1-P47)+P565*(1-P48)+P566*(1-P49)+P567*(1-P50)+P568*(1-P51))/P13	0.126019
Max of NR BSFC and the carbon balanced fuel consumption (KG/MJ)	BALBSFCKG	P572	MAX(P481,P570+P571)	0.126019
Percent change in fuel consumption based on mass	PERFCCHANGE	P573	(P572-P481)/P481	0.232768
Max of NR BSFC and the carbon balanced fuel consumption (GAL/MJ)	BALBSFCGAL	P574	(P572*1000)/P520	0.045028
Lubricating portion of carbon balanced fuel consumption (KG/MJ)	FINALLUBEUSE	P575	P534+P570/P496	0.00018
Fuel portion of carbon balanced fuel consumption (KG/MJ)	FINALFUELUSE	P576	P572-P575	0.125839
CO2 emissions from ethanol (for biogenic designation, KG/MJ)	CO2BIOGENIC	P577	IF(P490k=0,0,P299*P576*(24/46)*44/12)	0.017554
CO2 emissions from fossil (KG/MJ)	CO2FOSSIL	P578	MAX(0,P490k-P577)	0.250355
Lube to waste management as 20% of other (KG/MJ)	LUBETOWASTEMAN	P579	0.2*P534	3.61E-05
Fuel transport distance (MILES)	FUELTRANSMILES	P583		35
Lubricant transport distance (MILES)	LUBTRANSMILES	P584		23
Conversion factor for km per mile	KMPERMILE	P585		1.609344
Fuel transport (KG-KM)	FUELTRANSKGKM	P586	P576*P583*P585	7.088125
Lubricant transport (KG-KM)	LUBTRANSKGKM	P587	P576*P584*P585	4.657911
Total transport (METRIC TON-KM)	TOTALTRANTKM	P588	(P587+P586)/1000	0.011746
2-stroke final fuel consumption volume fraction	2STRFINALFUELVOLFRAC	P589	(P570/P509)/(P572/P520)	0
2-stroke exhaust + crankcase THC emissions mass fraction	2STREXHTHCFRAC	P590	(P42*P535+P43*P536+P44*P537+P45*P538+P46*P539+P47*P540+P48*P541+P49*P542+P50*P543+P51*P544)/P545	0
2-stroke non-crankcase evap THC emissions mass fraction	2STREVAPTHCFRAC	P591	P42*P242+P43*P243+P44*P244+P45*P245+P46*P246+P47*P247+P48*P248+P49*P249+P50*P250+P51*P251	0
2-stroke PM10 emissions mass fraction	2STRPM10FRAC	P592	(P386*P42*P242+P387*P43*P243+P388*P44*P244+P389*P45*P245+P390*P46*P246+P391*P47*P247+P392*P48*P248+P393*P49*P249+P394*P50*P250+P395*P51*P251)/(P396*(3600/1341))	0
2-stroke EF for Total Organic Gases (g/g exhaust THC)	2STRTOGex	P593		1.044
2-stroke EF for Non-Methane Organic Gases (g/g exhaust THC)	2STRNMOGex	P594		1.035
2-stroke EF for Non-Methane Hydrocarbons (g/g exhaust THC)	2STRNMHCex	P595		0.991

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
2-stroke EF for Non-Methane Volatile Organic Compounds (g/g exhaust THC)	2STRNMVOCex	P596		1.034
2-stroke EF for Secondary Organic Aerosol (g/g NMVOC)	2STRSOA	P597		0.0073
2-stroke EF for Total Organic Gases (g/g evap THC)	2STRTOGev	P598		1
2-stroke EF for Non-Methane Organic Gases (g/g evap THC)	2STRNMOGev	P599		1
2-stroke EF for Non-Methane Hydrocarbons (g/g evap THC)	2STRNMHCev	P600		1
2-stroke EF for Non-Methane Volatile Organic Compounds (g/g evap THC)	2STRNMVOCev	P601		1
2-stroke EF for Methane (g/g exhaust THC)	2STRCH4ex	P602		0.009
2-stroke EF for Ammonia (g/gal fuel)	2STRH3Nex	P603		0.116
2-stroke EF for 1,2,3,4,6,7,8-Heptachlorodibenzofuran (g/gal fuel)	2STRFD1gal	P604		2.61E-10
2-stroke EF for 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD2gal	P605		1.28E-10
2-stroke EF for 1,2,3,4,7,8,9-Heptachlorodibenzofuran (g/gal fuel)	2STRFD3gal	P606		8.33E-12
2-stroke EF for 1,2,3,4,7,8-Hexachlorodibenzofuran (g/gal fuel)	2STRFD4gal	P607		2.35E-11
2-stroke EF for 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD5gal	P608		8.33E-12
2-stroke EF for 1,2,3,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	2STRFD6gal	P609		2.5E-11
2-stroke EF for 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD7gal	P610		1.7E-11
2-stroke EF for 1,2,3,7,8,9-Hexachlorodibenzofuran (g/gal fuel)	2STRFD8gal	P611		6.81E-12
2-stroke EF for 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD9gal	P612		1.06E-11
2-stroke EF for 1,2,3,7,8-Pentachlorodibenzofuran (g/gal fuel)	2STRFD10gal	P613		2.84E-11
2-stroke EF for 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD11gal	P614		7.95E-12
2-stroke EF for 2,3,4,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	2STRFD12gal	P615		2.91E-11
2-stroke EF for 2,3,4,7,8-Pentachlorodibenzofuran (g/gal fuel)	2STRFD13gal	P616		2.08E-11
2-stroke EF for 2,3,7,8-Tetrachlorodibenzofuran (g/gal fuel)	2STRFD14gal	P617		5.94E-11
2-stroke EF for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (g/gal fuel)	2STRFD15gal	P618		1.78E-11
2-stroke EF for Chromium (Cr3+) (g/gal fuel)	2STRCr3gal	P619		7.02E-05
2-stroke EF for Chromium (Cr6+) (g/gal fuel)	2STRCr6gal	P620		3.62E-05
2-stroke EF for Manganese (g/gal fuel)	2STRMngal	P621		3.56E-05

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
2-stroke EF for Mercury (divalent gaseous) (g/gal fuel)	2STRdivHggal	P622		1.68E-07
2-stroke EF for Mercury (elemental gaseous) (g/gal fuel)	2STRelHggal	P623		1.77E-06
2-stroke EF for Mercury (particulate) (g/gal fuel)	2STRpartHggal	P624		6.9E-09
2-stroke EF for Nickel (g/gal fuel)	2STRNigal	P625		7.75E-05
2-stroke EF for Octachlorodibenzofuran (g/gal fuel)	2STRFD16gal	P626		2.95E-10
2-stroke EF for Octachlorodibenzo-p-dioxin (g/gal fuel)	2STRFD17gal	P627		1.01E-09
2-stroke EF for Acenaphthene (g/g exhaust PM10)	2STRHAP1PM10	P628		0.000002
2-stroke EF for Acenaphthylene (g/g exhaust PM10)	2STRHAP2PM10	P629		0.000075
2-stroke EF for Anthracene (g/g exhaust PM10)	2STRHAP3PM10	P630		0.000067
2-stroke EF for Arsenic & compounds (g/g exhaust PM10)	2STRHAP4PM10	P631		4.1E-05
2-stroke EF for Benz(a)anthracene (g/g exhaust PM10)	2STRHAP5PM10	P632		0.000034
2-stroke EF for Benzo(a)pyrene (g/g exhaust PM10)	2STRHAP6PM10	P633		0.000029
2-stroke EF for Benzo(b)fluoranthene (g/g exhaust PM10)	2STRHAP7PM10	P634		0.000016
2-stroke EF for Benzo(g,h,i)perylene (g/g exhaust PM10)	2STRHAP8PM10	P635		0.000116
2-stroke EF for Benzo(k)fluoranthene (g/g exhaust PM10)	2STRHAP9PM10	P636		0.000014
2-stroke EF for Chrysene (g/g exhaust PM10)	2STRHAP10PM10	P637		0.000021
2-stroke EF for Dibenzo(a,h)anthracene (g/g exhaust PM10)	2STRHAP11PM10	P638		0.000001
2-stroke EF for Fluoranthene (g/g exhaust PM10)	2STRHAP12PM10	P639		0.000267
2-stroke EF for Fluorene (g/g exhaust PM10)	2STRHAP13PM10	P640		0.000239
2-stroke EF for Indeno(1,2,3,c,d)pyrene (g/g exhaust PM10)	2STRHAP14PM10	P641		0.000035
2-stroke EF for Naphthalene (g/g exhaust PM10)	2STRHAP15PM10	P642		0.000004
2-stroke EF for Phenanthrene (g/g exhaust PM10)	2STRHAP16PM10	P643		0.000208
2-stroke EF for Pyrene (g/g exhaust PM10)	2STRHAP17PM10	P644		0.000318
2-stroke EF for 1,3-Butadiene (g/g exhaust NMVOC)	2STRHAP18NMVOCex	P645		0.002146
2-stroke EF for 2,2,4-Trimethylpentane (g/g exhaust NMVOC)	2STRHAP19NMVOCex	P646		0.037227
2-stroke EF for Acetaldehyde (g/g exhaust NMVOC)	2STRHAP20NMVOCex	P647		0.003328
2-stroke EF for Acrolein (g/g exhaust NMVOC)	2STRHAP21NMVOCex	P648		0.000297
2-stroke EF for Benzene (g/g exhaust NMVOC)	2STRHAP22NMVOCex	P649		0.022642

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
2-stroke EF for Ethyl Benzene (g/g exhaust NMVOC)	2STRHAP23NMVOCex	P650		0.021802
2-stroke EF for Formaldehyde (g/g exhaust NMVOC)	2STRHAP24NMVOCex	P651		0.003452
2-stroke EF for Hexane (g/g exhaust NMVOC)	2STRHAP25NMVOCex	P652		0.01401
2-stroke EF for Propionaldehyde (g/g exhaust NMVOC)	2STRHAP26NMVOCex	P653		0.000244
2-stroke EF for Styrene (g/g exhaust NMVOC)	2STRHAP27NMVOCex	P654		0.001179
2-stroke EF for Toluene (g/g exhaust NMVOC)	2STRHAP28NMVOCex	P655		0.088995
2-stroke EF for Xylene (g/g exhaust NMVOC)	2STRHAP29NMVOCex	P656		0.097813
2-stroke EF for 2,2,4-Trimethylpentane (g/g evap NMVOC)	2STRHAP19NMVOCev	P657		0.015767
2-stroke EF for Benzene (g/g evap NMVOC)	2STRHAP22NMVOCev	P658		0.01254
2-stroke EF for Ethyl Benzene (g/g evap NMVOC)	2STRHAP23NMVOCev	P659		0.0045
2-stroke EF for Hexane (g/g evap NMVOC)	2STRHAP25NMVOCev	P660		0.0096
2-stroke EF for Toluene (g/g evap NMVOC)	2STRHAP28NMVOCev	P661		0.0195
2-stroke EF for Xylene (g/g evap NMVOC)	2STRHAP29NMVOCev	P662		0.0119
NON 2-stroke EF for Total Organic Gases (g/g exhaust THC)	4STRTOGex	P663		1.043
NON 2-stroke EF for Non-Methane Organic Gases (g/g exhaust THC)	4STRNMOGex	P664		0.943
NON 2-stroke EF for Non-Methane Hydrocarbons (g/g exhaust THC)	4STRNMHCex	P665		0.9
NON 2-stroke EF for Non-Methane Volatile Organic Compounds (g/g exhaust THC)	4STRNMVOCex	P666		0.933
NON 2-stroke EF for Secondary Organic Aerosol (g/g NMVOC)	4STRSOA	P667		0.0073
NON 2-stroke EF for Total Organic Gases (g/g evap THC)	4STRTOGev	P668		1
NON 2-stroke EF for Non-Methane Organic Gases (g/g evap THC)	4STRNMOGev	P669		1
NON 2-stroke EF for Non-Methane Hydrocarbons (g/g evap THC)	4STRNMHCev	P670		1
NON 2-stroke EF for Non-Methane Volatile Organic Compounds (g/g evap THC)	4STRNMVOCev	P671		1
NON 2-stroke EF for Methane (g/g exhaust THC)	4STRCH4ex	P672		0.1
NON 2-stroke EF for Ammonia (g/gal fuel)	4STRH3Nex	P673		0.116
NON 2-stroke EF for 1,2,3,4,6,7,8-Heptachlorodibenzofuran (g/gal fuel)	4STRFD1gal	P674		2.61E-10
NON 2-stroke EF for 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD2gal	P675		1.28E-10
NON 2-stroke EF for 1,2,3,4,7,8,9-Heptachlorodibenzofuran (g/gal fuel)	4STRFD3gal	P676		8.33E-12
NON 2-stroke EF for 1,2,3,4,7,8-Hexachlorodibenzofuran (g/gal fuel)	4STRFD4gal	P677		2.35E-11

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
NON 2-stroke EF for 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD5gal	P678		8.33E-12
NON 2-stroke EF for 1,2,3,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	4STRFD6gal	P679		2.5E-11
NON 2-stroke EF for 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD7gal	P680		1.7E-11
NON 2-stroke EF for 1,2,3,7,8,9-Hexachlorodibenzofuran (g/gal fuel)	4STRFD8gal	P681		6.81E-12
NON 2-stroke EF for 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD9gal	P682		1.06E-11
NON 2-stroke EF for 1,2,3,7,8-Pentachlorodibenzofuran (g/gal fuel)	4STRFD10gal	P683		2.84E-11
NON 2-stroke EF for 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD11gal	P684		7.95E-12
NON 2-stroke EF for 2,3,4,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	4STRFD12gal	P685		2.91E-11
NON 2-stroke EF for 2,3,4,7,8-Pentachlorodibenzofuran (g/gal fuel)	4STRFD13gal	P686		2.08E-11
NON 2-stroke EF for 2,3,7,8-Tetrachlorodibenzofuran (g/gal fuel)	4STRFD14gal	P687		5.94E-11
NON 2-stroke EF for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (g/gal fuel)	4STRFD15gal	P688		1.78E-11
NON 2-stroke EF for Chromium (Cr3+) (g/gal fuel)	4STRCr3gal	P689		7.02E-05
NON 2-stroke EF for Chromium (Cr6+) (g/gal fuel)	4STRCr6gal	P690		3.62E-05
NON 2-stroke EF for Manganese (g/gal fuel)	4STRMngal	P691		3.56E-05
NON 2-stroke EF for Mercury (divalent gaseous) (g/gal fuel)	4STRdivHggal	P692		1.68E-07
NON 2-stroke EF for Mercury (elemental gaseous) (g/gal fuel)	4STRelHggal	P693		1.77E-06
NON 2-stroke EF for Mercury (particulate) (g/gal fuel)	4STRpartHggal	P694		6.9E-09
NON 2-stroke EF for Nickel (g/gal fuel)	4STRNigal	P695		7.75E-05
NON 2-stroke EF for Octachlorodibenzofuran (g/gal fuel)	4STRFD16gal	P696		2.95E-10
NON 2-stroke EF for Octachlorodibenzo-p-dioxin (g/gal fuel)	4STRFD17gal	P697		1.01E-09
NON 2-stroke EF for Acenaphthene (g/g exhaust PM10)	4STRHAP1PM10	P698		0.00073
NON 2-stroke EF for Acenaphthylene (g/g exhaust PM10)	4STRHAP2PM10	P699		0.00412
NON 2-stroke EF for Anthracene (g/g exhaust PM10)	4STRHAP3PM10	P700		0.00085
NON 2-stroke EF for Arsenic & compounds (g/g exhaust PM10)	4STRHAP4PM10	P701		4.1E-05
NON 2-stroke EF for Benz(a)anthracene (g/g exhaust PM10)	4STRHAP5PM10	P702		0.0001
NON 2-stroke EF for Benzo(a)pyrene (g/g exhaust PM10)	4STRHAP6PM10	P703		0.0001

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
NON 2-stroke EF for Benzo(b)fluoranthene (g/g exhaust PM10)	4STRHAP7PM10	P704		0.00012
NON 2-stroke EF for Benzo(g,h,i)perylene (g/g exhaust PM10)	4STRHAP8PM10	P705		0.00026
NON 2-stroke EF for Benzo(k)fluoranthene (g/g exhaust PM10)	4STRHAP9PM10	P706		0.00012
NON 2-stroke EF for Chrysene (g/g exhaust PM10)	4STRHAP10PM10	P707		0.0001
NON 2-stroke EF for Dibenzo(a,h)anthracene (g/g exhaust PM10)	4STRHAP11PM10	P708		0
NON 2-stroke EF for Fluoranthene (g/g exhaust PM10)	4STRHAP12PM10	P709		0.00091
NON 2-stroke EF for Fluorene (g/g exhaust PM10)	4STRHAP13PM10	P710		0.00151
NON 2-stroke EF for Indeno(1,2,3,c,d)pyrene (g/g exhaust PM10)	4STRHAP14PM10	P711		0.00008
NON 2-stroke EF for Naphthalene (g/g exhaust PM10)	4STRHAP15PM10	P712		0.09073
NON 2-stroke EF for Phenanthrene (g/g exhaust PM10)	4STRHAP16PM10	P713		0.00254
NON 2-stroke EF for Pyrene (g/g exhaust PM10)	4STRHAP17PM10	P714		0.00124
NON 2-stroke EF for 1,3-Butadiene (g/g exhaust NMVOC)	4STRHAP18NMVOCex	P715		0.009521
NON 2-stroke EF for 2,2,4-Trimethylpentane (g/g exhaust NMVOC)	4STRHAP19NMVOCex	P716		0.019254
NON 2-stroke EF for Acetaldehyde (g/g exhaust NMVOC)	4STRHAP20NMVOCex	P717		0.008201
NON 2-stroke EF for Acrolein (g/g exhaust NMVOC)	4STRHAP21NMVOCex	P718		0.000693
NON 2-stroke EF for Benzene (g/g exhaust NMVOC)	4STRHAP22NMVOCex	P719		0.047219
NON 2-stroke EF for Ethyl Benzene (g/g exhaust NMVOC)	4STRHAP23NMVOCex	P720		0.01804
NON 2-stroke EF for Formaldehyde (g/g exhaust NMVOC)	4STRHAP24NMVOCex	P721		0.015933
NON 2-stroke EF for Hexane (g/g exhaust NMVOC)	4STRHAP25NMVOCex	P722		0.009823
NON 2-stroke EF for Propionaldehyde (g/g exhaust NMVOC)	4STRHAP26NMVOCex	P723		0.001862
NON 2-stroke EF for Styrene (g/g exhaust NMVOC)	4STRHAP27NMVOCex	P724		0.00069
NON 2-stroke EF for Toluene (g/g exhaust NMVOC)	4STRHAP28NMVOCex	P725		0.065376
NON 2-stroke EF for Xylene (g/g exhaust NMVOC)	4STRHAP29NMVOCex	P726		0.061697
NON 2-stroke EF for 2,2,4-Trimethylpentane (g/g evap NMVOC)	4STRHAP19NMVOCev	P727		0.015767
NON 2-stroke EF for Benzene (g/g evap NMVOC)	4STRHAP22NMVOCev	P728		0.01254
NON 2-stroke EF for Ethyl Benzene (g/g evap NMVOC)	4STRHAP23NMVOCev	P729		0.0045

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
NON 2-stroke EF for Hexane (g/g evap NMVOC)	4STRHAP25NMVOCev	P730		0.0096
NON 2-stroke EF for Toluene (g/g evap NMVOC)	4STRHAP28NMVOCev	P731		0.0195
NON 2-stroke EF for Xylene (g/g evap NMVOC)	4STRHAP29NMVOCev	P732		0.0119
EF for Total Organic Gases (g/g exhaust THC)	TOGex	P733	P590*P593+(1-P590)*P663	1.043
EF for Non-Methane Organic Gases (g/g exhaust THC)	NMOGex	P734	P590*P594+(1-P590)*P664	0.943
EF for Non-Methane Hydrocarbons (g/g exhaust THC)	NMHCex	P735	P590*P595+(1-P590)*P665	0.9
EF for Non-Methane Volatile Organic Compounds (g/g exhaust THC)	NMVOCex	P736	P590*P596+(1-P590)*P666	0.933
EF for Secondary Organic Aerosol (g/g NMVOC)	SOAef	P737	P590*P597+(1-P590)*P667	0.0073
EF for Total Organic Gases (g/g evap THC)	TOGev	P738	P591*P598+(1-P591)*P668	1
EF for Non-Methane Organic Gases (g/g evap THC)	NMOGev	P739	P591*P599+(1-P591)*P669	1
EF for Non-Methane Hydrocarbons (g/g evap THC)	NMHCev	P740	P591*P600+(1-P591)*P670	1
EF for Non-Methane Volatile Organic Compounds (g/g evap THC)	NMVOCev	P741	P591*P601+(1-P591)*P671	1
EF for Methane (g/g exhaust THC)	CH4ex	P742	P590*P602+(1-P590)*P672	0.1
EF for Ammonia (g/gal fuel)	H3Nex	P743	P589*P603+(1-P589)*P673	0.116
EF for 1,2,3,4,6,7,8-Heptachlorodibenzofuran (g/gal fuel)	FD1gal	P744	P589*P604+(1-P589)*P674	2.61E-10
EF for 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (g/gal fuel)	FD2gal	P745	P589*P605+(1-P589)*P675	1.28E-10
EF for 1,2,3,4,7,8,9-Heptachlorodibenzofuran (g/gal fuel)	FD3gal	P746	P589*P606+(1-P589)*P676	8.33E-12
EF for 1,2,3,4,7,8-Hexachlorodibenzofuran (g/gal fuel)	FD4gal	P747	P589*P607+(1-P589)*P677	2.35E-11
EF for 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	FD5gal	P748	P589*P608+(1-P589)*P678	8.33E-12
EF for 1,2,3,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	FD6gal	P749	P589*P609+(1-P589)*P679	2.5E-11
EF for 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	FD7gal	P750	P589*P610+(1-P589)*P680	1.7E-11
EF for 1,2,3,7,8,9-Hexachlorodibenzofuran (g/gal fuel)	FD8gal	P751	P589*P611+(1-P589)*P681	6.81E-12
EF for 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	FD9gal	P752	P589*P612+(1-P589)*P682	1.06E-11
EF for 1,2,3,7,8-Pentachlorodibenzofuran (g/gal fuel)	FD10gal	P753	P589*P613+(1-P589)*P683	2.84E-11
EF for 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (g/gal fuel)	FD11gal	P754	P589*P614+(1-P589)*P684	7.95E-12
EF for 2,3,4,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	FD12gal	P755	P589*P615+(1-P589)*P685	2.91E-11
EF for 2,3,4,7,8-Pentachlorodibenzofuran (g/gal fuel)	FD13gal	P756	P589*P616+(1-P589)*P686	2.08E-11
EF for 2,3,7,8-Tetrachlorodibenzofuran (g/gal fuel)	FD14gal	P757	P589*P617+(1-P589)*P687	5.94E-11
EF for 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (g/gal fuel)	FD15gal	P758	P589*P618+(1-P589)*P688	1.78E-11
EF for Chromium (Cr3+) (g/gal fuel)	Cr3gal	P759	P589*P619+(1-P589)*P689	7.02E-05

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
EF for Chromium (Cr6+) (g/gal fuel)	Cr6gal	P760	P589*P620+(1-P589)*P690	3.62E-05
EF for Manganese (g/gal fuel)	Mngal	P761	P589*P621+(1-P589)*P691	3.56E-05
EF for Mercury (divalent gaseous) (g/gal fuel)	divHggal	P762	P589*P622+(1-P589)*P692	1.68E-07
EF for Mercury (elemental gaseous) (g/gal fuel)	elHggal	P763	P589*P623+(1-P589)*P693	1.77E-06
EF for Mercury (particulate) (g/gal fuel)	partHggal	P764	P589*P624+(1-P589)*P694	6.9E-09
EF for Nickel (g/gal fuel)	Nigal	P765	P589*P625+(1-P589)*P695	7.75E-05
EF for Octachlorodibenzofuran (g/gal fuel)	FD16gal	P766	P589*P626+(1-P589)*P696	2.95E-10
EF for Octachlorodibenzo-p-dioxin (g/gal fuel)	FD17gal	P767	P589*P627+(1-P589)*P697	1.01E-09
EF for Acenaphthene (g/g exhaust PM10)	HAP1PM10	P768	P592*P628+(1-P592)*P698	0.00073
EF for Acenaphthylene (g/g exhaust PM10)	HAP2PM10	P769	P592*P629+(1-P592)*P699	0.00412
EF for Anthracene (g/g exhaust PM10)	HAP3PM10	P770	P592*P630+(1-P592)*P700	0.00085
EF for Arsenic & compounds (g/g exhaust PM10)	HAP4PM10	P771	P592*P631+(1-P592)*P701	4.1E-05
EF for Benz(a)anthracene (g/g exhaust PM10)	HAP5PM10	P772	P592*P632+(1-P592)*P702	0.0001
EF for Benzo(a)pyrene (g/g exhaust PM10)	HAP6PM10	P773	P592*P633+(1-P592)*P703	0.0001
EF for Benzo(b)fluoranthene (g/g exhaust PM10)	HAP7PM10	P774	P592*P634+(1-P592)*P704	0.00012
EF for Benzo(g,h,i)perylene (g/g exhaust PM10)	HAP8PM10	P775	P592*P635+(1-P592)*P705	0.00026
EF for Benzo(k)fluoranthene (g/g exhaust PM10)	HAP9PM10	P776	P592*P636+(1-P592)*P706	0.00012
EF for Chrysene (g/g exhaust PM10)	HAP10PM10	P777	P592*P637+(1-P592)*P707	0.0001
EF for Dibenzo(a,h)anthracene (g/g exhaust PM10)	HAP11PM10	P778	P592*P638+(1-P592)*P708	0
EF for Fluoranthene (g/g exhaust PM10)	HAP12PM10	P779	P592*P639+(1-P592)*P709	0.00091
EF for Fluorene (g/g exhaust PM10)	HAP13PM10	P780	P592*P640+(1-P592)*P710	0.00151
EF for Indeno(1,2,3,c,d)pyrene (g/g exhaust PM10)	HAP14PM10	P781	P592*P641+(1-P592)*P711	0.00008
EF for Naphthalene (g/g exhaust PM10)	HAP15PM10	P782	P592*P642+(1-P592)*P712	0.09073
EF for Phenanthrene (g/g exhaust PM10)	HAP16PM10	P783	P592*P643+(1-P592)*P713	0.00254
EF for Pyrene (g/g exhaust PM10)	HAP17PM10	P784	P592*P644+(1-P592)*P714	0.00124
EF for 1,3-Butadiene (g/g exhaust NMVOC)	HAP18NMVOCex	P785	P590*P645+(1-P590)*P715	0.009521
EF for 2,2,4-Trimethylpentane (g/g exhaust NMVOC)	HAP19NMVOCex	P786	P590*P646+(1-P590)*P716	0.019254
EF for Acetaldehyde (g/g exhaust NMVOC)	HAP20NMVOCex	P787	P590*P647+(1-P590)*P717	0.008201
EF for Acrolein (g/g exhaust NMVOC)	HAP21NMVOCex	P788	P590*P648+(1-P590)*P718	0.000693
EF for Benzene (g/g exhaust NMVOC)	HAP22NMVOCex	P789	P590*P649+(1-P590)*P719	0.047219
EF for Ethyl Benzene (g/g exhaust NMVOC)	HAP23NMVOCex	P790	P590*P650+(1-P590)*P720	0.01804

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
EF for Formaldehyde (g/g exhaust NMVOC)	HAP24NMVOCex	P791	P590*P651+(1-P590)*P721	0.015933
EF for Hexane (g/g exhaust NMVOC)	HAP25NMVOCex	P792	P590*P652+(1-P590)*P722	0.009823
EF for Propionaldehyde (g/g exhaust NMVOC)	HAP26NMVOCex	P793	P590*P653+(1-P590)*P723	0.001862
EF for Styrene (g/g exhaust NMVOC)	HAP27NMVOCex	P794	P590*P654+(1-P590)*P724	0.00069
EF for Toluene (g/g exhaust NMVOC)	HAP28NMVOCex	P795	P590*P655+(1-P590)*P725	0.065376
EF for Xylene (g/g exhaust NMVOC)	HAP29NMVOCex	P796	P590*P656+(1-P590)*P726	0.061697
EF for 2,2,4-Trimethylpentane (g/g evap NMVOC)	HAP19NMVOCev	P797	P591*P657+(1-P591)*P727	0.015767
EF for Benzene (g/g evap NMVOC)	HAP22NMVOCev	P798	P591*P658+(1-P591)*P728	0.01254
EF for Ethyl Benzene (g/g evap NMVOC)	HAP23NMVOCev	P799	P591*P659+(1-P591)*P729	0.0045
EF for Hexane (g/g evap NMVOC)	HAP25NMVOCev	P800	P591*P660+(1-P591)*P730	0.0096
EF for Toluene (g/g evap NMVOC)	HAP28NMVOCev	P801	P591*P661+(1-P591)*P731	0.0195
EF for Xylene (g/g evap NMVOC)	HAP29NMVOCev	P802	P591*P662+(1-P591)*P732	0.0119
Total Organic Gases (KG/MJ)	TOG	P803	P733*P545+P738*P557	0.005602
Non-Methane Organic Gases (KG/MJ)	NMOG	P804	P734*P545+P739*P557	0.005323
Non-Methane Hydrocarbons (KG/MJ)	NMHC	P805	P735*P545+P740*P557	0.005203
Non-Methane Volatile Organic Compounds (KG/MJ)	NMVOC	P806	P736*P545+P741*P557	0.005295
Secondary Organic Aerosol (KG/MJ)	SOA	P807	P737*P806	3.87E-05
Methane (KG/MJ)	CH4	P808	P742*P545	0.000279
Ammonia (KG/MJ)	H3N	P809	P743*P574	0.005223
1,2,3,4,6,7,8-Heptachlorodibenzofuran (KG/MJ)	FD1	P810	P744*P574	1.18E-11
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (KG/MJ)	FD2	P811	P745*P574	5.76E-12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (KG/MJ)	FD3	P812	P746*P574	3.75E-13
1,2,3,4,7,8-Hexachlorodibenzofuran (KG/MJ)	FD4	P813	P747*P574	1.06E-12
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (KG/MJ)	FD5	P814	P748*P574	3.75E-13
1,2,3,6,7,8-Hexachlorodibenzofuran (KG/MJ)	FD6	P815	P749*P574	1.12E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (KG/MJ)	FD7	P816	P750*P574	7.67E-13
1,2,3,7,8,9-Hexachlorodibenzofuran (KG/MJ)	FD8	P817	P751*P574	3.07E-13
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (KG/MJ)	FD9	P818	P752*P574	4.77E-13
1,2,3,7,8-Pentachlorodibenzofuran (KG/MJ)	FD10	P819	P753*P574	1.28E-12
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (KG/MJ)	FD11	P820	P754*P574	3.58E-13
2,3,4,6,7,8-Hexachlorodibenzofuran (KG/MJ)	FD12	P821	P755*P574	1.31E-12
2,3,4,7,8-Pentachlorodibenzofuran (KG/MJ)	FD13	P822	P756*P574	9.37E-13
2,3,7,8-Tetrachlorodibenzofuran (KG/MJ)	FD14	P823	P757*P574	2.68E-12

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (KG/MJ)	FD15	P824	P758*P574	8.01E-13
Chromium (Cr3+) (KG/MJ)	Cr3	P825	P759*P574	3.16E-06
Chromium (Cr6+) (KG/MJ)	Cr6	P826	P760*P574	1.63E-06
Manganese (KG/MJ)	Mn	P827	P761*P574	1.6E-06
Mercury (divalent gaseous) (KG/MJ)	divHg	P828	P762*P574	7.58E-09
Mercury (elemental gaseous) (KG/MJ)	elHg	P829	P763*P574	7.98E-08
Mercury (particulate) (KG/MJ)	partHg	P830	P764*P574	3.11E-10
Nickel (KG/MJ)	Ni	P831	P765*P574	3.49E-06
Octachlorodibenzofuran (KG/MJ)	FD16	P832	P766*P574	1.33E-11
Octachlorodibenzo-p-dioxin (KG/MJ)	FD17	P833	P767*P574	4.55E-11
Acenaphthene (KG/MJ)	HAP1	P834	P768*P484	1.97E-08
Acenaphthylene (KG/MJ)	HAP2	P835	P769*P484	1.11E-07
Anthracene (KG/MJ)	HAP3	P836	P770*P484	2.29E-08
Arsenic & compounds (KG/MJ)	HAP4	P837	P771*P484	1.11E-09
Benz(a)anthracene (KG/MJ)	HAP5	P838	P772*P484	2.7E-09
Benzo(a)pyrene (KG/MJ)	HAP6	P839	P773*P484	2.7E-09
Benzo(b)fluoranthene (KG/MJ)	HAP7	P840	P774*P484	3.24E-09
Benzo(g,h,i)perylene (KG/MJ)	HAP8	P841	P775*P484	7.02E-09
Benzo(k)fluoranthene (KG/MJ)	HAP9	P842	P776*P484	3.24E-09
Chrysene (KG/MJ)	HAP10	P843	P777*P484	2.7E-09
Dibenzo(a,h)anthracene (KG/MJ)	HAP11	P844	P778*P484	0
Fluoranthene (KG/MJ)	HAP12	P845	P779*P484	2.46E-08
Fluorene (KG/MJ)	HAP13	P846	P780*P484	4.08E-08
Indeno(1,2,3,c,d)pyrene (KG/MJ)	HAP14	P847	P781*P484	2.16E-09
Naphthalene (KG/MJ)	HAP15	P848	P782*P484	2.45E-06
Phenanthrene (KG/MJ)	HAP16	P849	P783*P484	6.86E-08
Pyrene (KG/MJ)	HAP17	P850	P784*P484	3.35E-08
1,3-Butadiene (KG/MJ)	HAP18	P851	P785*P736*P545	2.48E-05
2,2,4-Trimethylpentane (KG/MJ)	HAP19	P852	P786*P736*P545+P797*P741*P557	9.26E-05
Acetaldehyde (KG/MJ)	HAP20	P853	P787*P736*P545	2.13E-05
Acrolein (KG/MJ)	HAP21	P854	P788*P736*P545	1.8E-06
Benzene (KG/MJ)	HAP22	P855	P789*P736*P545+P798*P741*P557	0.000157
Ethyl Benzene (KG/MJ)	HAP23	P856	P790*P736*P545+P799*P741*P557	5.91E-05
Formaldehyde (KG/MJ)	HAP24	P857	P791*P736*P545	4.15E-05
Hexane (KG/MJ)	HAP25	P858	P792*P736*P545+P800*P741*P557	5.14E-05
Propionaldehyde (KG/MJ)	HAP26	P859	P793*P736*P545	4.85E-06
Styrene (KG/MJ)	HAP27	P860	P794*P736*P545	1.8E-06
Toluene (KG/MJ)	HAP28	P861	P795*P736*P545+P801*P741*P557	0.000223
Xylene (KG/MJ)	HAP29	P862	P796*P736*P545+P802*P741*P557	0.000193

Parameter Description	Descriptive and numbered parameter names		Mathematical relation (blanks are raw data)	Resulting value
N2O emission factor (kg/kg fuel) (KG/KG)	N2OEF	P863		0.00008
Equipment N2O emissions kg N (KG/MJ)	N2O	P864	P863*P572	1.01E-05

Appendix C: Example parameterization of self-propelled fleet datasets

Data represent the dataset "work; balers, 2009 fleet, all fuels; 25-300HP at 12-28C"

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Population of 25 to 40HP 4-StrBalers (Tech_1)	p1_T1		2.56E+02
Population of 40 to 50HP Dsl -Balers (Tech_2)	p1_T2		2.95E+00
Population of 50 to 75HP 4-StrBalers (Tech_3)	p1_T3		8.21E+01
Population of 50 to 75HP Dsl -Balers (Tech_4)	p1_T4		6.31E+01
Population of 75 to 100HP Dsl -Balers (Tech_5)	p1_T5		2.33E+01
Population of 100 to 175HP 4-StrBalers (Tech_6)	p1_T6		9.32E+00
Population of 100 to 175HP Dsl -Balers (Tech_7)	p1_T7		1.98E+01
Population of 175 to 300HP Dsl -Balers (Tech_8)	p1_T8		9.84E-01
Sum of the individual technology populations	p2_GLOBALPOP	p1_T1+p1_T2+p1_T3+p1_T4+p1_T5+p1_T6+p1_T7+p1_T8	4.58E+02
Tech_1 population fraction with model year of 2009	p3_POPTech_1_2009		4.73E-02
Tech_1 population fraction with model year of 2008	p3_POPTech_1_2008		4.64E-02
Tech_1 population fraction with model year of 2007	p3_POPTech_1_2007		4.55E-02
Tech_1 population fraction with model year of 2006	p3_POPTech_1_2006		4.45E-02
Tech_1 population fraction with model year of 2005	p3_POPTech_1_2005		4.36E-02
Tech_1 population fraction with model year of 2004	p3_POPTech_1_2004		4.27E-02
Tech_1 population fraction with model year of 2003	p3_POPTech_1_2003		4.18E-02
Tech_1 population fraction with model year of 2002	p3_POPTech_1_2002		4.09E-02
Tech_1 population fraction with model year of 2001	p3_POPTech_1_2001		3.99E-02
Tech_1 population fraction with model year of 2000	p3_POPTech_1_2000		3.91E-02
Tech_1 population fraction with model year of 1999	p3_POPTech_1_1999		3.81E-02
Tech_1 population fraction with model year of 1998	p3_POPTech_1_1998		3.77E-02
Tech_1 population fraction with model year of 1997	p3_POPTech_1_1997		3.67E-02
Tech_1 population fraction with model year of 1996	p3_POPTech_1_1996		3.57E-02
Tech_1 population fraction with model year of 1995	p3_POPTech_1_1995		3.48E-02
Tech_1 population fraction with model year of 1994	p3_POPTech_1_1994		3.38E-02
Tech_1 population fraction with model year of 1993	p3_POPTech_1_1993		3.27E-02
Tech_1 population fraction with model year of 1992	p3_POPTech_1_1992		3.17E-02
Tech_1 population fraction with model year of 1991	p3_POPTech_1_1991		3.06E-02
Tech_1 population fraction with model year of 1990	p3_POPTech_1_1990		2.96E-02
Tech_1 population fraction with model year of 1989	p3_POPTech_1_1989		2.84E-02
Tech_1 population fraction with model year of 1988	p3_POPTech_1_1988		2.72E-02
Tech_1 population fraction with model year of 1987	p3_POPTech_1_1987		2.59E-02
Tech_1 population fraction with model year of 1986	p3_POPTech_1_1986		2.43E-02
Tech_1 population fraction with model year of 1985	p3_POPTech_1_1985		2.24E-02
Tech_1 population fraction with model year of 1984	p3_POPTech_1_1984		1.64E-02
Tech_1 population fraction with model year of 1983	p3_POPTech_1_1983		1.06E-02
Tech_1 population fraction with model year of 1982	p3_POPTech_1_1982		8.99E-03
Tech_1 population fraction with model year of 1981	p3_POPTech_1_1981		7.85E-03
Tech_1 population fraction with model year of 1980	p3_POPTech_1_1980		6.94E-03
Tech_1 population fraction with model year of 1979	p3_POPTech_1_1979		6.18E-03
Tech_1 population fraction with model year of 1978	p3_POPTech_1_1978		5.52E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_1 population fraction with model year of 1977	p3_POPTech_1_1977		4.94E-03
Tech_1 population fraction with model year of 1976	p3_POPTech_1_1976		4.42E-03
Tech_1 population fraction with model year of 1975	p3_POPTech_1_1975		3.95E-03
Tech_1 population fraction with model year of 1974	p3_POPTech_1_1974		3.52E-03
Tech_1 population fraction with model year of 1973	p3_POPTech_1_1973		3.13E-03
Tech_1 population fraction with model year of 1972	p3_POPTech_1_1972		2.77E-03
Tech_1 population fraction with model year of 1971	p3_POPTech_1_1971		2.44E-03
Tech_1 population fraction with model year of 1970	p3_POPTech_1_1970		2.14E-03
Tech_1 population fraction with model year of 1969	p3_POPTech_1_1969		1.86E-03
Tech_1 population fraction with model year of 1968	p3_POPTech_1_1968		1.60E-03
Tech_1 population fraction with model year of 1967	p3_POPTech_1_1967		1.36E-03
Tech_1 population fraction with model year of 1966	p3_POPTech_1_1966		1.13E-03
Tech_1 population fraction with model year of 1965	p3_POPTech_1_1965		9.30E-04
Tech_1 population fraction with model year of 1964	p3_POPTech_1_1964		7.41E-04
Tech_1 population fraction with model year of 1963	p3_POPTech_1_1963		5.66E-04
Tech_1 population fraction with model year of 1962	p3_POPTech_1_1962		4.06E-04
Tech_1 population fraction with model year of 1961	p3_POPTech_1_1961		2.58E-04
Tech_1 population fraction with model year of 1960	p3_POPTech_1_1960		1.23E-04
Tech_1 population fraction with model year of 1959	p3_POPTech_1_1959		5.87E-18
Tech_2 population fraction with model year of 2009	p3_POPTech_2_2009		4.97E-02
Tech_2 population fraction with model year of 2008	p3_POPTech_2_2008		4.84E-02
Tech_2 population fraction with model year of 2007	p3_POPTech_2_2007		4.71E-02
Tech_2 population fraction with model year of 2006	p3_POPTech_2_2006		4.58E-02
Tech_2 population fraction with model year of 2005	p3_POPTech_2_2005		4.48E-02
Tech_2 population fraction with model year of 2004	p3_POPTech_2_2004		4.36E-02
Tech_2 population fraction with model year of 2003	p3_POPTech_2_2003		4.23E-02
Tech_2 population fraction with model year of 2002	p3_POPTech_2_2002		4.10E-02
Tech_2 population fraction with model year of 2001	p3_POPTech_2_2001		3.97E-02
Tech_2 population fraction with model year of 2000	p3_POPTech_2_2000		4.28E-02
Tech_2 population fraction with model year of 1999	p3_POPTech_2_1999		4.14E-02
Tech_2 population fraction with model year of 1998	p3_POPTech_2_1998		4.01E-02
Tech_2 population fraction with model year of 1997	p3_POPTech_2_1997		3.87E-02
Tech_2 population fraction with model year of 1996	p3_POPTech_2_1996		3.74E-02
Tech_2 population fraction with model year of 1995	p3_POPTech_2_1995		3.60E-02
Tech_2 population fraction with model year of 1994	p3_POPTech_2_1994		3.47E-02
Tech_2 population fraction with model year of 1993	p3_POPTech_2_1993		3.33E-02
Tech_2 population fraction with model year of 1992	p3_POPTech_2_1992		3.19E-02
Tech_2 population fraction with model year of 1991	p3_POPTech_2_1991		3.05E-02
Tech_2 population fraction with model year of 1990	p3_POPTech_2_1990		2.91E-02
Tech_2 population fraction with model year of 1989	p3_POPTech_2_1989		2.76E-02
Tech_2 population fraction with model year of 1988	p3_POPTech_2_1988		2.61E-02
Tech_2 population fraction with model year of 1987	p3_POPTech_2_1987		2.45E-02
Tech_2 population fraction with model year of 1986	p3_POPTech_2_1986		2.28E-02
Tech_2 population fraction with model year of 1985	p3_POPTech_2_1985		2.07E-02
Tech_2 population fraction with model year of 1984	p3_POPTech_2_1984		1.49E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_2 population fraction with model year of 1983	p3_POPTech_2_1983		9.50E-03
Tech_2 population fraction with model year of 1982	p3_POPTech_2_1982		7.93E-03
Tech_2 population fraction with model year of 1981	p3_POPTech_2_1981		6.80E-03
Tech_2 population fraction with model year of 1980	p3_POPTech_2_1980		5.91E-03
Tech_2 population fraction with model year of 1979	p3_POPTech_2_1979		5.16E-03
Tech_2 population fraction with model year of 1978	p3_POPTech_2_1978		4.51E-03
Tech_2 population fraction with model year of 1977	p3_POPTech_2_1977		3.95E-03
Tech_2 population fraction with model year of 1976	p3_POPTech_2_1976		3.45E-03
Tech_2 population fraction with model year of 1975	p3_POPTech_2_1975		3.01E-03
Tech_2 population fraction with model year of 1974	p3_POPTech_2_1974		2.61E-03
Tech_2 population fraction with model year of 1973	p3_POPTech_2_1973		2.25E-03
Tech_2 population fraction with model year of 1972	p3_POPTech_2_1972		1.93E-03
Tech_2 population fraction with model year of 1971	p3_POPTech_2_1971		1.65E-03
Tech_2 population fraction with model year of 1970	p3_POPTech_2_1970		1.39E-03
Tech_2 population fraction with model year of 1969	p3_POPTech_2_1969		1.16E-03
Tech_2 population fraction with model year of 1968	p3_POPTech_2_1968		9.54E-04
Tech_2 population fraction with model year of 1967	p3_POPTech_2_1967		7.72E-04
Tech_2 population fraction with model year of 1966	p3_POPTech_2_1966		6.11E-04
Tech_2 population fraction with model year of 1965	p3_POPTech_2_1965		4.71E-04
Tech_2 population fraction with model year of 1964	p3_POPTech_2_1964		3.51E-04
Tech_2 population fraction with model year of 1963	p3_POPTech_2_1963		2.48E-04
Tech_2 population fraction with model year of 1962	p3_POPTech_2_1962		1.62E-04
Tech_2 population fraction with model year of 1961	p3_POPTech_2_1961		9.28E-05
Tech_2 population fraction with model year of 1960	p3_POPTech_2_1960		3.90E-05
Tech_2 population fraction with model year of 1959	p3_POPTech_2_1959		1.59E-18
Tech_3 population fraction with model year of 2009	p3_POPTech_3_2009		4.73E-02
Tech_3 population fraction with model year of 2008	p3_POPTech_3_2008		4.64E-02
Tech_3 population fraction with model year of 2007	p3_POPTech_3_2007		4.55E-02
Tech_3 population fraction with model year of 2006	p3_POPTech_3_2006		4.45E-02
Tech_3 population fraction with model year of 2005	p3_POPTech_3_2005		4.36E-02
Tech_3 population fraction with model year of 2004	p3_POPTech_3_2004		4.27E-02
Tech_3 population fraction with model year of 2003	p3_POPTech_3_2003		4.18E-02
Tech_3 population fraction with model year of 2002	p3_POPTech_3_2002		4.09E-02
Tech_3 population fraction with model year of 2001	p3_POPTech_3_2001		3.99E-02
Tech_3 population fraction with model year of 2000	p3_POPTech_3_2000		3.91E-02
Tech_3 population fraction with model year of 1999	p3_POPTech_3_1999		3.81E-02
Tech_3 population fraction with model year of 1998	p3_POPTech_3_1998		3.77E-02
Tech_3 population fraction with model year of 1997	p3_POPTech_3_1997		3.67E-02
Tech_3 population fraction with model year of 1996	p3_POPTech_3_1996		3.57E-02
Tech_3 population fraction with model year of 1995	p3_POPTech_3_1995		3.48E-02
Tech_3 population fraction with model year of 1994	p3_POPTech_3_1994		3.38E-02
Tech_3 population fraction with model year of 1993	p3_POPTech_3_1993		3.27E-02
Tech_3 population fraction with model year of 1992	p3_POPTech_3_1992		3.17E-02
Tech_3 population fraction with model year of 1991	p3_POPTech_3_1991		3.06E-02
Tech_3 population fraction with model year of 1990	p3_POPTech_3_1990		2.96E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_3 population fraction with model year of 1989	p3_POPTech_3_1989		2.84E-02
Tech_3 population fraction with model year of 1988	p3_POPTech_3_1988		2.72E-02
Tech_3 population fraction with model year of 1987	p3_POPTech_3_1987		2.59E-02
Tech_3 population fraction with model year of 1986	p3_POPTech_3_1986		2.43E-02
Tech_3 population fraction with model year of 1985	p3_POPTech_3_1985		2.24E-02
Tech_3 population fraction with model year of 1984	p3_POPTech_3_1984		1.64E-02
Tech_3 population fraction with model year of 1983	p3_POPTech_3_1983		1.06E-02
Tech_3 population fraction with model year of 1982	p3_POPTech_3_1982		8.99E-03
Tech_3 population fraction with model year of 1981	p3_POPTech_3_1981		7.85E-03
Tech_3 population fraction with model year of 1980	p3_POPTech_3_1980		6.94E-03
Tech_3 population fraction with model year of 1979	p3_POPTech_3_1979		6.18E-03
Tech_3 population fraction with model year of 1978	p3_POPTech_3_1978		5.52E-03
Tech_3 population fraction with model year of 1977	p3_POPTech_3_1977		4.94E-03
Tech_3 population fraction with model year of 1976	p3_POPTech_3_1976		4.42E-03
Tech_3 population fraction with model year of 1975	p3_POPTech_3_1975		3.95E-03
Tech_3 population fraction with model year of 1974	p3_POPTech_3_1974		3.52E-03
Tech_3 population fraction with model year of 1973	p3_POPTech_3_1973		3.13E-03
Tech_3 population fraction with model year of 1972	p3_POPTech_3_1972		2.77E-03
Tech_3 population fraction with model year of 1971	p3_POPTech_3_1971		2.44E-03
Tech_3 population fraction with model year of 1970	p3_POPTech_3_1970		2.14E-03
Tech_3 population fraction with model year of 1969	p3_POPTech_3_1969		1.86E-03
Tech_3 population fraction with model year of 1968	p3_POPTech_3_1968		1.60E-03
Tech_3 population fraction with model year of 1967	p3_POPTech_3_1967		1.36E-03
Tech_3 population fraction with model year of 1966	p3_POPTech_3_1966		1.13E-03
Tech_3 population fraction with model year of 1965	p3_POPTech_3_1965		9.30E-04
Tech_3 population fraction with model year of 1964	p3_POPTech_3_1964		7.41E-04
Tech_3 population fraction with model year of 1963	p3_POPTech_3_1963		5.66E-04
Tech_3 population fraction with model year of 1962	p3_POPTech_3_1962		4.06E-04
Tech_3 population fraction with model year of 1961	p3_POPTech_3_1961		2.58E-04
Tech_3 population fraction with model year of 1960	p3_POPTech_3_1960		1.23E-04
Tech_3 population fraction with model year of 1959	p3_POPTech_3_1959		5.87E-18
Tech_4 population fraction with model year of 2009	p3_POPTech_4_2009		4.97E-02
Tech_4 population fraction with model year of 2008	p3_POPTech_4_2008		4.84E-02
Tech_4 population fraction with model year of 2007	p3_POPTech_4_2007		4.71E-02
Tech_4 population fraction with model year of 2006	p3_POPTech_4_2006		4.58E-02
Tech_4 population fraction with model year of 2005	p3_POPTech_4_2005		4.48E-02
Tech_4 population fraction with model year of 2004	p3_POPTech_4_2004		4.36E-02
Tech_4 population fraction with model year of 2003	p3_POPTech_4_2003		4.23E-02
Tech_4 population fraction with model year of 2002	p3_POPTech_4_2002		4.10E-02
Tech_4 population fraction with model year of 2001	p3_POPTech_4_2001		3.97E-02
Tech_4 population fraction with model year of 2000	p3_POPTech_4_2000		4.28E-02
Tech_4 population fraction with model year of 1999	p3_POPTech_4_1999		4.14E-02
Tech_4 population fraction with model year of 1998	p3_POPTech_4_1998		4.01E-02
Tech_4 population fraction with model year of 1997	p3_POPTech_4_1997		3.87E-02
Tech_4 population fraction with model year of 1996	p3_POPTech_4_1996		3.74E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_4 population fraction with model year of 1995	p3_POPTech_4_1995		3.60E-02
Tech_4 population fraction with model year of 1994	p3_POPTech_4_1994		3.47E-02
Tech_4 population fraction with model year of 1993	p3_POPTech_4_1993		3.33E-02
Tech_4 population fraction with model year of 1992	p3_POPTech_4_1992		3.19E-02
Tech_4 population fraction with model year of 1991	p3_POPTech_4_1991		3.05E-02
Tech_4 population fraction with model year of 1990	p3_POPTech_4_1990		2.91E-02
Tech_4 population fraction with model year of 1989	p3_POPTech_4_1989		2.76E-02
Tech_4 population fraction with model year of 1988	p3_POPTech_4_1988		2.61E-02
Tech_4 population fraction with model year of 1987	p3_POPTech_4_1987		2.45E-02
Tech_4 population fraction with model year of 1986	p3_POPTech_4_1986		2.28E-02
Tech_4 population fraction with model year of 1985	p3_POPTech_4_1985		2.07E-02
Tech_4 population fraction with model year of 1984	p3_POPTech_4_1984		1.49E-02
Tech_4 population fraction with model year of 1983	p3_POPTech_4_1983		9.50E-03
Tech_4 population fraction with model year of 1982	p3_POPTech_4_1982		7.93E-03
Tech_4 population fraction with model year of 1981	p3_POPTech_4_1981		6.80E-03
Tech_4 population fraction with model year of 1980	p3_POPTech_4_1980		5.91E-03
Tech_4 population fraction with model year of 1979	p3_POPTech_4_1979		5.16E-03
Tech_4 population fraction with model year of 1978	p3_POPTech_4_1978		4.51E-03
Tech_4 population fraction with model year of 1977	p3_POPTech_4_1977		3.95E-03
Tech_4 population fraction with model year of 1976	p3_POPTech_4_1976		3.45E-03
Tech_4 population fraction with model year of 1975	p3_POPTech_4_1975		3.01E-03
Tech_4 population fraction with model year of 1974	p3_POPTech_4_1974		2.61E-03
Tech_4 population fraction with model year of 1973	p3_POPTech_4_1973		2.25E-03
Tech_4 population fraction with model year of 1972	p3_POPTech_4_1972		1.93E-03
Tech_4 population fraction with model year of 1971	p3_POPTech_4_1971		1.65E-03
Tech_4 population fraction with model year of 1970	p3_POPTech_4_1970		1.39E-03
Tech_4 population fraction with model year of 1969	p3_POPTech_4_1969		1.16E-03
Tech_4 population fraction with model year of 1968	p3_POPTech_4_1968		9.54E-04
Tech_4 population fraction with model year of 1967	p3_POPTech_4_1967		7.72E-04
Tech_4 population fraction with model year of 1966	p3_POPTech_4_1966		6.11E-04
Tech_4 population fraction with model year of 1965	p3_POPTech_4_1965		4.71E-04
Tech_4 population fraction with model year of 1964	p3_POPTech_4_1964		3.51E-04
Tech_4 population fraction with model year of 1963	p3_POPTech_4_1963		2.48E-04
Tech_4 population fraction with model year of 1962	p3_POPTech_4_1962		1.62E-04
Tech_4 population fraction with model year of 1961	p3_POPTech_4_1961		9.28E-05
Tech_4 population fraction with model year of 1960	p3_POPTech_4_1960		3.90E-05
Tech_4 population fraction with model year of 1959	p3_POPTech_4_1959		1.59E-18
Tech_5 population fraction with model year of 2009	p3_POPTech_5_2009		4.97E-02
Tech_5 population fraction with model year of 2008	p3_POPTech_5_2008		4.84E-02
Tech_5 population fraction with model year of 2007	p3_POPTech_5_2007		4.71E-02
Tech_5 population fraction with model year of 2006	p3_POPTech_5_2006		4.58E-02
Tech_5 population fraction with model year of 2005	p3_POPTech_5_2005		4.48E-02
Tech_5 population fraction with model year of 2004	p3_POPTech_5_2004		4.36E-02
Tech_5 population fraction with model year of 2003	p3_POPTech_5_2003		4.23E-02
Tech_5 population fraction with model year of 2002	p3_POPTech_5_2002		4.10E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_5 population fraction with model year of 2001	p3_POPTech_5_2001		3.97E-02
Tech_5 population fraction with model year of 2000	p3_POPTech_5_2000		4.28E-02
Tech_5 population fraction with model year of 1999	p3_POPTech_5_1999		4.14E-02
Tech_5 population fraction with model year of 1998	p3_POPTech_5_1998		4.01E-02
Tech_5 population fraction with model year of 1997	p3_POPTech_5_1997		3.87E-02
Tech_5 population fraction with model year of 1996	p3_POPTech_5_1996		3.74E-02
Tech_5 population fraction with model year of 1995	p3_POPTech_5_1995		3.60E-02
Tech_5 population fraction with model year of 1994	p3_POPTech_5_1994		3.47E-02
Tech_5 population fraction with model year of 1993	p3_POPTech_5_1993		3.33E-02
Tech_5 population fraction with model year of 1992	p3_POPTech_5_1992		3.19E-02
Tech_5 population fraction with model year of 1991	p3_POPTech_5_1991		3.05E-02
Tech_5 population fraction with model year of 1990	p3_POPTech_5_1990		2.91E-02
Tech_5 population fraction with model year of 1989	p3_POPTech_5_1989		2.76E-02
Tech_5 population fraction with model year of 1988	p3_POPTech_5_1988		2.61E-02
Tech_5 population fraction with model year of 1987	p3_POPTech_5_1987		2.45E-02
Tech_5 population fraction with model year of 1986	p3_POPTech_5_1986		2.28E-02
Tech_5 population fraction with model year of 1985	p3_POPTech_5_1985		2.07E-02
Tech_5 population fraction with model year of 1984	p3_POPTech_5_1984		1.49E-02
Tech_5 population fraction with model year of 1983	p3_POPTech_5_1983		9.50E-03
Tech_5 population fraction with model year of 1982	p3_POPTech_5_1982		7.93E-03
Tech_5 population fraction with model year of 1981	p3_POPTech_5_1981		6.80E-03
Tech_5 population fraction with model year of 1980	p3_POPTech_5_1980		5.91E-03
Tech_5 population fraction with model year of 1979	p3_POPTech_5_1979		5.16E-03
Tech_5 population fraction with model year of 1978	p3_POPTech_5_1978		4.51E-03
Tech_5 population fraction with model year of 1977	p3_POPTech_5_1977		3.95E-03
Tech_5 population fraction with model year of 1976	p3_POPTech_5_1976		3.45E-03
Tech_5 population fraction with model year of 1975	p3_POPTech_5_1975		3.01E-03
Tech_5 population fraction with model year of 1974	p3_POPTech_5_1974		2.61E-03
Tech_5 population fraction with model year of 1973	p3_POPTech_5_1973		2.25E-03
Tech_5 population fraction with model year of 1972	p3_POPTech_5_1972		1.93E-03
Tech_5 population fraction with model year of 1971	p3_POPTech_5_1971		1.65E-03
Tech_5 population fraction with model year of 1970	p3_POPTech_5_1970		1.39E-03
Tech_5 population fraction with model year of 1969	p3_POPTech_5_1969		1.16E-03
Tech_5 population fraction with model year of 1968	p3_POPTech_5_1968		9.54E-04
Tech_5 population fraction with model year of 1967	p3_POPTech_5_1967		7.72E-04
Tech_5 population fraction with model year of 1966	p3_POPTech_5_1966		6.11E-04
Tech_5 population fraction with model year of 1965	p3_POPTech_5_1965		4.71E-04
Tech_5 population fraction with model year of 1964	p3_POPTech_5_1964		3.51E-04
Tech_5 population fraction with model year of 1963	p3_POPTech_5_1963		2.48E-04
Tech_5 population fraction with model year of 1962	p3_POPTech_5_1962		1.62E-04
Tech_5 population fraction with model year of 1961	p3_POPTech_5_1961		9.28E-05
Tech_5 population fraction with model year of 1960	p3_POPTech_5_1960		3.90E-05
Tech_5 population fraction with model year of 1959	p3_POPTech_5_1959		1.59E-18
Tech_6 population fraction with model year of 2009	p3_POPTech_6_2009		4.73E-02
Tech_6 population fraction with model year of 2008	p3_POPTech_6_2008		4.64E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_6 population fraction with model year of 2007	p3_POPTech_6_2007		4.55E-02
Tech_6 population fraction with model year of 2006	p3_POPTech_6_2006		4.45E-02
Tech_6 population fraction with model year of 2005	p3_POPTech_6_2005		4.36E-02
Tech_6 population fraction with model year of 2004	p3_POPTech_6_2004		4.27E-02
Tech_6 population fraction with model year of 2003	p3_POPTech_6_2003		4.18E-02
Tech_6 population fraction with model year of 2002	p3_POPTech_6_2002		4.09E-02
Tech_6 population fraction with model year of 2001	p3_POPTech_6_2001		3.99E-02
Tech_6 population fraction with model year of 2000	p3_POPTech_6_2000		3.91E-02
Tech_6 population fraction with model year of 1999	p3_POPTech_6_1999		3.81E-02
Tech_6 population fraction with model year of 1998	p3_POPTech_6_1998		3.77E-02
Tech_6 population fraction with model year of 1997	p3_POPTech_6_1997		3.67E-02
Tech_6 population fraction with model year of 1996	p3_POPTech_6_1996		3.57E-02
Tech_6 population fraction with model year of 1995	p3_POPTech_6_1995		3.48E-02
Tech_6 population fraction with model year of 1994	p3_POPTech_6_1994		3.38E-02
Tech_6 population fraction with model year of 1993	p3_POPTech_6_1993		3.27E-02
Tech_6 population fraction with model year of 1992	p3_POPTech_6_1992		3.17E-02
Tech_6 population fraction with model year of 1991	p3_POPTech_6_1991		3.06E-02
Tech_6 population fraction with model year of 1990	p3_POPTech_6_1990		2.96E-02
Tech_6 population fraction with model year of 1989	p3_POPTech_6_1989		2.84E-02
Tech_6 population fraction with model year of 1988	p3_POPTech_6_1988		2.72E-02
Tech_6 population fraction with model year of 1987	p3_POPTech_6_1987		2.59E-02
Tech_6 population fraction with model year of 1986	p3_POPTech_6_1986		2.43E-02
Tech_6 population fraction with model year of 1985	p3_POPTech_6_1985		2.24E-02
Tech_6 population fraction with model year of 1984	p3_POPTech_6_1984		1.64E-02
Tech_6 population fraction with model year of 1983	p3_POPTech_6_1983		1.06E-02
Tech_6 population fraction with model year of 1982	p3_POPTech_6_1982		8.99E-03
Tech_6 population fraction with model year of 1981	p3_POPTech_6_1981		7.85E-03
Tech_6 population fraction with model year of 1980	p3_POPTech_6_1980		6.94E-03
Tech_6 population fraction with model year of 1979	p3_POPTech_6_1979		6.18E-03
Tech_6 population fraction with model year of 1978	p3_POPTech_6_1978		5.52E-03
Tech_6 population fraction with model year of 1977	p3_POPTech_6_1977		4.94E-03
Tech_6 population fraction with model year of 1976	p3_POPTech_6_1976		4.42E-03
Tech_6 population fraction with model year of 1975	p3_POPTech_6_1975		3.95E-03
Tech_6 population fraction with model year of 1974	p3_POPTech_6_1974		3.52E-03
Tech_6 population fraction with model year of 1973	p3_POPTech_6_1973		3.13E-03
Tech_6 population fraction with model year of 1972	p3_POPTech_6_1972		2.77E-03
Tech_6 population fraction with model year of 1971	p3_POPTech_6_1971		2.44E-03
Tech_6 population fraction with model year of 1970	p3_POPTech_6_1970		2.14E-03
Tech_6 population fraction with model year of 1969	p3_POPTech_6_1969		1.86E-03
Tech_6 population fraction with model year of 1968	p3_POPTech_6_1968		1.60E-03
Tech_6 population fraction with model year of 1967	p3_POPTech_6_1967		1.36E-03
Tech_6 population fraction with model year of 1966	p3_POPTech_6_1966		1.13E-03
Tech_6 population fraction with model year of 1965	p3_POPTech_6_1965		9.30E-04
Tech_6 population fraction with model year of 1964	p3_POPTech_6_1964		7.41E-04
Tech_6 population fraction with model year of 1963	p3_POPTech_6_1963		5.66E-04

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_6 population fraction with model year of 1962	p3_POPTech_6_1962		4.06E-04
Tech_6 population fraction with model year of 1961	p3_POPTech_6_1961		2.58E-04
Tech_6 population fraction with model year of 1960	p3_POPTech_6_1960		1.23E-04
Tech_6 population fraction with model year of 1959	p3_POPTech_6_1959		5.87E-18
Tech_7 population fraction with model year of 2009	p3_POPTech_7_2009		4.97E-02
Tech_7 population fraction with model year of 2008	p3_POPTech_7_2008		4.84E-02
Tech_7 population fraction with model year of 2007	p3_POPTech_7_2007		4.71E-02
Tech_7 population fraction with model year of 2006	p3_POPTech_7_2006		4.58E-02
Tech_7 population fraction with model year of 2005	p3_POPTech_7_2005		4.48E-02
Tech_7 population fraction with model year of 2004	p3_POPTech_7_2004		4.36E-02
Tech_7 population fraction with model year of 2003	p3_POPTech_7_2003		4.23E-02
Tech_7 population fraction with model year of 2002	p3_POPTech_7_2002		4.10E-02
Tech_7 population fraction with model year of 2001	p3_POPTech_7_2001		3.97E-02
Tech_7 population fraction with model year of 2000	p3_POPTech_7_2000		4.28E-02
Tech_7 population fraction with model year of 1999	p3_POPTech_7_1999		4.14E-02
Tech_7 population fraction with model year of 1998	p3_POPTech_7_1998		4.01E-02
Tech_7 population fraction with model year of 1997	p3_POPTech_7_1997		3.87E-02
Tech_7 population fraction with model year of 1996	p3_POPTech_7_1996		3.74E-02
Tech_7 population fraction with model year of 1995	p3_POPTech_7_1995		3.60E-02
Tech_7 population fraction with model year of 1994	p3_POPTech_7_1994		3.47E-02
Tech_7 population fraction with model year of 1993	p3_POPTech_7_1993		3.33E-02
Tech_7 population fraction with model year of 1992	p3_POPTech_7_1992		3.19E-02
Tech_7 population fraction with model year of 1991	p3_POPTech_7_1991		3.05E-02
Tech_7 population fraction with model year of 1990	p3_POPTech_7_1990		2.91E-02
Tech_7 population fraction with model year of 1989	p3_POPTech_7_1989		2.76E-02
Tech_7 population fraction with model year of 1988	p3_POPTech_7_1988		2.61E-02
Tech_7 population fraction with model year of 1987	p3_POPTech_7_1987		2.45E-02
Tech_7 population fraction with model year of 1986	p3_POPTech_7_1986		2.28E-02
Tech_7 population fraction with model year of 1985	p3_POPTech_7_1985		2.07E-02
Tech_7 population fraction with model year of 1984	p3_POPTech_7_1984		1.49E-02
Tech_7 population fraction with model year of 1983	p3_POPTech_7_1983		9.50E-03
Tech_7 population fraction with model year of 1982	p3_POPTech_7_1982		7.93E-03
Tech_7 population fraction with model year of 1981	p3_POPTech_7_1981		6.80E-03
Tech_7 population fraction with model year of 1980	p3_POPTech_7_1980		5.91E-03
Tech_7 population fraction with model year of 1979	p3_POPTech_7_1979		5.16E-03
Tech_7 population fraction with model year of 1978	p3_POPTech_7_1978		4.51E-03
Tech_7 population fraction with model year of 1977	p3_POPTech_7_1977		3.95E-03
Tech_7 population fraction with model year of 1976	p3_POPTech_7_1976		3.45E-03
Tech_7 population fraction with model year of 1975	p3_POPTech_7_1975		3.01E-03
Tech_7 population fraction with model year of 1974	p3_POPTech_7_1974		2.61E-03
Tech_7 population fraction with model year of 1973	p3_POPTech_7_1973		2.25E-03
Tech_7 population fraction with model year of 1972	p3_POPTech_7_1972		1.93E-03
Tech_7 population fraction with model year of 1971	p3_POPTech_7_1971		1.65E-03
Tech_7 population fraction with model year of 1970	p3_POPTech_7_1970		1.39E-03
Tech_7 population fraction with model year of 1969	p3_POPTech_7_1969		1.16E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_7 population fraction with model year of 1968	p3_POPTech_7_1968		9.54E-04
Tech_7 population fraction with model year of 1967	p3_POPTech_7_1967		7.72E-04
Tech_7 population fraction with model year of 1966	p3_POPTech_7_1966		6.11E-04
Tech_7 population fraction with model year of 1965	p3_POPTech_7_1965		4.71E-04
Tech_7 population fraction with model year of 1964	p3_POPTech_7_1964		3.51E-04
Tech_7 population fraction with model year of 1963	p3_POPTech_7_1963		2.48E-04
Tech_7 population fraction with model year of 1962	p3_POPTech_7_1962		1.62E-04
Tech_7 population fraction with model year of 1961	p3_POPTech_7_1961		9.28E-05
Tech_7 population fraction with model year of 1960	p3_POPTech_7_1960		3.90E-05
Tech_7 population fraction with model year of 1959	p3_POPTech_7_1959		1.59E-18
Tech_8 population fraction with model year of 2009	p3_POPTech_8_2009		4.97E-02
Tech_8 population fraction with model year of 2008	p3_POPTech_8_2008		4.84E-02
Tech_8 population fraction with model year of 2007	p3_POPTech_8_2007		4.71E-02
Tech_8 population fraction with model year of 2006	p3_POPTech_8_2006		4.58E-02
Tech_8 population fraction with model year of 2005	p3_POPTech_8_2005		4.48E-02
Tech_8 population fraction with model year of 2004	p3_POPTech_8_2004		4.36E-02
Tech_8 population fraction with model year of 2003	p3_POPTech_8_2003		4.23E-02
Tech_8 population fraction with model year of 2002	p3_POPTech_8_2002		4.10E-02
Tech_8 population fraction with model year of 2001	p3_POPTech_8_2001		3.97E-02
Tech_8 population fraction with model year of 2000	p3_POPTech_8_2000		4.28E-02
Tech_8 population fraction with model year of 1999	p3_POPTech_8_1999		4.14E-02
Tech_8 population fraction with model year of 1998	p3_POPTech_8_1998		4.01E-02
Tech_8 population fraction with model year of 1997	p3_POPTech_8_1997		3.87E-02
Tech_8 population fraction with model year of 1996	p3_POPTech_8_1996		3.74E-02
Tech_8 population fraction with model year of 1995	p3_POPTech_8_1995		3.60E-02
Tech_8 population fraction with model year of 1994	p3_POPTech_8_1994		3.47E-02
Tech_8 population fraction with model year of 1993	p3_POPTech_8_1993		3.33E-02
Tech_8 population fraction with model year of 1992	p3_POPTech_8_1992		3.19E-02
Tech_8 population fraction with model year of 1991	p3_POPTech_8_1991		3.05E-02
Tech_8 population fraction with model year of 1990	p3_POPTech_8_1990		2.91E-02
Tech_8 population fraction with model year of 1989	p3_POPTech_8_1989		2.76E-02
Tech_8 population fraction with model year of 1988	p3_POPTech_8_1988		2.61E-02
Tech_8 population fraction with model year of 1987	p3_POPTech_8_1987		2.45E-02
Tech_8 population fraction with model year of 1986	p3_POPTech_8_1986		2.28E-02
Tech_8 population fraction with model year of 1985	p3_POPTech_8_1985		2.07E-02
Tech_8 population fraction with model year of 1984	p3_POPTech_8_1984		1.49E-02
Tech_8 population fraction with model year of 1983	p3_POPTech_8_1983		9.50E-03
Tech_8 population fraction with model year of 1982	p3_POPTech_8_1982		7.93E-03
Tech_8 population fraction with model year of 1981	p3_POPTech_8_1981		6.80E-03
Tech_8 population fraction with model year of 1980	p3_POPTech_8_1980		5.91E-03
Tech_8 population fraction with model year of 1979	p3_POPTech_8_1979		5.16E-03
Tech_8 population fraction with model year of 1978	p3_POPTech_8_1978		4.51E-03
Tech_8 population fraction with model year of 1977	p3_POPTech_8_1977		3.95E-03
Tech_8 population fraction with model year of 1976	p3_POPTech_8_1976		3.45E-03
Tech_8 population fraction with model year of 1975	p3_POPTech_8_1975		3.01E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
Tech_8 population fraction with model year of 1974	p3_POPTech_8_1974		2.61E-03
Tech_8 population fraction with model year of 1973	p3_POPTech_8_1973		2.25E-03
Tech_8 population fraction with model year of 1972	p3_POPTech_8_1972		1.93E-03
Tech_8 population fraction with model year of 1971	p3_POPTech_8_1971		1.65E-03
Tech_8 population fraction with model year of 1970	p3_POPTech_8_1970		1.39E-03
Tech_8 population fraction with model year of 1969	p3_POPTech_8_1969		1.16E-03
Tech_8 population fraction with model year of 1968	p3_POPTech_8_1968		9.54E-04
Tech_8 population fraction with model year of 1967	p3_POPTech_8_1967		7.72E-04
Tech_8 population fraction with model year of 1966	p3_POPTech_8_1966		6.11E-04
Tech_8 population fraction with model year of 1965	p3_POPTech_8_1965		4.71E-04
Tech_8 population fraction with model year of 1964	p3_POPTech_8_1964		3.51E-04
Tech_8 population fraction with model year of 1963	p3_POPTech_8_1963		2.48E-04
Tech_8 population fraction with model year of 1962	p3_POPTech_8_1962		1.62E-04
Tech_8 population fraction with model year of 1961	p3_POPTech_8_1961		9.28E-05
Tech_8 population fraction with model year of 1960	p3_POPTech_8_1960		3.90E-05
Tech_8 population fraction with model year of 1959	p3_POPTech_8_1959		1.59E-18
work; 4str baler, 2009 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2009	p3_POPTech_1_2009*p1_T1/p2_GLOBALPOP	2.65E-02
work; 4str baler, 2008 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2008	p3_POPTech_1_2008*p1_T1/p2_GLOBALPOP	2.60E-02
work; 4str baler, 2007 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2007	p3_POPTech_1_2007*p1_T1/p2_GLOBALPOP	2.55E-02
work; 4str baler, 2006 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2006	p3_POPTech_1_2006*p1_T1/p2_GLOBALPOP	2.49E-02
work; 4str baler, 2005 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2005	p3_POPTech_1_2005*p1_T1/p2_GLOBALPOP	2.44E-02
work; 4str baler, 2004 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2004	p3_POPTech_1_2004*p1_T1/p2_GLOBALPOP	2.39E-02
work; 4str baler, 2003 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2003	p3_POPTech_1_2003*p1_T1/p2_GLOBALPOP	2.34E-02
work; 4str baler, 2002 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2002	p3_POPTech_1_2002*p1_T1/p2_GLOBALPOP	2.29E-02
work; 4str baler, 2001 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2001	p3_POPTech_1_2001*p1_T1/p2_GLOBALPOP	2.24E-02
work; 4str baler, 2000 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_2000	p3_POPTech_1_2000*p1_T1/p2_GLOBALPOP	2.19E-02
work; 4str baler, 1999 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1999	p3_POPTech_1_1999*p1_T1/p2_GLOBALPOP	2.13E-02
work; 4str baler, 1998 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1998	p3_POPTech_1_1998*p1_T1/p2_GLOBALPOP	2.11E-02
work; 4str baler, 1997 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1997	p3_POPTech_1_1997*p1_T1/p2_GLOBALPOP	2.06E-02
work; 4str baler, 1996 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1996	p3_POPTech_1_1996*p1_T1/p2_GLOBALPOP	2.00E-02
work; 4str baler, 1995 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1995	p3_POPTech_1_1995*p1_T1/p2_GLOBALPOP	1.95E-02
work; 4str baler, 1994 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1994	p3_POPTech_1_1994*p1_T1/p2_GLOBALPOP	1.89E-02
work; 4str baler, 1993 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1993	p3_POPTech_1_1993*p1_T1/p2_GLOBALPOP	1.83E-02
work; 4str baler, 1992 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1992	p3_POPTech_1_1992*p1_T1/p2_GLOBALPOP	1.78E-02
work; 4str baler, 1991 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1991	p3_POPTech_1_1991*p1_T1/p2_GLOBALPOP	1.72E-02

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; 4str baler, 1990 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1990	p3_POPTech_1_1990*p1_T1/p2_GLOBALPOP	1.65E-02
work; 4str baler, 1989 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1989	p3_POPTech_1_1989*p1_T1/p2_GLOBALPOP	1.59E-02
work; 4str baler, 1988 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1988	p3_POPTech_1_1988*p1_T1/p2_GLOBALPOP	1.52E-02
work; 4str baler, 1987 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1987	p3_POPTech_1_1987*p1_T1/p2_GLOBALPOP	1.45E-02
work; 4str baler, 1986 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1986	p3_POPTech_1_1986*p1_T1/p2_GLOBALPOP	1.36E-02
work; 4str baler, 1985 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1985	p3_POPTech_1_1985*p1_T1/p2_GLOBALPOP	1.26E-02
work; 4str baler, 1984 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1984	p3_POPTech_1_1984*p1_T1/p2_GLOBALPOP	9.18E-03
work; 4str baler, 1983 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1983	p3_POPTech_1_1983*p1_T1/p2_GLOBALPOP	5.93E-03
work; 4str baler, 1982 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1982	p3_POPTech_1_1982*p1_T1/p2_GLOBALPOP	5.03E-03
work; 4str baler, 1981 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1981	p3_POPTech_1_1981*p1_T1/p2_GLOBALPOP	4.40E-03
work; 4str baler, 1980 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1980	p3_POPTech_1_1980*p1_T1/p2_GLOBALPOP	3.89E-03
work; 4str baler, 1979 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1979	p3_POPTech_1_1979*p1_T1/p2_GLOBALPOP	3.46E-03
work; 4str baler, 1978 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1978	p3_POPTech_1_1978*p1_T1/p2_GLOBALPOP	3.09E-03
work; 4str baler, 1977 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1977	p3_POPTech_1_1977*p1_T1/p2_GLOBALPOP	2.76E-03
work; 4str baler, 1976 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1976	p3_POPTech_1_1976*p1_T1/p2_GLOBALPOP	2.47E-03
work; 4str baler, 1975 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1975	p3_POPTech_1_1975*p1_T1/p2_GLOBALPOP	2.21E-03
work; 4str baler, 1974 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1974	p3_POPTech_1_1974*p1_T1/p2_GLOBALPOP	1.97E-03
work; 4str baler, 1973 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1973	p3_POPTech_1_1973*p1_T1/p2_GLOBALPOP	1.75E-03
work; 4str baler, 1972 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1972	p3_POPTech_1_1972*p1_T1/p2_GLOBALPOP	1.55E-03
work; 4str baler, 1971 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1971	p3_POPTech_1_1971*p1_T1/p2_GLOBALPOP	1.37E-03
work; 4str baler, 1970 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1970	p3_POPTech_1_1970*p1_T1/p2_GLOBALPOP	1.20E-03
work; 4str baler, 1969 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1969	p3_POPTech_1_1969*p1_T1/p2_GLOBALPOP	1.04E-03
work; 4str baler, 1968 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1968	p3_POPTech_1_1968*p1_T1/p2_GLOBALPOP	8.94E-04
work; 4str baler, 1967 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1967	p3_POPTech_1_1967*p1_T1/p2_GLOBALPOP	7.59E-04
work; 4str baler, 1966 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1966	p3_POPTech_1_1966*p1_T1/p2_GLOBALPOP	6.35E-04
work; 4str baler, 1965 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1965	p3_POPTech_1_1965*p1_T1/p2_GLOBALPOP	5.21E-04
work; 4str baler, 1964 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1964	p3_POPTech_1_1964*p1_T1/p2_GLOBALPOP	4.15E-04
work; 4str baler, 1963 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1963	p3_POPTech_1_1963*p1_T1/p2_GLOBALPOP	3.17E-04
work; 4str baler, 1962 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1962	p3_POPTech_1_1962*p1_T1/p2_GLOBALPOP	2.27E-04

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; 4str baler, 1961 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1961	p3_POPTech_1_1961*p1_T1/p2_GLOBALPOP	1.45E-04
work; 4str baler, 1960 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1960	p3_POPTech_1_1960*p1_T1/p2_GLOBALPOP	6.90E-05
work; 4str baler, 1959 model in 2009, DFF; 25-40HP at 12-28C	p4_MJTech_1_1959	p3_POPTech_1_1959*p1_T1/p2_GLOBALPOP	3.29E-18
work; diesel baler, 2009 model in 2009, DFF; 40-50HP	p4_MJTech_2_2009	p3_POPTech_2_2009*p1_T2/p2_GLOBALPOP	3.21E-04
work; diesel baler, 2008 model in 2009, DFF; 40-50HP	p4_MJTech_2_2008	p3_POPTech_2_2008*p1_T2/p2_GLOBALPOP	3.12E-04
work; diesel baler, 2007 model in 2009, DFF; 40-50HP	p4_MJTech_2_2007	p3_POPTech_2_2007*p1_T2/p2_GLOBALPOP	3.04E-04
work; diesel baler, 2006 model in 2009, DFF; 40-50HP	p4_MJTech_2_2006	p3_POPTech_2_2006*p1_T2/p2_GLOBALPOP	2.96E-04
work; diesel baler, 2005 model in 2009, DFF; 40-50HP	p4_MJTech_2_2005	p3_POPTech_2_2005*p1_T2/p2_GLOBALPOP	2.89E-04
work; diesel baler, 2004 model in 2009, DFF; 40-50HP	p4_MJTech_2_2004	p3_POPTech_2_2004*p1_T2/p2_GLOBALPOP	2.81E-04
work; diesel baler, 2003 model in 2009, DFF; 40-50HP	p4_MJTech_2_2003	p3_POPTech_2_2003*p1_T2/p2_GLOBALPOP	2.73E-04
work; diesel baler, 2002 model in 2009, DFF; 40-50HP	p4_MJTech_2_2002	p3_POPTech_2_2002*p1_T2/p2_GLOBALPOP	2.64E-04
work; diesel baler, 2001 model in 2009, DFF; 40-50HP	p4_MJTech_2_2001	p3_POPTech_2_2001*p1_T2/p2_GLOBALPOP	2.56E-04
work; diesel baler, 2000 model in 2009, DFF; 40-50HP	p4_MJTech_2_2000	p3_POPTech_2_2000*p1_T2/p2_GLOBALPOP	2.76E-04
work; diesel baler, 1999 model in 2009, DFF; 40-50HP	p4_MJTech_2_1999	p3_POPTech_2_1999*p1_T2/p2_GLOBALPOP	2.67E-04
work; diesel baler, 1998 model in 2009, DFF; 40-50HP	p4_MJTech_2_1998	p3_POPTech_2_1998*p1_T2/p2_GLOBALPOP	2.58E-04
work; diesel baler, 1997 model in 2009, DFF; 40-50HP	p4_MJTech_2_1997	p3_POPTech_2_1997*p1_T2/p2_GLOBALPOP	2.50E-04
work; diesel baler, 1996 model in 2009, DFF; 40-50HP	p4_MJTech_2_1996	p3_POPTech_2_1996*p1_T2/p2_GLOBALPOP	2.41E-04
work; diesel baler, 1995 model in 2009, DFF; 40-50HP	p4_MJTech_2_1995	p3_POPTech_2_1995*p1_T2/p2_GLOBALPOP	2.32E-04
work; diesel baler, 1994 model in 2009, DFF; 40-50HP	p4_MJTech_2_1994	p3_POPTech_2_1994*p1_T2/p2_GLOBALPOP	2.23E-04
work; diesel baler, 1993 model in 2009, DFF; 40-50HP	p4_MJTech_2_1993	p3_POPTech_2_1993*p1_T2/p2_GLOBALPOP	2.15E-04
work; diesel baler, 1992 model in 2009, DFF; 40-50HP	p4_MJTech_2_1992	p3_POPTech_2_1992*p1_T2/p2_GLOBALPOP	2.06E-04
work; diesel baler, 1991 model in 2009, DFF; 40-50HP	p4_MJTech_2_1991	p3_POPTech_2_1991*p1_T2/p2_GLOBALPOP	1.97E-04
work; diesel baler, 1990 model in 2009, DFF; 40-50HP	p4_MJTech_2_1990	p3_POPTech_2_1990*p1_T2/p2_GLOBALPOP	1.88E-04
work; diesel baler, 1989 model in 2009, DFF; 40-50HP	p4_MJTech_2_1989	p3_POPTech_2_1989*p1_T2/p2_GLOBALPOP	1.78E-04
work; diesel baler, 1988 model in 2009, DFF; 40-50HP	p4_MJTech_2_1988	p3_POPTech_2_1988*p1_T2/p2_GLOBALPOP	1.69E-04
work; diesel baler, 1987 model in 2009, DFF; 40-50HP	p4_MJTech_2_1987	p3_POPTech_2_1987*p1_T2/p2_GLOBALPOP	1.58E-04
work; diesel baler, 1986 model in 2009, DFF; 40-50HP	p4_MJTech_2_1986	p3_POPTech_2_1986*p1_T2/p2_GLOBALPOP	1.47E-04
work; diesel baler, 1985 model in 2009, DFF; 40-50HP	p4_MJTech_2_1985	p3_POPTech_2_1985*p1_T2/p2_GLOBALPOP	1.34E-04
work; diesel baler, 1984 model in 2009, DFF; 40-50HP	p4_MJTech_2_1984	p3_POPTech_2_1984*p1_T2/p2_GLOBALPOP	9.63E-05
work; diesel baler, 1983 model in 2009, DFF; 40-50HP	p4_MJTech_2_1983	p3_POPTech_2_1983*p1_T2/p2_GLOBALPOP	6.12E-05
work; diesel baler, 1982 model in 2009, DFF; 40-50HP	p4_MJTech_2_1982	p3_POPTech_2_1982*p1_T2/p2_GLOBALPOP	5.11E-05
work; diesel baler, 1981 model in 2009, DFF; 40-50HP	p4_MJTech_2_1981	p3_POPTech_2_1981*p1_T2/p2_GLOBALPOP	4.39E-05
work; diesel baler, 1980 model in 2009, DFF; 40-50HP	p4_MJTech_2_1980	p3_POPTech_2_1980*p1_T2/p2_GLOBALPOP	3.81E-05
work; diesel baler, 1979 model in 2009, DFF; 40-50HP	p4_MJTech_2_1979	p3_POPTech_2_1979*p1_T2/p2_GLOBALPOP	3.33E-05
work; diesel baler, 1978 model in 2009, DFF; 40-50HP	p4_MJTech_2_1978	p3_POPTech_2_1978*p1_T2/p2_GLOBALPOP	2.91E-05
work; diesel baler, 1977 model in 2009, DFF; 40-50HP	p4_MJTech_2_1977	p3_POPTech_2_1977*p1_T2/p2_GLOBALPOP	2.55E-05
work; diesel baler, 1976 model in 2009, DFF; 40-50HP	p4_MJTech_2_1976	p3_POPTech_2_1976*p1_T2/p2_GLOBALPOP	2.22E-05
work; diesel baler, 1975 model in 2009, DFF; 40-50HP	p4_MJTech_2_1975	p3_POPTech_2_1975*p1_T2/p2_GLOBALPOP	1.94E-05
work; diesel baler, 1974 model in 2009, DFF; 40-50HP	p4_MJTech_2_1974	p3_POPTech_2_1974*p1_T2/p2_GLOBALPOP	1.68E-05
work; diesel baler, 1973 model in 2009, DFF; 40-50HP	p4_MJTech_2_1973	p3_POPTech_2_1973*p1_T2/p2_GLOBALPOP	1.45E-05
work; diesel baler, 1972 model in 2009, DFF; 40-50HP	p4_MJTech_2_1972	p3_POPTech_2_1972*p1_T2/p2_GLOBALPOP	1.25E-05
work; diesel baler, 1971 model in 2009, DFF; 40-50HP	p4_MJTech_2_1971	p3_POPTech_2_1971*p1_T2/p2_GLOBALPOP	1.06E-05
work; diesel baler, 1970 model in 2009, DFF; 40-50HP	p4_MJTech_2_1970	p3_POPTech_2_1970*p1_T2/p2_GLOBALPOP	8.96E-06

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 1969 model in 2009, DFF; 40-50HP	p4_MJTech_2_1969	p3_POPTech_2_1969*p1_T2/p2_GLOBALPOP	7.47E-06
work; diesel baler, 1968 model in 2009, DFF; 40-50HP	p4_MJTech_2_1968	p3_POPTech_2_1968*p1_T2/p2_GLOBALPOP	6.15E-06
work; diesel baler, 1967 model in 2009, DFF; 40-50HP	p4_MJTech_2_1967	p3_POPTech_2_1967*p1_T2/p2_GLOBALPOP	4.98E-06
work; diesel baler, 1966 model in 2009, DFF; 40-50HP	p4_MJTech_2_1966	p3_POPTech_2_1966*p1_T2/p2_GLOBALPOP	3.94E-06
work; diesel baler, 1965 model in 2009, DFF; 40-50HP	p4_MJTech_2_1965	p3_POPTech_2_1965*p1_T2/p2_GLOBALPOP	3.04E-06
work; diesel baler, 1964 model in 2009, DFF; 40-50HP	p4_MJTech_2_1964	p3_POPTech_2_1964*p1_T2/p2_GLOBALPOP	2.26E-06
work; diesel baler, 1963 model in 2009, DFF; 40-50HP	p4_MJTech_2_1963	p3_POPTech_2_1963*p1_T2/p2_GLOBALPOP	1.60E-06
work; diesel baler, 1962 model in 2009, DFF; 40-50HP	p4_MJTech_2_1962	p3_POPTech_2_1962*p1_T2/p2_GLOBALPOP	1.05E-06
work; diesel baler, 1961 model in 2009, DFF; 40-50HP	p4_MJTech_2_1961	p3_POPTech_2_1961*p1_T2/p2_GLOBALPOP	5.98E-07
work; diesel baler, 1960 model in 2009, DFF; 40-50HP	p4_MJTech_2_1960	p3_POPTech_2_1960*p1_T2/p2_GLOBALPOP	2.51E-07
work; diesel baler, 1959 model in 2009, DFF; 40-50HP	p4_MJTech_2_1959	p3_POPTech_2_1959*p1_T2/p2_GLOBALPOP	1.02E-20
work; 4str baler, 2009 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2009	p3_POPTech_3_2009*p1_T3/p2_GLOBALPOP	8.48E-03
work; 4str baler, 2008 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2008	p3_POPTech_3_2008*p1_T3/p2_GLOBALPOP	8.32E-03
work; 4str baler, 2007 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2007	p3_POPTech_3_2007*p1_T3/p2_GLOBALPOP	8.15E-03
work; 4str baler, 2006 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2006	p3_POPTech_3_2006*p1_T3/p2_GLOBALPOP	7.99E-03
work; 4str baler, 2005 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2005	p3_POPTech_3_2005*p1_T3/p2_GLOBALPOP	7.82E-03
work; 4str baler, 2004 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2004	p3_POPTech_3_2004*p1_T3/p2_GLOBALPOP	7.66E-03
work; 4str baler, 2003 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2003	p3_POPTech_3_2003*p1_T3/p2_GLOBALPOP	7.49E-03
work; 4str baler, 2002 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2002	p3_POPTech_3_2002*p1_T3/p2_GLOBALPOP	7.33E-03
work; 4str baler, 2001 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2001	p3_POPTech_3_2001*p1_T3/p2_GLOBALPOP	7.16E-03
work; 4str baler, 2000 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_2000	p3_POPTech_3_2000*p1_T3/p2_GLOBALPOP	7.00E-03
work; 4str baler, 1999 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1999	p3_POPTech_3_1999*p1_T3/p2_GLOBALPOP	6.84E-03
work; 4str baler, 1998 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1998	p3_POPTech_3_1998*p1_T3/p2_GLOBALPOP	6.76E-03
work; 4str baler, 1997 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1997	p3_POPTech_3_1997*p1_T3/p2_GLOBALPOP	6.58E-03
work; 4str baler, 1996 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1996	p3_POPTech_3_1996*p1_T3/p2_GLOBALPOP	6.41E-03
work; 4str baler, 1995 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1995	p3_POPTech_3_1995*p1_T3/p2_GLOBALPOP	6.23E-03
work; 4str baler, 1994 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1994	p3_POPTech_3_1994*p1_T3/p2_GLOBALPOP	6.05E-03
work; 4str baler, 1993 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1993	p3_POPTech_3_1993*p1_T3/p2_GLOBALPOP	5.87E-03
work; 4str baler, 1992 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1992	p3_POPTech_3_1992*p1_T3/p2_GLOBALPOP	5.69E-03
work; 4str baler, 1991 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1991	p3_POPTech_3_1991*p1_T3/p2_GLOBALPOP	5.50E-03
work; 4str baler, 1990 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1990	p3_POPTech_3_1990*p1_T3/p2_GLOBALPOP	5.30E-03
work; 4str baler, 1989 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1989	p3_POPTech_3_1989*p1_T3/p2_GLOBALPOP	5.09E-03
work; 4str baler, 1988 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1988	p3_POPTech_3_1988*p1_T3/p2_GLOBALPOP	4.87E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; 4str baler, 1987 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1987	p3_POPTech_3_1987*p1_T3/p2_GLOBALPOP	4.64E-03
work; 4str baler, 1986 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1986	p3_POPTech_3_1986*p1_T3/p2_GLOBALPOP	4.36E-03
work; 4str baler, 1985 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1985	p3_POPTech_3_1985*p1_T3/p2_GLOBALPOP	4.02E-03
work; 4str baler, 1984 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1984	p3_POPTech_3_1984*p1_T3/p2_GLOBALPOP	2.94E-03
work; 4str baler, 1983 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1983	p3_POPTech_3_1983*p1_T3/p2_GLOBALPOP	1.90E-03
work; 4str baler, 1982 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1982	p3_POPTech_3_1982*p1_T3/p2_GLOBALPOP	1.61E-03
work; 4str baler, 1981 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1981	p3_POPTech_3_1981*p1_T3/p2_GLOBALPOP	1.41E-03
work; 4str baler, 1980 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1980	p3_POPTech_3_1980*p1_T3/p2_GLOBALPOP	1.25E-03
work; 4str baler, 1979 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1979	p3_POPTech_3_1979*p1_T3/p2_GLOBALPOP	1.11E-03
work; 4str baler, 1978 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1978	p3_POPTech_3_1978*p1_T3/p2_GLOBALPOP	9.90E-04
work; 4str baler, 1977 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1977	p3_POPTech_3_1977*p1_T3/p2_GLOBALPOP	8.85E-04
work; 4str baler, 1976 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1976	p3_POPTech_3_1976*p1_T3/p2_GLOBALPOP	7.92E-04
work; 4str baler, 1975 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1975	p3_POPTech_3_1975*p1_T3/p2_GLOBALPOP	7.08E-04
work; 4str baler, 1974 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1974	p3_POPTech_3_1974*p1_T3/p2_GLOBALPOP	6.31E-04
work; 4str baler, 1973 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1973	p3_POPTech_3_1973*p1_T3/p2_GLOBALPOP	5.61E-04
work; 4str baler, 1972 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1972	p3_POPTech_3_1972*p1_T3/p2_GLOBALPOP	4.97E-04
work; 4str baler, 1971 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1971	p3_POPTech_3_1971*p1_T3/p2_GLOBALPOP	4.38E-04
work; 4str baler, 1970 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1970	p3_POPTech_3_1970*p1_T3/p2_GLOBALPOP	3.83E-04
work; 4str baler, 1969 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1969	p3_POPTech_3_1969*p1_T3/p2_GLOBALPOP	3.33E-04
work; 4str baler, 1968 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1968	p3_POPTech_3_1968*p1_T3/p2_GLOBALPOP	2.86E-04
work; 4str baler, 1967 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1967	p3_POPTech_3_1967*p1_T3/p2_GLOBALPOP	2.43E-04
work; 4str baler, 1966 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1966	p3_POPTech_3_1966*p1_T3/p2_GLOBALPOP	2.03E-04
work; 4str baler, 1965 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1965	p3_POPTech_3_1965*p1_T3/p2_GLOBALPOP	1.67E-04
work; 4str baler, 1964 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1964	p3_POPTech_3_1964*p1_T3/p2_GLOBALPOP	1.33E-04
work; 4str baler, 1963 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1963	p3_POPTech_3_1963*p1_T3/p2_GLOBALPOP	1.02E-04
work; 4str baler, 1962 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1962	p3_POPTech_3_1962*p1_T3/p2_GLOBALPOP	7.28E-05
work; 4str baler, 1961 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1961	p3_POPTech_3_1961*p1_T3/p2_GLOBALPOP	4.63E-05
work; 4str baler, 1960 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1960	p3_POPTech_3_1960*p1_T3/p2_GLOBALPOP	2.21E-05
work; 4str baler, 1959 model in 2009, DFF; 50-75HP at 12-28C	p4_MJTech_3_1959	p3_POPTech_3_1959*p1_T3/p2_GLOBALPOP	1.05E-18
work; diesel baler, 2009 model in 2009, DFF; 50-75HP	p4_MJTech_4_2009	p3_POPTech_4_2009*p1_T4/p2_GLOBALPOP	6.85E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 2008 model in 2009, DFF; 50-75HP	p4_MJTech_4_2008	p3_POPTech_4_2008*p1_T4/p2_GLOBALPOP	6.67E-03
work; diesel baler, 2007 model in 2009, DFF; 50-75HP	p4_MJTech_4_2007	p3_POPTech_4_2007*p1_T4/p2_GLOBALPOP	6.50E-03
work; diesel baler, 2006 model in 2009, DFF; 50-75HP	p4_MJTech_4_2006	p3_POPTech_4_2006*p1_T4/p2_GLOBALPOP	6.32E-03
work; diesel baler, 2005 model in 2009, DFF; 50-75HP	p4_MJTech_4_2005	p3_POPTech_4_2005*p1_T4/p2_GLOBALPOP	6.18E-03
work; diesel baler, 2004 model in 2009, DFF; 50-75HP	p4_MJTech_4_2004	p3_POPTech_4_2004*p1_T4/p2_GLOBALPOP	6.00E-03
work; diesel baler, 2003 model in 2009, DFF; 50-75HP	p4_MJTech_4_2003	p3_POPTech_4_2003*p1_T4/p2_GLOBALPOP	5.83E-03
work; diesel baler, 2002 model in 2009, DFF; 50-75HP	p4_MJTech_4_2002	p3_POPTech_4_2002*p1_T4/p2_GLOBALPOP	5.65E-03
work; diesel baler, 2001 model in 2009, DFF; 50-75HP	p4_MJTech_4_2001	p3_POPTech_4_2001*p1_T4/p2_GLOBALPOP	5.47E-03
work; diesel baler, 2000 model in 2009, DFF; 50-75HP	p4_MJTech_4_2000	p3_POPTech_4_2000*p1_T4/p2_GLOBALPOP	5.89E-03
work; diesel baler, 1999 model in 2009, DFF; 50-75HP	p4_MJTech_4_1999	p3_POPTech_4_1999*p1_T4/p2_GLOBALPOP	5.71E-03
work; diesel baler, 1998 model in 2009, DFF; 50-75HP	p4_MJTech_4_1998	p3_POPTech_4_1998*p1_T4/p2_GLOBALPOP	5.52E-03
work; diesel baler, 1997 model in 2009, DFF; 50-75HP	p4_MJTech_4_1997	p3_POPTech_4_1997*p1_T4/p2_GLOBALPOP	5.34E-03
work; diesel baler, 1996 model in 2009, DFF; 50-75HP	p4_MJTech_4_1996	p3_POPTech_4_1996*p1_T4/p2_GLOBALPOP	5.15E-03
work; diesel baler, 1995 model in 2009, DFF; 50-75HP	p4_MJTech_4_1995	p3_POPTech_4_1995*p1_T4/p2_GLOBALPOP	4.96E-03
work; diesel baler, 1994 model in 2009, DFF; 50-75HP	p4_MJTech_4_1994	p3_POPTech_4_1994*p1_T4/p2_GLOBALPOP	4.78E-03
work; diesel baler, 1993 model in 2009, DFF; 50-75HP	p4_MJTech_4_1993	p3_POPTech_4_1993*p1_T4/p2_GLOBALPOP	4.59E-03
work; diesel baler, 1992 model in 2009, DFF; 50-75HP	p4_MJTech_4_1992	p3_POPTech_4_1992*p1_T4/p2_GLOBALPOP	4.40E-03
work; diesel baler, 1991 model in 2009, DFF; 50-75HP	p4_MJTech_4_1991	p3_POPTech_4_1991*p1_T4/p2_GLOBALPOP	4.21E-03
work; diesel baler, 1990 model in 2009, DFF; 50-75HP	p4_MJTech_4_1990	p3_POPTech_4_1990*p1_T4/p2_GLOBALPOP	4.01E-03
work; diesel baler, 1989 model in 2009, DFF; 50-75HP	p4_MJTech_4_1989	p3_POPTech_4_1989*p1_T4/p2_GLOBALPOP	3.81E-03
work; diesel baler, 1988 model in 2009, DFF; 50-75HP	p4_MJTech_4_1988	p3_POPTech_4_1988*p1_T4/p2_GLOBALPOP	3.60E-03
work; diesel baler, 1987 model in 2009, DFF; 50-75HP	p4_MJTech_4_1987	p3_POPTech_4_1987*p1_T4/p2_GLOBALPOP	3.38E-03
work; diesel baler, 1986 model in 2009, DFF; 50-75HP	p4_MJTech_4_1986	p3_POPTech_4_1986*p1_T4/p2_GLOBALPOP	3.14E-03
work; diesel baler, 1985 model in 2009, DFF; 50-75HP	p4_MJTech_4_1985	p3_POPTech_4_1985*p1_T4/p2_GLOBALPOP	2.85E-03
work; diesel baler, 1984 model in 2009, DFF; 50-75HP	p4_MJTech_4_1984	p3_POPTech_4_1984*p1_T4/p2_GLOBALPOP	2.06E-03
work; diesel baler, 1983 model in 2009, DFF; 50-75HP	p4_MJTech_4_1983	p3_POPTech_4_1983*p1_T4/p2_GLOBALPOP	1.31E-03
work; diesel baler, 1982 model in 2009, DFF; 50-75HP	p4_MJTech_4_1982	p3_POPTech_4_1982*p1_T4/p2_GLOBALPOP	1.09E-03
work; diesel baler, 1981 model in 2009, DFF; 50-75HP	p4_MJTech_4_1981	p3_POPTech_4_1981*p1_T4/p2_GLOBALPOP	9.38E-04
work; diesel baler, 1980 model in 2009, DFF; 50-75HP	p4_MJTech_4_1980	p3_POPTech_4_1980*p1_T4/p2_GLOBALPOP	8.14E-04
work; diesel baler, 1979 model in 2009, DFF; 50-75HP	p4_MJTech_4_1979	p3_POPTech_4_1979*p1_T4/p2_GLOBALPOP	7.11E-04
work; diesel baler, 1978 model in 2009, DFF; 50-75HP	p4_MJTech_4_1978	p3_POPTech_4_1978*p1_T4/p2_GLOBALPOP	6.22E-04
work; diesel baler, 1977 model in 2009, DFF; 50-75HP	p4_MJTech_4_1977	p3_POPTech_4_1977*p1_T4/p2_GLOBALPOP	5.44E-04
work; diesel baler, 1976 model in 2009, DFF; 50-75HP	p4_MJTech_4_1976	p3_POPTech_4_1976*p1_T4/p2_GLOBALPOP	4.75E-04
work; diesel baler, 1975 model in 2009, DFF; 50-75HP	p4_MJTech_4_1975	p3_POPTech_4_1975*p1_T4/p2_GLOBALPOP	4.14E-04
work; diesel baler, 1974 model in 2009, DFF; 50-75HP	p4_MJTech_4_1974	p3_POPTech_4_1974*p1_T4/p2_GLOBALPOP	3.60E-04
work; diesel baler, 1973 model in 2009, DFF; 50-75HP	p4_MJTech_4_1973	p3_POPTech_4_1973*p1_T4/p2_GLOBALPOP	3.10E-04
work; diesel baler, 1972 model in 2009, DFF; 50-75HP	p4_MJTech_4_1972	p3_POPTech_4_1972*p1_T4/p2_GLOBALPOP	2.66E-04
work; diesel baler, 1971 model in 2009, DFF; 50-75HP	p4_MJTech_4_1971	p3_POPTech_4_1971*p1_T4/p2_GLOBALPOP	2.27E-04
work; diesel baler, 1970 model in 2009, DFF; 50-75HP	p4_MJTech_4_1970	p3_POPTech_4_1970*p1_T4/p2_GLOBALPOP	1.91E-04
work; diesel baler, 1969 model in 2009, DFF; 50-75HP	p4_MJTech_4_1969	p3_POPTech_4_1969*p1_T4/p2_GLOBALPOP	1.60E-04
work; diesel baler, 1968 model in 2009, DFF; 50-75HP	p4_MJTech_4_1968	p3_POPTech_4_1968*p1_T4/p2_GLOBALPOP	1.31E-04
work; diesel baler, 1967 model in 2009, DFF; 50-75HP	p4_MJTech_4_1967	p3_POPTech_4_1967*p1_T4/p2_GLOBALPOP	1.06E-04
work; diesel baler, 1966 model in 2009, DFF; 50-75HP	p4_MJTech_4_1966	p3_POPTech_4_1966*p1_T4/p2_GLOBALPOP	8.43E-05
work; diesel baler, 1965 model in 2009, DFF; 50-75HP	p4_MJTech_4_1965	p3_POPTech_4_1965*p1_T4/p2_GLOBALPOP	6.50E-05
work; diesel baler, 1964 model in 2009, DFF; 50-75HP	p4_MJTech_4_1964	p3_POPTech_4_1964*p1_T4/p2_GLOBALPOP	4.83E-05

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 1963 model in 2009, DFF; 50-75HP	p4_MJTech_4_1963	p3_POPTech_4_1963*p1_T4/p2_GLOBALPOP	3.42E-05
work; diesel baler, 1962 model in 2009, DFF; 50-75HP	p4_MJTech_4_1962	p3_POPTech_4_1962*p1_T4/p2_GLOBALPOP	2.23E-05
work; diesel baler, 1961 model in 2009, DFF; 50-75HP	p4_MJTech_4_1961	p3_POPTech_4_1961*p1_T4/p2_GLOBALPOP	1.28E-05
work; diesel baler, 1960 model in 2009, DFF; 50-75HP	p4_MJTech_4_1960	p3_POPTech_4_1960*p1_T4/p2_GLOBALPOP	5.37E-06
work; diesel baler, 1959 model in 2009, DFF; 50-75HP	p4_MJTech_4_1959	p3_POPTech_4_1959*p1_T4/p2_GLOBALPOP	2.19E-19
work; diesel baler, 2009 model in 2009, DFF; 75-100HP	p4_MJTech_5_2009	p3_POPTech_5_2009*p1_T5/p2_GLOBALPOP	2.52E-03
work; diesel baler, 2008 model in 2009, DFF; 75-100HP	p4_MJTech_5_2008	p3_POPTech_5_2008*p1_T5/p2_GLOBALPOP	2.46E-03
work; diesel baler, 2007 model in 2009, DFF; 75-100HP	p4_MJTech_5_2007	p3_POPTech_5_2007*p1_T5/p2_GLOBALPOP	2.39E-03
work; diesel baler, 2006 model in 2009, DFF; 75-100HP	p4_MJTech_5_2006	p3_POPTech_5_2006*p1_T5/p2_GLOBALPOP	2.33E-03
work; diesel baler, 2005 model in 2009, DFF; 75-100HP	p4_MJTech_5_2005	p3_POPTech_5_2005*p1_T5/p2_GLOBALPOP	2.28E-03
work; diesel baler, 2004 model in 2009, DFF; 75-100HP	p4_MJTech_5_2004	p3_POPTech_5_2004*p1_T5/p2_GLOBALPOP	2.21E-03
work; diesel baler, 2003 model in 2009, DFF; 75-100HP	p4_MJTech_5_2003	p3_POPTech_5_2003*p1_T5/p2_GLOBALPOP	2.15E-03
work; diesel baler, 2002 model in 2009, DFF; 75-100HP	p4_MJTech_5_2002	p3_POPTech_5_2002*p1_T5/p2_GLOBALPOP	2.08E-03
work; diesel baler, 2001 model in 2009, DFF; 75-100HP	p4_MJTech_5_2001	p3_POPTech_5_2001*p1_T5/p2_GLOBALPOP	2.01E-03
work; diesel baler, 2000 model in 2009, DFF; 75-100HP	p4_MJTech_5_2000	p3_POPTech_5_2000*p1_T5/p2_GLOBALPOP	2.17E-03
work; diesel baler, 1999 model in 2009, DFF; 75-100HP	p4_MJTech_5_1999	p3_POPTech_5_1999*p1_T5/p2_GLOBALPOP	2.10E-03
work; diesel baler, 1998 model in 2009, DFF; 75-100HP	p4_MJTech_5_1998	p3_POPTech_5_1998*p1_T5/p2_GLOBALPOP	2.03E-03
work; diesel baler, 1997 model in 2009, DFF; 75-100HP	p4_MJTech_5_1997	p3_POPTech_5_1997*p1_T5/p2_GLOBALPOP	1.97E-03
work; diesel baler, 1996 model in 2009, DFF; 75-100HP	p4_MJTech_5_1996	p3_POPTech_5_1996*p1_T5/p2_GLOBALPOP	1.90E-03
work; diesel baler, 1995 model in 2009, DFF; 75-100HP	p4_MJTech_5_1995	p3_POPTech_5_1995*p1_T5/p2_GLOBALPOP	1.83E-03
work; diesel baler, 1994 model in 2009, DFF; 75-100HP	p4_MJTech_5_1994	p3_POPTech_5_1994*p1_T5/p2_GLOBALPOP	1.76E-03
work; diesel baler, 1993 model in 2009, DFF; 75-100HP	p4_MJTech_5_1993	p3_POPTech_5_1993*p1_T5/p2_GLOBALPOP	1.69E-03
work; diesel baler, 1992 model in 2009, DFF; 75-100HP	p4_MJTech_5_1992	p3_POPTech_5_1992*p1_T5/p2_GLOBALPOP	1.62E-03
work; diesel baler, 1991 model in 2009, DFF; 75-100HP	p4_MJTech_5_1991	p3_POPTech_5_1991*p1_T5/p2_GLOBALPOP	1.55E-03
work; diesel baler, 1990 model in 2009, DFF; 75-100HP	p4_MJTech_5_1990	p3_POPTech_5_1990*p1_T5/p2_GLOBALPOP	1.48E-03
work; diesel baler, 1989 model in 2009, DFF; 75-100HP	p4_MJTech_5_1989	p3_POPTech_5_1989*p1_T5/p2_GLOBALPOP	1.40E-03
work; diesel baler, 1988 model in 2009, DFF; 75-100HP	p4_MJTech_5_1988	p3_POPTech_5_1988*p1_T5/p2_GLOBALPOP	1.33E-03
work; diesel baler, 1987 model in 2009, DFF; 75-100HP	p4_MJTech_5_1987	p3_POPTech_5_1987*p1_T5/p2_GLOBALPOP	1.25E-03
work; diesel baler, 1986 model in 2009, DFF; 75-100HP	p4_MJTech_5_1986	p3_POPTech_5_1986*p1_T5/p2_GLOBALPOP	1.16E-03
work; diesel baler, 1985 model in 2009, DFF; 75-100HP	p4_MJTech_5_1985	p3_POPTech_5_1985*p1_T5/p2_GLOBALPOP	1.05E-03
work; diesel baler, 1984 model in 2009, DFF; 75-100HP	p4_MJTech_5_1984	p3_POPTech_5_1984*p1_T5/p2_GLOBALPOP	7.58E-04
work; diesel baler, 1983 model in 2009, DFF; 75-100HP	p4_MJTech_5_1983	p3_POPTech_5_1983*p1_T5/p2_GLOBALPOP	4.82E-04
work; diesel baler, 1982 model in 2009, DFF; 75-100HP	p4_MJTech_5_1982	p3_POPTech_5_1982*p1_T5/p2_GLOBALPOP	4.03E-04
work; diesel baler, 1981 model in 2009, DFF; 75-100HP	p4_MJTech_5_1981	p3_POPTech_5_1981*p1_T5/p2_GLOBALPOP	3.45E-04
work; diesel baler, 1980 model in 2009, DFF; 75-100HP	p4_MJTech_5_1980	p3_POPTech_5_1980*p1_T5/p2_GLOBALPOP	3.00E-04
work; diesel baler, 1979 model in 2009, DFF; 75-100HP	p4_MJTech_5_1979	p3_POPTech_5_1979*p1_T5/p2_GLOBALPOP	2.62E-04
work; diesel baler, 1978 model in 2009, DFF; 75-100HP	p4_MJTech_5_1978	p3_POPTech_5_1978*p1_T5/p2_GLOBALPOP	2.29E-04
work; diesel baler, 1977 model in 2009, DFF; 75-100HP	p4_MJTech_5_1977	p3_POPTech_5_1977*p1_T5/p2_GLOBALPOP	2.00E-04
work; diesel baler, 1976 model in 2009, DFF; 75-100HP	p4_MJTech_5_1976	p3_POPTech_5_1976*p1_T5/p2_GLOBALPOP	1.75E-04
work; diesel baler, 1975 model in 2009, DFF; 75-100HP	p4_MJTech_5_1975	p3_POPTech_5_1975*p1_T5/p2_GLOBALPOP	1.53E-04
work; diesel baler, 1974 model in 2009, DFF; 75-100HP	p4_MJTech_5_1974	p3_POPTech_5_1974*p1_T5/p2_GLOBALPOP	1.32E-04
work; diesel baler, 1973 model in 2009, DFF; 75-100HP	p4_MJTech_5_1973	p3_POPTech_5_1973*p1_T5/p2_GLOBALPOP	1.14E-04
work; diesel baler, 1972 model in 2009, DFF; 75-100HP	p4_MJTech_5_1972	p3_POPTech_5_1972*p1_T5/p2_GLOBALPOP	9.82E-05
work; diesel baler, 1971 model in 2009, DFF; 75-100HP	p4_MJTech_5_1971	p3_POPTech_5_1971*p1_T5/p2_GLOBALPOP	8.36E-05
work; diesel baler, 1970 model in 2009, DFF; 75-100HP	p4_MJTech_5_1970	p3_POPTech_5_1970*p1_T5/p2_GLOBALPOP	7.05E-05

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 1969 model in 2009, DFF; 75-100HP	p4_MJTech_5_1969	p3_POPTech_5_1969*p1_T5/p2_GLOBALPOP	5.88E-05
work; diesel baler, 1968 model in 2009, DFF; 75-100HP	p4_MJTech_5_1968	p3_POPTech_5_1968*p1_T5/p2_GLOBALPOP	4.84E-05
work; diesel baler, 1967 model in 2009, DFF; 75-100HP	p4_MJTech_5_1967	p3_POPTech_5_1967*p1_T5/p2_GLOBALPOP	3.92E-05
work; diesel baler, 1966 model in 2009, DFF; 75-100HP	p4_MJTech_5_1966	p3_POPTech_5_1966*p1_T5/p2_GLOBALPOP	3.10E-05
work; diesel baler, 1965 model in 2009, DFF; 75-100HP	p4_MJTech_5_1965	p3_POPTech_5_1965*p1_T5/p2_GLOBALPOP	2.39E-05
work; diesel baler, 1964 model in 2009, DFF; 75-100HP	p4_MJTech_5_1964	p3_POPTech_5_1964*p1_T5/p2_GLOBALPOP	1.78E-05
work; diesel baler, 1963 model in 2009, DFF; 75-100HP	p4_MJTech_5_1963	p3_POPTech_5_1963*p1_T5/p2_GLOBALPOP	1.26E-05
work; diesel baler, 1962 model in 2009, DFF; 75-100HP	p4_MJTech_5_1962	p3_POPTech_5_1962*p1_T5/p2_GLOBALPOP	8.23E-06
work; diesel baler, 1961 model in 2009, DFF; 75-100HP	p4_MJTech_5_1961	p3_POPTech_5_1961*p1_T5/p2_GLOBALPOP	4.71E-06
work; diesel baler, 1960 model in 2009, DFF; 75-100HP	p4_MJTech_5_1960	p3_POPTech_5_1960*p1_T5/p2_GLOBALPOP	1.98E-06
work; diesel baler, 1959 model in 2009, DFF; 75-100HP	p4_MJTech_5_1959	p3_POPTech_5_1959*p1_T5/p2_GLOBALPOP	8.05E-20
work; 4str baler, 2009 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2009	p3_POPTech_6_2009*p1_T6/p2_GLOBALPOP	9.63E-04
work; 4str baler, 2008 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2008	p3_POPTech_6_2008*p1_T6/p2_GLOBALPOP	9.44E-04
work; 4str baler, 2007 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2007	p3_POPTech_6_2007*p1_T6/p2_GLOBALPOP	9.26E-04
work; 4str baler, 2006 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2006	p3_POPTech_6_2006*p1_T6/p2_GLOBALPOP	9.07E-04
work; 4str baler, 2005 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2005	p3_POPTech_6_2005*p1_T6/p2_GLOBALPOP	8.88E-04
work; 4str baler, 2004 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2004	p3_POPTech_6_2004*p1_T6/p2_GLOBALPOP	8.69E-04
work; 4str baler, 2003 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2003	p3_POPTech_6_2003*p1_T6/p2_GLOBALPOP	8.51E-04
work; 4str baler, 2002 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2002	p3_POPTech_6_2002*p1_T6/p2_GLOBALPOP	8.32E-04
work; 4str baler, 2001 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2001	p3_POPTech_6_2001*p1_T6/p2_GLOBALPOP	8.13E-04
work; 4str baler, 2000 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_2000	p3_POPTech_6_2000*p1_T6/p2_GLOBALPOP	7.95E-04
work; 4str baler, 1999 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1999	p3_POPTech_6_1999*p1_T6/p2_GLOBALPOP	7.76E-04
work; 4str baler, 1998 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1998	p3_POPTech_6_1998*p1_T6/p2_GLOBALPOP	7.67E-04
work; 4str baler, 1997 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1997	p3_POPTech_6_1997*p1_T6/p2_GLOBALPOP	7.47E-04
work; 4str baler, 1996 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1996	p3_POPTech_6_1996*p1_T6/p2_GLOBALPOP	7.28E-04
work; 4str baler, 1995 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1995	p3_POPTech_6_1995*p1_T6/p2_GLOBALPOP	7.08E-04
work; 4str baler, 1994 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1994	p3_POPTech_6_1994*p1_T6/p2_GLOBALPOP	6.87E-04
work; 4str baler, 1993 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1993	p3_POPTech_6_1993*p1_T6/p2_GLOBALPOP	6.67E-04
work; 4str baler, 1992 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1992	p3_POPTech_6_1992*p1_T6/p2_GLOBALPOP	6.46E-04
work; 4str baler, 1991 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1991	p3_POPTech_6_1991*p1_T6/p2_GLOBALPOP	6.24E-04
work; 4str baler, 1990 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1990	p3_POPTech_6_1990*p1_T6/p2_GLOBALPOP	6.02E-04
work; 4str baler, 1989 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1989	p3_POPTech_6_1989*p1_T6/p2_GLOBALPOP	5.78E-04
work; 4str baler, 1988 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1988	p3_POPTech_6_1988*p1_T6/p2_GLOBALPOP	5.53E-04

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; 4str baler, 1987 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1987	p3_POPTech_6_1987*p1_T6/p2_GLOBALPOP	5.26E-04
work; 4str baler, 1986 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1986	p3_POPTech_6_1986*p1_T6/p2_GLOBALPOP	4.96E-04
work; 4str baler, 1985 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1985	p3_POPTech_6_1985*p1_T6/p2_GLOBALPOP	4.56E-04
work; 4str baler, 1984 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1984	p3_POPTech_6_1984*p1_T6/p2_GLOBALPOP	3.34E-04
work; 4str baler, 1983 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1983	p3_POPTech_6_1983*p1_T6/p2_GLOBALPOP	2.16E-04
work; 4str baler, 1982 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1982	p3_POPTech_6_1982*p1_T6/p2_GLOBALPOP	1.83E-04
work; 4str baler, 1981 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1981	p3_POPTech_6_1981*p1_T6/p2_GLOBALPOP	1.60E-04
work; 4str baler, 1980 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1980	p3_POPTech_6_1980*p1_T6/p2_GLOBALPOP	1.41E-04
work; 4str baler, 1979 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1979	p3_POPTech_6_1979*p1_T6/p2_GLOBALPOP	1.26E-04
work; 4str baler, 1978 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1978	p3_POPTech_6_1978*p1_T6/p2_GLOBALPOP	1.12E-04
work; 4str baler, 1977 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1977	p3_POPTech_6_1977*p1_T6/p2_GLOBALPOP	1.01E-04
work; 4str baler, 1976 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1976	p3_POPTech_6_1976*p1_T6/p2_GLOBALPOP	8.99E-05
work; 4str baler, 1975 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1975	p3_POPTech_6_1975*p1_T6/p2_GLOBALPOP	8.03E-05
work; 4str baler, 1974 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1974	p3_POPTech_6_1974*p1_T6/p2_GLOBALPOP	7.16E-05
work; 4str baler, 1973 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1973	p3_POPTech_6_1973*p1_T6/p2_GLOBALPOP	6.37E-05
work; 4str baler, 1972 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1972	p3_POPTech_6_1972*p1_T6/p2_GLOBALPOP	5.64E-05
work; 4str baler, 1971 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1971	p3_POPTech_6_1971*p1_T6/p2_GLOBALPOP	4.97E-05
work; 4str baler, 1970 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1970	p3_POPTech_6_1970*p1_T6/p2_GLOBALPOP	4.35E-05
work; 4str baler, 1969 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1969	p3_POPTech_6_1969*p1_T6/p2_GLOBALPOP	3.78E-05
work; 4str baler, 1968 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1968	p3_POPTech_6_1968*p1_T6/p2_GLOBALPOP	3.25E-05
work; 4str baler, 1967 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1967	p3_POPTech_6_1967*p1_T6/p2_GLOBALPOP	2.76E-05
work; 4str baler, 1966 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1966	p3_POPTech_6_1966*p1_T6/p2_GLOBALPOP	2.31E-05
work; 4str baler, 1965 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1965	p3_POPTech_6_1965*p1_T6/p2_GLOBALPOP	1.89E-05
work; 4str baler, 1964 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1964	p3_POPTech_6_1964*p1_T6/p2_GLOBALPOP	1.51E-05
work; 4str baler, 1963 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1963	p3_POPTech_6_1963*p1_T6/p2_GLOBALPOP	1.15E-05
work; 4str baler, 1962 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1962	p3_POPTech_6_1962*p1_T6/p2_GLOBALPOP	8.26E-06
work; 4str baler, 1961 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1961	p3_POPTech_6_1961*p1_T6/p2_GLOBALPOP	5.26E-06
work; 4str baler, 1960 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1960	p3_POPTech_6_1960*p1_T6/p2_GLOBALPOP	2.51E-06
work; 4str baler, 1959 model in 2009, DFF; 100-175HP at 12-28C	p4_MJTech_6_1959	p3_POPTech_6_1959*p1_T6/p2_GLOBALPOP	1.20E-19
work; diesel baler, 2009 model in 2009, DFF; 100-175HP	p4_MJTech_7_2009	p3_POPTech_7_2009*p1_T7/p2_GLOBALPOP	2.15E-03

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 2008 model in 2009, DFF; 100-175HP	p4_MJTech_7_2008	p3_POPTech_7_2008*p1_T7/p2_GLOBALPOP	2.09E-03
work; diesel baler, 2007 model in 2009, DFF; 100-175HP	p4_MJTech_7_2007	p3_POPTech_7_2007*p1_T7/p2_GLOBALPOP	2.04E-03
work; diesel baler, 2006 model in 2009, DFF; 100-175HP	p4_MJTech_7_2006	p3_POPTech_7_2006*p1_T7/p2_GLOBALPOP	1.98E-03
work; diesel baler, 2005 model in 2009, DFF; 100-175HP	p4_MJTech_7_2005	p3_POPTech_7_2005*p1_T7/p2_GLOBALPOP	1.94E-03
work; diesel baler, 2004 model in 2009, DFF; 100-175HP	p4_MJTech_7_2004	p3_POPTech_7_2004*p1_T7/p2_GLOBALPOP	1.88E-03
work; diesel baler, 2003 model in 2009, DFF; 100-175HP	p4_MJTech_7_2003	p3_POPTech_7_2003*p1_T7/p2_GLOBALPOP	1.83E-03
work; diesel baler, 2002 model in 2009, DFF; 100-175HP	p4_MJTech_7_2002	p3_POPTech_7_2002*p1_T7/p2_GLOBALPOP	1.77E-03
work; diesel baler, 2001 model in 2009, DFF; 100-175HP	p4_MJTech_7_2001	p3_POPTech_7_2001*p1_T7/p2_GLOBALPOP	1.72E-03
work; diesel baler, 2000 model in 2009, DFF; 100-175HP	p4_MJTech_7_2000	p3_POPTech_7_2000*p1_T7/p2_GLOBALPOP	1.85E-03
work; diesel baler, 1999 model in 2009, DFF; 100-175HP	p4_MJTech_7_1999	p3_POPTech_7_1999*p1_T7/p2_GLOBALPOP	1.79E-03
work; diesel baler, 1998 model in 2009, DFF; 100-175HP	p4_MJTech_7_1998	p3_POPTech_7_1998*p1_T7/p2_GLOBALPOP	1.73E-03
work; diesel baler, 1997 model in 2009, DFF; 100-175HP	p4_MJTech_7_1997	p3_POPTech_7_1997*p1_T7/p2_GLOBALPOP	1.67E-03
work; diesel baler, 1996 model in 2009, DFF; 100-175HP	p4_MJTech_7_1996	p3_POPTech_7_1996*p1_T7/p2_GLOBALPOP	1.62E-03
work; diesel baler, 1995 model in 2009, DFF; 100-175HP	p4_MJTech_7_1995	p3_POPTech_7_1995*p1_T7/p2_GLOBALPOP	1.56E-03
work; diesel baler, 1994 model in 2009, DFF; 100-175HP	p4_MJTech_7_1994	p3_POPTech_7_1994*p1_T7/p2_GLOBALPOP	1.50E-03
work; diesel baler, 1993 model in 2009, DFF; 100-175HP	p4_MJTech_7_1993	p3_POPTech_7_1993*p1_T7/p2_GLOBALPOP	1.44E-03
work; diesel baler, 1992 model in 2009, DFF; 100-175HP	p4_MJTech_7_1992	p3_POPTech_7_1992*p1_T7/p2_GLOBALPOP	1.38E-03
work; diesel baler, 1991 model in 2009, DFF; 100-175HP	p4_MJTech_7_1991	p3_POPTech_7_1991*p1_T7/p2_GLOBALPOP	1.32E-03
work; diesel baler, 1990 model in 2009, DFF; 100-175HP	p4_MJTech_7_1990	p3_POPTech_7_1990*p1_T7/p2_GLOBALPOP	1.26E-03
work; diesel baler, 1989 model in 2009, DFF; 100-175HP	p4_MJTech_7_1989	p3_POPTech_7_1989*p1_T7/p2_GLOBALPOP	1.20E-03
work; diesel baler, 1988 model in 2009, DFF; 100-175HP	p4_MJTech_7_1988	p3_POPTech_7_1988*p1_T7/p2_GLOBALPOP	1.13E-03
work; diesel baler, 1987 model in 2009, DFF; 100-175HP	p4_MJTech_7_1987	p3_POPTech_7_1987*p1_T7/p2_GLOBALPOP	1.06E-03
work; diesel baler, 1986 model in 2009, DFF; 100-175HP	p4_MJTech_7_1986	p3_POPTech_7_1986*p1_T7/p2_GLOBALPOP	9.86E-04
work; diesel baler, 1985 model in 2009, DFF; 100-175HP	p4_MJTech_7_1985	p3_POPTech_7_1985*p1_T7/p2_GLOBALPOP	8.96E-04
work; diesel baler, 1984 model in 2009, DFF; 100-175HP	p4_MJTech_7_1984	p3_POPTech_7_1984*p1_T7/p2_GLOBALPOP	6.46E-04
work; diesel baler, 1983 model in 2009, DFF; 100-175HP	p4_MJTech_7_1983	p3_POPTech_7_1983*p1_T7/p2_GLOBALPOP	4.11E-04
work; diesel baler, 1982 model in 2009, DFF; 100-175HP	p4_MJTech_7_1982	p3_POPTech_7_1982*p1_T7/p2_GLOBALPOP	3.43E-04
work; diesel baler, 1981 model in 2009, DFF; 100-175HP	p4_MJTech_7_1981	p3_POPTech_7_1981*p1_T7/p2_GLOBALPOP	2.94E-04
work; diesel baler, 1980 model in 2009, DFF; 100-175HP	p4_MJTech_7_1980	p3_POPTech_7_1980*p1_T7/p2_GLOBALPOP	2.56E-04
work; diesel baler, 1979 model in 2009, DFF; 100-175HP	p4_MJTech_7_1979	p3_POPTech_7_1979*p1_T7/p2_GLOBALPOP	2.23E-04
work; diesel baler, 1978 model in 2009, DFF; 100-175HP	p4_MJTech_7_1978	p3_POPTech_7_1978*p1_T7/p2_GLOBALPOP	1.95E-04
work; diesel baler, 1977 model in 2009, DFF; 100-175HP	p4_MJTech_7_1977	p3_POPTech_7_1977*p1_T7/p2_GLOBALPOP	1.71E-04
work; diesel baler, 1976 model in 2009, DFF; 100-175HP	p4_MJTech_7_1976	p3_POPTech_7_1976*p1_T7/p2_GLOBALPOP	1.49E-04
work; diesel baler, 1975 model in 2009, DFF; 100-175HP	p4_MJTech_7_1975	p3_POPTech_7_1975*p1_T7/p2_GLOBALPOP	1.30E-04
work; diesel baler, 1974 model in 2009, DFF; 100-175HP	p4_MJTech_7_1974	p3_POPTech_7_1974*p1_T7/p2_GLOBALPOP	1.13E-04
work; diesel baler, 1973 model in 2009, DFF; 100-175HP	p4_MJTech_7_1973	p3_POPTech_7_1973*p1_T7/p2_GLOBALPOP	9.74E-05
work; diesel baler, 1972 model in 2009, DFF; 100-175HP	p4_MJTech_7_1972	p3_POPTech_7_1972*p1_T7/p2_GLOBALPOP	8.36E-05
work; diesel baler, 1971 model in 2009, DFF; 100-175HP	p4_MJTech_7_1971	p3_POPTech_7_1971*p1_T7/p2_GLOBALPOP	7.12E-05
work; diesel baler, 1970 model in 2009, DFF; 100-175HP	p4_MJTech_7_1970	p3_POPTech_7_1970*p1_T7/p2_GLOBALPOP	6.01E-05
work; diesel baler, 1969 model in 2009, DFF; 100-175HP	p4_MJTech_7_1969	p3_POPTech_7_1969*p1_T7/p2_GLOBALPOP	5.01E-05
work; diesel baler, 1968 model in 2009, DFF; 100-175HP	p4_MJTech_7_1968	p3_POPTech_7_1968*p1_T7/p2_GLOBALPOP	4.13E-05

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 1967 model in 2009, DFF; 100-175HP	p4_MJTech_7_1967	p3_POPTech_7_1967*p1_T7/p2_GLOBALPOP	3.34E-05
work; diesel baler, 1966 model in 2009, DFF; 100-175HP	p4_MJTech_7_1966	p3_POPTech_7_1966*p1_T7/p2_GLOBALPOP	2.64E-05
work; diesel baler, 1965 model in 2009, DFF; 100-175HP	p4_MJTech_7_1965	p3_POPTech_7_1965*p1_T7/p2_GLOBALPOP	2.04E-05
work; diesel baler, 1964 model in 2009, DFF; 100-175HP	p4_MJTech_7_1964	p3_POPTech_7_1964*p1_T7/p2_GLOBALPOP	1.52E-05
work; diesel baler, 1963 model in 2009, DFF; 100-175HP	p4_MJTech_7_1963	p3_POPTech_7_1963*p1_T7/p2_GLOBALPOP	1.07E-05
work; diesel baler, 1962 model in 2009, DFF; 100-175HP	p4_MJTech_7_1962	p3_POPTech_7_1962*p1_T7/p2_GLOBALPOP	7.01E-06
work; diesel baler, 1961 model in 2009, DFF; 100-175HP	p4_MJTech_7_1961	p3_POPTech_7_1961*p1_T7/p2_GLOBALPOP	4.01E-06
work; diesel baler, 1960 model in 2009, DFF; 100-175HP	p4_MJTech_7_1960	p3_POPTech_7_1960*p1_T7/p2_GLOBALPOP	1.69E-06
work; diesel baler, 1959 model in 2009, DFF; 100-175HP	p4_MJTech_7_1959	p3_POPTech_7_1959*p1_T7/p2_GLOBALPOP	6.86E-20
work; diesel baler, 2009 model in 2009, DFF; 175-300HP	p4_MJTech_8_2009	p3_POPTech_8_2009*p1_T8/p2_GLOBALPOP	1.07E-04
work; diesel baler, 2008 model in 2009, DFF; 175-300HP	p4_MJTech_8_2008	p3_POPTech_8_2008*p1_T8/p2_GLOBALPOP	1.04E-04
work; diesel baler, 2007 model in 2009, DFF; 175-300HP	p4_MJTech_8_2007	p3_POPTech_8_2007*p1_T8/p2_GLOBALPOP	1.01E-04
work; diesel baler, 2006 model in 2009, DFF; 175-300HP	p4_MJTech_8_2006	p3_POPTech_8_2006*p1_T8/p2_GLOBALPOP	9.85E-05
work; diesel baler, 2005 model in 2009, DFF; 175-300HP	p4_MJTech_8_2005	p3_POPTech_8_2005*p1_T8/p2_GLOBALPOP	9.64E-05
work; diesel baler, 2004 model in 2009, DFF; 175-300HP	p4_MJTech_8_2004	p3_POPTech_8_2004*p1_T8/p2_GLOBALPOP	9.36E-05
work; diesel baler, 2003 model in 2009, DFF; 175-300HP	p4_MJTech_8_2003	p3_POPTech_8_2003*p1_T8/p2_GLOBALPOP	9.09E-05
work; diesel baler, 2002 model in 2009, DFF; 175-300HP	p4_MJTech_8_2002	p3_POPTech_8_2002*p1_T8/p2_GLOBALPOP	8.82E-05
work; diesel baler, 2001 model in 2009, DFF; 175-300HP	p4_MJTech_8_2001	p3_POPTech_8_2001*p1_T8/p2_GLOBALPOP	8.53E-05
work; diesel baler, 2000 model in 2009, DFF; 175-300HP	p4_MJTech_8_2000	p3_POPTech_8_2000*p1_T8/p2_GLOBALPOP	9.19E-05
work; diesel baler, 1999 model in 2009, DFF; 175-300HP	p4_MJTech_8_1999	p3_POPTech_8_1999*p1_T8/p2_GLOBALPOP	8.90E-05
work; diesel baler, 1998 model in 2009, DFF; 175-300HP	p4_MJTech_8_1998	p3_POPTech_8_1998*p1_T8/p2_GLOBALPOP	8.61E-05
work; diesel baler, 1997 model in 2009, DFF; 175-300HP	p4_MJTech_8_1997	p3_POPTech_8_1997*p1_T8/p2_GLOBALPOP	8.32E-05
work; diesel baler, 1996 model in 2009, DFF; 175-300HP	p4_MJTech_8_1996	p3_POPTech_8_1996*p1_T8/p2_GLOBALPOP	8.03E-05
work; diesel baler, 1995 model in 2009, DFF; 175-300HP	p4_MJTech_8_1995	p3_POPTech_8_1995*p1_T8/p2_GLOBALPOP	7.74E-05
work; diesel baler, 1994 model in 2009, DFF; 175-300HP	p4_MJTech_8_1994	p3_POPTech_8_1994*p1_T8/p2_GLOBALPOP	7.45E-05
work; diesel baler, 1993 model in 2009, DFF; 175-300HP	p4_MJTech_8_1993	p3_POPTech_8_1993*p1_T8/p2_GLOBALPOP	7.15E-05
work; diesel baler, 1992 model in 2009, DFF; 175-300HP	p4_MJTech_8_1992	p3_POPTech_8_1992*p1_T8/p2_GLOBALPOP	6.86E-05
work; diesel baler, 1991 model in 2009, DFF; 175-300HP	p4_MJTech_8_1991	p3_POPTech_8_1991*p1_T8/p2_GLOBALPOP	6.56E-05
work; diesel baler, 1990 model in 2009, DFF; 175-300HP	p4_MJTech_8_1990	p3_POPTech_8_1990*p1_T8/p2_GLOBALPOP	6.25E-05
work; diesel baler, 1989 model in 2009, DFF; 175-300HP	p4_MJTech_8_1989	p3_POPTech_8_1989*p1_T8/p2_GLOBALPOP	5.94E-05
work; diesel baler, 1988 model in 2009, DFF; 175-300HP	p4_MJTech_8_1988	p3_POPTech_8_1988*p1_T8/p2_GLOBALPOP	5.62E-05
work; diesel baler, 1987 model in 2009, DFF; 175-300HP	p4_MJTech_8_1987	p3_POPTech_8_1987*p1_T8/p2_GLOBALPOP	5.28E-05
work; diesel baler, 1986 model in 2009, DFF; 175-300HP	p4_MJTech_8_1986	p3_POPTech_8_1986*p1_T8/p2_GLOBALPOP	4.90E-05
work; diesel baler, 1985 model in 2009, DFF; 175-300HP	p4_MJTech_8_1985	p3_POPTech_8_1985*p1_T8/p2_GLOBALPOP	4.45E-05
work; diesel baler, 1984 model in 2009, DFF; 175-300HP	p4_MJTech_8_1984	p3_POPTech_8_1984*p1_T8/p2_GLOBALPOP	3.21E-05
work; diesel baler, 1983 model in 2009, DFF; 175-300HP	p4_MJTech_8_1983	p3_POPTech_8_1983*p1_T8/p2_GLOBALPOP	2.04E-05
work; diesel baler, 1982 model in 2009, DFF; 175-300HP	p4_MJTech_8_1982	p3_POPTech_8_1982*p1_T8/p2_GLOBALPOP	1.70E-05
work; diesel baler, 1981 model in 2009, DFF; 175-300HP	p4_MJTech_8_1981	p3_POPTech_8_1981*p1_T8/p2_GLOBALPOP	1.46E-05
work; diesel baler, 1980 model in 2009, DFF; 175-300HP	p4_MJTech_8_1980	p3_POPTech_8_1980*p1_T8/p2_GLOBALPOP	1.27E-05
work; diesel baler, 1979 model in 2009, DFF; 175-300HP	p4_MJTech_8_1979	p3_POPTech_8_1979*p1_T8/p2_GLOBALPOP	1.11E-05
work; diesel baler, 1978 model in 2009, DFF; 175-300HP	p4_MJTech_8_1978	p3_POPTech_8_1978*p1_T8/p2_GLOBALPOP	9.70E-06

Parameter Description	Parameter Name	Mathematical Relation (blank for raw data)	Resulting Value
work; diesel baler, 1977 model in 2009, DFF; 175-300HP	p4_MJTech_8_1977	p3_POPTech_8_1977*p1_T8/p2_GLOBALPOP	8.49E-06
work; diesel baler, 1976 model in 2009, DFF; 175-300HP	p4_MJTech_8_1976	p3_POPTech_8_1976*p1_T8/p2_GLOBALPOP	7.41E-06
work; diesel baler, 1975 model in 2009, DFF; 175-300HP	p4_MJTech_8_1975	p3_POPTech_8_1975*p1_T8/p2_GLOBALPOP	6.46E-06
work; diesel baler, 1974 model in 2009, DFF; 175-300HP	p4_MJTech_8_1974	p3_POPTech_8_1974*p1_T8/p2_GLOBALPOP	5.61E-06
work; diesel baler, 1973 model in 2009, DFF; 175-300HP	p4_MJTech_8_1973	p3_POPTech_8_1973*p1_T8/p2_GLOBALPOP	4.84E-06
work; diesel baler, 1972 model in 2009, DFF; 175-300HP	p4_MJTech_8_1972	p3_POPTech_8_1972*p1_T8/p2_GLOBALPOP	4.16E-06
work; diesel baler, 1971 model in 2009, DFF; 175-300HP	p4_MJTech_8_1971	p3_POPTech_8_1971*p1_T8/p2_GLOBALPOP	3.54E-06
work; diesel baler, 1970 model in 2009, DFF; 175-300HP	p4_MJTech_8_1970	p3_POPTech_8_1970*p1_T8/p2_GLOBALPOP	2.99E-06
work; diesel baler, 1969 model in 2009, DFF; 175-300HP	p4_MJTech_8_1969	p3_POPTech_8_1969*p1_T8/p2_GLOBALPOP	2.49E-06
work; diesel baler, 1968 model in 2009, DFF; 175-300HP	p4_MJTech_8_1968	p3_POPTech_8_1968*p1_T8/p2_GLOBALPOP	2.05E-06
work; diesel baler, 1967 model in 2009, DFF; 175-300HP	p4_MJTech_8_1967	p3_POPTech_8_1967*p1_T8/p2_GLOBALPOP	1.66E-06
work; diesel baler, 1966 model in 2009, DFF; 175-300HP	p4_MJTech_8_1966	p3_POPTech_8_1966*p1_T8/p2_GLOBALPOP	1.31E-06
work; diesel baler, 1965 model in 2009, DFF; 175-300HP	p4_MJTech_8_1965	p3_POPTech_8_1965*p1_T8/p2_GLOBALPOP	1.01E-06
work; diesel baler, 1964 model in 2009, DFF; 175-300HP	p4_MJTech_8_1964	p3_POPTech_8_1964*p1_T8/p2_GLOBALPOP	7.54E-07
work; diesel baler, 1963 model in 2009, DFF; 175-300HP	p4_MJTech_8_1963	p3_POPTech_8_1963*p1_T8/p2_GLOBALPOP	5.33E-07
work; diesel baler, 1962 model in 2009, DFF; 175-300HP	p4_MJTech_8_1962	p3_POPTech_8_1962*p1_T8/p2_GLOBALPOP	3.48E-07
work; diesel baler, 1961 model in 2009, DFF; 175-300HP	p4_MJTech_8_1961	p3_POPTech_8_1961*p1_T8/p2_GLOBALPOP	1.99E-07
work; diesel baler, 1960 model in 2009, DFF; 175-300HP	p4_MJTech_8_1960	p3_POPTech_8_1960*p1_T8/p2_GLOBALPOP	8.37E-08
work; diesel baler, 1959 model in 2009, DFF; 175-300HP	p4_MJTech_8_1959	p3_POPTech_8_1959*p1_T8/p2_GLOBALPOP	3.41E-21

Appendix D: NMIM emissions relationships

Note that CAS numbers, formulas, molecular weights, and carbon fractions are given in the second table of this appendix.

	Baseline Gasoline (<5vol% ethanol)		Winter Oxygenate Gasoline / Ethanol (=>5 vol% ethanol)				
Parameter name	**2-stroke**	**4-stroke**	**2-stroke EtOH**	**4-stroke EtOH**	**LPG**	**CNG**	**Diesel**
Total Organic Gases (g/g exhaust THC)	1.044	1.043	1.044	1.043	1.0995	1.002	1.07
Non-Methane Organic Gases (g/g exhaust THC)	1.035	0.943	1.035	0.943	1.0195	0.049	1.054
Non-Methane Hydrocarbons (g/g exhaust THC)	0.991	0.9	0.991	0.9	0.92	0.048	0.984
Non-Methane Volatile Organic Compounds (g/g exhaust THC)	1.034	0.933	1.034	0.933	0.9953	0.004	1.053
Secondary Organic Aerosol (g/g NMVOC)	0.0073	0.0073	0.0073	0.0073	0.0007	0.0007	0.0237
Total Organic Gases (g/g evap THC)	1	1	1	1			
Non-Methane Organic Gases (g/g evap THC)	1	1	1	1			
Non-Methane Hydrocarbons (g/g evap THC)	1	1	1	1			
Non-Methane Volatile Organic Compounds (g/g evap THC)	1	1	1	1			
Methane (g/g exhaust THC)	0.009	0.1	0.009	0.1	0.08	0.952	0.016
Ammonia (g/gal fuel)	0.116	0.116	0.116	0.116			0.0833
1,2,3,4,6,7,8-Heptachlorodibenzofuran (g/gal fuel)	2.61E-10	2.61E-10	2.61E-10	2.61E-10			3.01E-09
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (g/gal fuel)	1.28E-10	1.28E-10	1.28E-10	1.28E-10			1.08E-08
1,2,3,4,7,8,9-Heptachlorodibenzofuran (g/gal fuel)	8.33E-12	8.33E-12	8.33E-12	8.33E-12			3.43E-10
1,2,3,4,7,8-Hexachlorodibenzofuran (g/gal fuel)	2.35E-11	2.35E-11	2.35E-11	2.35E-11			1.45E-09
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	8.33E-12	8.33E-12	8.33E-12	8.33E-12			4.60E-10
1,2,3,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	2.50E-11	2.50E-11	2.50E-11	2.50E-11			6.63E-10
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	1.70E-11	1.70E-11	1.70E-11	1.70E-11			9.02E-10
1,2,3,7,8,9-Hexachlorodibenzofuran (g/gal fuel)	6.81E-12	6.81E-12	6.81E-12	6.81E-12			3.85E-10
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	1.06E-11	1.06E-11	1.06E-11	1.06E-11			1.66E-09
1,2,3,7,8-Pentachlorodibenzofuran (g/gal fuel)	2.84E-11	2.84E-11	2.84E-11	2.84E-11			3.89E-10
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (g/gal fuel)	7.95E-12	7.95E-12	7.95E-12	7.95E-12			3.27E-10
2,3,4,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	2.91E-11	2.91E-11	2.91E-11	2.91E-11			9.60E-10
2,3,4,7,8-Pentachlorodibenzofuran (g/gal fuel)	2.08E-11	2.08E-11	2.08E-11	2.08E-11			8.61E-10
2,3,7,8-Tetrachlorodibenzofuran (g/gal fuel)	5.94E-11	5.94E-11	5.94E-11	5.94E-11			9.75E-10
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (g/gal fuel)	1.78E-11	1.78E-11	1.78E-11	1.78E-11			3.87E-10
Chromium (Cr3+) (g/gal fuel)	7.02E-05	7.02E-05	7.02E-05	7.02E-05			3.78E-07
Chromium (Cr6+) (g/gal fuel)	3.62E-05	3.62E-05	3.62E-05	3.62E-05			1.95E-07
Manganese (g/gal fuel)	3.56E-05	3.56E-05	3.56E-05	3.56E-05			2.62E-05
Mercury (divalent gaseous) (g/gal fuel)	1.68E-07	1.68E-07	1.68E-07	1.68E-07			6.22E-08
Mercury (elemental gaseous) (g/gal fuel)	1.77E-06	1.77E-06	1.77E-06	1.77E-06			1.20E-07

	Baseline Gasoline (<5vol% ethanol)		Winter Oxygenate Gasoline / Ethanol (=>5 vol% ethanol)				
Parameter name	**2-stroke**	**4-stroke**	**2-stroke EtOH**	**4-stroke EtOH**	**LPG**	**CNG**	**Diesel**
Mercury (particulate) (g/gal fuel)	6.90E-09	6.90E-09	6.90E-09	6.90E-09			3.21E-08
Nickel (g/gal fuel)	7.75E-05	7.75E-05	7.75E-05	7.75E-05			3.89E-05
Octachlorodibenzofuran (g/gal fuel)	2.95E-10	2.95E-10	2.95E-10	2.95E-10			3.43E-09
Octachlorodibenzo-p-dioxin (g/gal fuel)	1.01E-09	1.01E-09	1.01E-09	1.01E-09			5.00E-08
Acenaphthene (g/g exhaust PM10)	2.00E-06	7.30E-04	2.00E-06	7.30E-04			1.00E-04
Acenaphthylene (g/g exhaust PM10)	7.50E-05	4.12E-03	7.50E-05	4.12E-03			8.40E-05
Anthracene (g/g exhaust PM10)	6.70E-05	8.50E-04	6.70E-05	8.50E-04			4.30E-07
Arsenic & compounds (g/g exhaust PM10)	4.10E-05	4.10E-05	4.10E-05	4.10E-05			3.89E-05
Benz(a)anthracene (g/g exhaust PM10)	3.40E-05	1.00E-04	3.40E-05	1.00E-04			7.10E-07
Benzo(a)pyrene (g/g exhaust PM10)	2.90E-05	1.00E-04	2.90E-05	1.00E-04			3.50E-07
Benzo(b)fluoranthene (g/g exhaust PM10)	1.60E-05	1.20E-04	1.60E-05	1.20E-04			4.90E-07
Benzo(g,h,i)perylene (g/g exhaust PM10)	1.16E-04	2.60E-04	1.16E-04	2.60E-04			1.90E-07
Benzo(k)fluoranthene (g/g exhaust PM10)	1.40E-05	1.20E-04	1.40E-05	1.20E-04			3.50E-07
Chrysene (g/g exhaust PM10)	2.10E-05	1.00E-04	2.10E-05	1.00E-04			1.90E-06
Dibenzo(a,h)anthracene (g/g exhaust PM10)	1.00E-06		1.00E-06				2.90E-09
Fluoranthene (g/g exhaust PM10)	2.67E-04	9.10E-04	2.67E-04	9.10E-04			1.70E-05
Fluorene (g/g exhaust PM10)	2.39E-04	1.51E-03	2.39E-04	1.51E-03			1.00E-04
Indeno(1,2,3,c,d)pyrene (g/g exhaust PM10)	3.50E-05	8.00E-05	3.50E-05	8.00E-05			7.90E-08
Naphthalene (g/g exhaust PM10)	4.00E-06	9.07E-02	4.00E-06	9.07E-02			4.60E-04
Phenanthrene (g/g exhaust PM10)	2.08E-04	2.54E-03	2.08E-04	2.54E-03			2.60E-04
Pyrene (g/g exhaust PM10)	3.18E-04	1.24E-03	3.18E-04	1.24E-03			2.90E-06
1,3-Butadiene (g/g exhaust NMVOC)	2.15E-03	9.52E-03	2.15E-03	9.52E-03			1.86E-03
2,2,4-Trimethylpentane (g/g exhaust NMVOC)	3.72E-02	1.93E-02	3.72E-02	1.93E-02			7.19E-04
Acetaldehyde (g/g exhaust NMVOC)	1.66E-03	4.10E-03	3.33E-03	8.20E-03			5.31E-02
Acrolein (g/g exhaust NMVOC)	3.00E-04	7.00E-04	2.97E-04	6.93E-04			3.03E-03
Benzene (g/g exhaust NMVOC)	2.52E-02	5.25E-02	2.26E-02	4.72E-02			2.03E-02
Ethyl Benzene (g/g exhaust NMVOC)	2.40E-02	1.98E-02	2.18E-02	1.80E-02			3.10E-03
Formaldehyde (g/g exhaust NMVOC)	2.54E-03	1.17E-02	3.45E-03	1.59E-02			1.18E-01
Hexane (g/g exhaust NMVOC)	1.42E-02	9.92E-03	1.40E-02	9.82E-03			1.59E-03
Propionaldehyde (g/g exhaust NMVOC)	2.47E-04	1.88E-03	2.44E-04	1.86E-03			1.18E-02
Styrene (g/g exhaust NMVOC)	1.30E-03	7.58E-04	1.18E-03	6.90E-04			5.94E-04
Toluene (g/g exhaust NMVOC)	9.78E-02	7.18E-02	8.90E-02	6.54E-02			1.50E-02
Xylene (g/g exhaust NMVOC)	1.07E-01	6.78E-02	9.78E-02	6.17E-02			1.06E-02
2,2,4-Trimethylpentane (g/g evap NMVOC)	1.58E-02	1.58E-02	1.58E-02	1.58E-02			
Benzene (g/g evap NMVOC)	2.20E-02	2.20E-02	1.25E-02	1.25E-02			
Ethyl Benzene (g/g evap NMVOC)	7.70E-03	7.70E-03	4.50E-03	4.50E-03			
Hexane (g/g evap NMVOC)	2.34E-02	2.34E-02	9.60E-03	9.60E-03			
Toluene (g/g evap NMVOC)	4.13E-02	4.13E-02	1.95E-02	1.95E-02			
Xylene (g/g evap NMVOC)	2.23E-02	2.23E-02	1.19E-02	1.19E-02			

Parameter name	CAS or other ID	Formula	Mol wt	Carbon fraction
Total Organic Gases (g/g exhaust THC)	TOG			
Non-Methane Organic Gases (g/g exhaust THC)	NMOG			
Non-Methane Hydrocarbons (g/g exhaust THC)	NMHC			
Non-Methane Volatile Organic Compounds (g/g exhaust THC)	NMVOC			
Secondary Organic Aerosol (g/g NMVOC)	SOA			
Total Organic Gases (g/g evap THC)	TOG			
Non-Methane Organic Gases (g/g evap THC)	NMOG			
Non-Methane Hydrocarbons (g/g evap THC)	NMHC			
Non-Methane Volatile Organic Compounds (g/g evap THC)	NMVOC			
Methane (g/g exhaust THC)	000074-82-8	CH4	16.04	0.75
Ammonia (g/gal fuel)	007664-41-7	H3N	17.03	0.00
1,2,3,4,6,7,8-Heptachlorodibenzofuran (g/gal fuel)	067562-39-4	C12HCl7O	409.31	0.35
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (g/gal fuel)	035822-46-9	C12HCl7O2	425.31	0.34
1,2,3,4,7,8,9-Heptachlorodibenzofuran (g/gal fuel)	055673-89-7	C12HCl7O	409.31	0.35
1,2,3,4,7,8-Hexachlorodibenzofuran (g/gal fuel)	070648-26-9	C12H2Cl6O	374.86	0.38
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	039227-28-6	C12H2Cl6O2	390.86	0.37
1,2,3,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	057117-44-9	C12H2Cl6O	374.86	0.38
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	057653-85-7	C12H2Cl6O2	390.86	0.37
1,2,3,7,8,9-Hexachlorodibenzofuran (g/gal fuel)	072918-21-9	C12H2Cl6O	374.86	0.38
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (g/gal fuel)	019408-74-3	C12H2Cl6O2	390.86	0.37
1,2,3,7,8-Pentachlorodibenzofuran (g/gal fuel)	057117-41-6	C12H3Cl5O	340.42	0.42
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (g/gal fuel)	040321-76-4	C12H3Cl5O2	356.42	0.40
2,3,4,6,7,8-Hexachlorodibenzofuran (g/gal fuel)	060851-34-5	C12H2Cl6O	374.86	0.38
2,3,4,7,8-Pentachlorodibenzofuran (g/gal fuel)	057117-31-4	C12H3Cl5O	340.42	0.42
2,3,7,8-Tetrachlorodibenzofuran (g/gal fuel)	051207-31-9	C12H4Cl4O	305.97	0.47
2,3,7,8-Tetrachlorodibenzo-p-Dioxin (g/gal fuel)	001746-01-6	C12H4Cl4O2	321.97	0.45
Chromium (Cr3+) (g/gal fuel)	016065-83-1	Cr	51.99	0.00
Chromium (Cr6+) (g/gal fuel)	018540-29-9	Cr	51.99	0.00
Manganese (g/gal fuel)	007439-96-5	Mn	54.94	0.00
Mercury (divalent gaseous) (g/gal fuel)	000000000NA	Hg+2	200.59	0.00
Mercury (elemental gaseous) (g/gal fuel)	007439-97-6	Hg	200.59	0.00
Mercury (particulate) (g/gal fuel)	000000000NA	Hg	200.59	0.00
Nickel (g/gal fuel)	007440-02-0	Ni	58.69	0.00
Octachlorodibenzofuran (g/gal fuel)	039001-02-0	C12Cl8O	443.75	0.32
Octachlorodibenzo-p-dioxin (g/gal fuel)	003268-87-9	C12Cl8O2	459.75	0.31
Acenaphthene (g/g exhaust PM10)	000083-32-9	C12H10	154.21	0.93
Acenaphthylene (g/g exhaust PM10)	000208-96-8	C12H8	152.19	0.95
Anthracene (g/g exhaust PM10)	000120-12-7	C14H10	178.23	0.94
Arsenic & compounds (g/g exhaust PM10)	000000000NA	As	74.92	0.00
Benz(a)anthracene (g/g exhaust PM10)	000056-55-3	C18H12	228.29	0.95
Benzo(a)pyrene (g/g exhaust PM10)	000050-32-8	C20H12	252.31	0.95
Benzo(b)fluoranthene (g/g exhaust PM10)	000205-99-2	C20H12	252.31	0.95
Benzo(g,h,i)perylene (g/g exhaust PM10)	000191-24-2	C22H12	276.33	0.96
Benzo(k)fluoranthene (g/g exhaust PM10)	000207-08-9	C20H12	252.31	0.95
Chrysene (g/g exhaust PM10)	000218-01-9	C18H12	228.29	0.95
Dibenzo(a,h)anthracene (g/g exhaust PM10)	000053-70-3	C22H14	278.35	0.95
Fluoranthene (g/g exhaust PM10)	000206-44-0	C16H10	202.25	0.95
Fluorene (g/g exhaust PM10)	000086-73-7	C13H10	166.22	0.94
Indeno(1,2,3,c,d)pyrene (g/g exhaust PM10)	000193-39-5	C22H12	276.33	0.96
Naphthalene (g/g exhaust PM10)	000091-20-3	C10H8	128.17	0.94
Phenanthrene (g/g exhaust PM10)	000085-01-8	C14H10	178.23	0.94
Pyrene (g/g exhaust PM10)	000129-00-0	C16H10	202.25	0.95
1,3-Butadiene (g/g exhaust NMVOC)	000106-99-0	C4H6	54.09	0.89
2,2,4-Trimethylpentane (g/g exhaust NMVOC)	000540-84-1	C8H18	114.23	0.84
Acetaldehyde (g/g exhaust NMVOC)	000075-07-0	C2H4O	44.05	0.55
Acrolein (g/g exhaust NMVOC)	000107-02-8	C3H4O	56.06	0.64

Parameter name	CAS or other ID	Formula	Mol wt	Carbon fraction
Benzene (g/g exhaust NMVOC)	000071-43-2	C6H6	78.11	0.92
Ethyl Benzene (g/g exhaust NMVOC)	000100-41-4	C8H10	106.17	0.91
Formaldehyde (g/g exhaust NMVOC)	000050-00-0	CH2O	30.03	0.40
Hexane (g/g exhaust NMVOC)	000110-54-3	C6H14	86.18	0.84
Propionaldehyde (g/g exhaust NMVOC)	000123-38-6	C3H6O	58.08	0.62
Styrene (g/g exhaust NMVOC)	000100-42-5	C8H8	104.15	0.92
Toluene (g/g exhaust NMVOC)	000108-88-3	C7H8	92.14	0.91
Xylene (g/g exhaust NMVOC)	001330-20-7	C8H10	106.17	0.91
2,2,4-Trimethylpentane (g/g evap NMVOC)	000540-84-1	C8H18	114.23	0.84
Benzene (g/g evap NMVOC)	000071-43-2	C6H6	78.11	0.92
Ethyl Benzene (g/g evap NMVOC)	000100-41-4	C8H10	106.17	0.91
Hexane (g/g evap NMVOC)	000110-54-3	C6H14	86.18	0.84
Toluene (g/g evap NMVOC)	000108-88-3	C7H8	92.14	0.91
Xylene (g/g evap NMVOC)	001330-20-7	C8H10	106.17	0.91