

EDMS Reference Manual Supplement

- EDMS 4.1 Default GSE Assignment Revisions -

EDMS 4.1 marks the first phase of migration towards the EPA draft NONROAD model for GSE emissions. This transition includes incorporating EPA-provided fleet average emission indices (in units of grams per brake horsepower-hour) for four fuel types (gasoline, diesel, CNG, and LPG) and study years 1990 to 2020 into the EDMS system tables. Since emission indices are looked up by year, this requires users to provide a study year in EDMS. This is a new input requirement for EDMS that will increase the accuracy of GSE results.

In addition to incorporating new emission factors, EDMS 4.1 updates the default GSE assignments and their fuels used, operating times, brake horsepower (BHP) ratings, and load factors based on EPA's draft NONROAD model where data was available and supplemented by an expert review. The GSE types from NONROAD were split into subtypes for version 4.1 in order to gain a finer level of detail, which resulted in a more accurate characterization of GSE operations. Furthermore, the user is given the opportunity in EDMS 4.1 to edit load factor and brake horsepower values. The previous version of EDMS (4.0) allowed the user to only edit the fuel-type and operating time for GSE. The EDMS default GSE assignments for any version of EDMS is found in the GSE_DEF.DBF system table file.

Previously, some aircraft did not have any default GSE assignments, however all aircraft in version 4.1 have at least one default GSE assigned. There are 399 aircraft types available in the EDMS 4.0 database. Table 1 lists the 19 aircraft that have default GSE assignments in version 4.1, but did not in 4.0. Table 1 also provides the range of emissions that result from the newly added default GSE per landing and takeoff cycle (LTO). A range is given in Table 1, instead of a fixed number, since emissions rates change year to year. In general, the greater value occurs for 1990 and the lesser for 2020, due to EPA's assumptions on more efficient technologies in the future. Interpolation can be used to estimate the impact for any year between 1990 and 2020. In most of these cases, Table 1 shows the impact of including the default assignment of a fuel truck servicing small aircraft, which results in small amounts of emissions. Table 2 lists the percent change in emissions from default GSE assignments for the remaining 380 aircraft in the EDMS database.

These enhancements to the EDMS system tables significantly impact emissions for the default GSE assignments. For some aircraft, the changes appear to be quite excessive (e.g., CO for the Vickers 953 Vanguard). While not all aircraft see such dramatic increases, a majority of them do experience an increase on the order of 100% for some pollutant and study year. Such changes can be attributed to an increase in the default GSE assignments using gasoline fuel as well as the revised emission factors. The reasons for these increases are described below.

The almost 400 aircraft listed in Tables 1 and 2 all have between 1 to 14 GSE assigned to them in version 4.1. In version 4.0, there were over 2,700 default GSE-to-aircraft assignments (about 7 GSE are assigned to each aircraft on average). In version 4.1, there are over 3,000 such assignments. The net gain of 300 assignments in version 4.1 is the result of adding over 1,000 new assignments while simultaneously phasing out over 700 obsolete assignments in order to be more representative of current GSE usage. The exactly 2,000 assignments retained between

versions had their names, most of their default parameters (e.g., operating time, BHP and load factor) and emission factors revised. For example, the *Diesel Lavatory Trucks* assigned to narrow body aircraft (with defaults of 20 minutes/LTO, 172 BHP and a 20% load factor) are renamed *Lavatory Truck, Narrow Body* (with defaults of 15 minutes/LTO, 56 BHP and a 25% load factor). For some assignments, even the fuel was changed. For example, the *Diesel Belt Loaders* in 4.0 are replaced by their gasoline-powered counterparts in 4.1.

To isolate the contributing factors to the changes presented in Tables 1 and 2, Tables 3 and 4 show the changes to the emission factors and default parameters, respectively, for the 2,000 retained assignments. To illustrate the relative significance of some GSE replacements over others, both Tables 3 and 4 list the frequency distribution of each of the replacements in decreasing order.

The top 7 replacements of Table 3 all show a large increase in the emission factors for two or more pollutants. To determine the dominant cause of the change in emissions, Tables 3 and 4 should be compared. In fact, there might even be a decrease in the default parameters (operating time, BHP and load factor) for GSE that are overshadowed by a more significant increase in the emission factors. For example, the hydrocarbon (HC) emission factor for the *Gasoline Baggage Tug* in Table 3 increases 218%. From the second row of Table 4, the operating time, BHP and load factor for the “Baggage Tractor, Narrow Body” change by -12%, 7% and 0%, respectively, resulting in a change of -6% in total work output. Since -6% has little effect on +218%, the HC emission contribution from this baggage tug replacement still increases significantly.

Table 5 lists the frequencies with which obsolete GSE assignments were phased out during the transition from version 4.0 to 4.1, as well as the per LTO emission contribution from a single GSE assignment. Similarly, Table 6 lists the same for default GSE assignments added in version 4.1. Neither table demonstrates any significant net change in emissions from those GSE assignments that were phased out or added. Those GSE that are large contributors to the emissions inventory are ranked quite low. For example, the largest CO emission that was phased out is 18.700 (kg/LTO), but this occurs only for 2 gasoline baggage tugs as shown in Table 5. Likewise, the largest CO emission added to EDMS 4.1 is 25.597 (kg/LTO), which occurs for only 3 narrow body baggage tractors as shown in Table 6. Therefore, the large increases can best be explained by the revision of the emission factors and operating parameters for the GSE presented in Tables 3 and 4.

To determine the impact on emissions for a given study, it is important to look at the GSE changes for each aircraft. As an example, a study includes the default GSE assignments for a single LTO cycle of a Boeing 737-300 modeled for the year 1990. In version 4.0, the following 7 GSE are assigned by default to a 737-300: *Diesel Aircraft Tug Narrow*, *Diesel Belt Loader*, *Diesel Cabin Service*, *Diesel Food Truck*, *Diesel Fuel Truck*, *Diesel Lavatory Truck* and a *Gasoline Baggage Tug* (see Table 7). In version 4.1, there are 11 GSE assigned by default to this aircraft (see Table 8). The fuel truck assignment is phased-out for the Boeing 737-300 (and shaded in Table 7), hence there is a net gain of 5 new assignments. Two of the new additions are an electric *Water Service* and *Air Conditioner Narrow Body*, and therefore do not contribute any emissions. The three other new assignments are a Diesel-powered *Service Truck*, *Air Start 180 PPM* and a *Hydrant Truck Narrow Body*, which is what replaces the function of the phased-out fuel truck. The last five columns of Tables 7 and 8 clearly show the emissions increasing by

showing what each GSE contributes to the inventory (the high values of Table 8 are much greater than those in Table 7). The retained 6 assignments (all for a narrow body aircraft) have significant increases in two or more of their emission factors. Three of these 6 (lavatory truck, baggage tractor and aircraft tractor) have decreases in the total work output (-69%, -6% and -33%, respectively), but none of these decreases are significant enough to overcome increases in the emission indices such as 45% for CO, 218% for HC, 81% for NO_x, 391% for SO_x and 325% for PM. Simply put, the values of table 4 are more often than not smaller in magnitude than those of table 3. This explains the increases in emissions for the Boeing 737-300's, as shown in Table 2.

Table 9 lists the percent change in the emission rates for individual GSE. A range of percent values is shown where emissions rates change from year to year.

**Table 1: Default GSE Emission Ranges
for Aircraft Previously without Any Default GSE Assignment.**

Aircraft Names	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
337H Skymaster Aztec Cessna 150 Cessna T337 Cherokee six Commanche Navajo P-337P Skymaster Piper PA-28 Robin DR 400 Robin R 2160 Robin R 3000 Robinson R22 Rockwell Commander Socata Tampico Socata Tobago	0.002 to 0.067 lbs/LTO	0.002 to 0.017 lbs/LTO	0.004 to 0.121 lbs/LTO	0.009 to 0.013 lbs/LTO	0.014 to 0.032 lbs/LTO
A-7 CORSAIR II A-7E CORSAIR H-550A Stallion	0.6 to 2.031 lbs/LTO	0.134 to 0.666 lbs/LTO	1.852 to 7.719 lbs/LTO	0.482 to 0.484 lbs/LTO	0.201 to 0.667 lbs/LTO

Table 2: Percent Changes in Emissions from Default GSE Assigned to Aircraft.

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
400A Hustler	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
Cessna Citations (except CITATION T-47A)	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
A-10A Thunderbolt II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
A300's (except -F models)	144% to 150%	210% to 264%	-39% to 66%	241% to 298%	83% to 339%
A300-600F	146% to 153%	216% to 291%	-26% to 97%	306% to 331%	74% to 389%
A300-F4-200	146% to 155%	218% to 307%	-25% to 127%	389% to 445%	142% to 520%
A310, A310-200 & A310-200C	153% to 159%	327% to 401%	18% to 220%	461% to 555%	296% to 851%
A310-200F	155% to 162%	335% to 439%	44% to 281%	570% to 607%	266% to 974%
A310-300	153% to 159%	327% to 401%	18% to 220%	461% to 555%	296% to 851%
A310-304	153% to 159%	325% to 390%	7% to 174%	378% to 473%	277% to 766%
A319, A320's, & A321's	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
A330's	153% to 160%	328% to 409%	24% to 249%	519% to 613%	311% to 920%
A340's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
A-4 SKYHAWK, A-4M SKYHAWK, A-6 INTRUDER, Alpha 70, AN-72, AN-74 & AV-8B Harrier II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
AH-1J Cobra	-97% to -90%	-90% to -48%	353% to 1787%	4282% to 4300%	458% to 1753%
ATR's	-4% to -3%	63% to 79%	-55% to -5%	51% to 70%	-13% to 105%
AVRO-RJ100	87% to 89%	215% to 242%	-29% to 46%	131% to 195%	108% to 330%
AVRO-RJ's (except RJ100)	87% to 89%	215% to 238%	-30% to 38%	111% to 168%	86% to 279%
Beech 99's	-38% to -37%	2% to 15%	-71% to -26%	26% to 40%	-32% to 70%
B-1B & B52's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
B707's (except B707-300C & B707-E)	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B707-300C	88% to 91%	220% to 267%	-9% to 126%	281% to 335%	142% to 493%
B707-E	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B717-200; B720-00B; B727-100, -100RE, -200, -200RE; B737-100 through -900	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
B727-100C, B737-200C	87% to 91%	220% to 264%	-12% to 115%	260% to 316%	137% to 468%
B727-100F, -100RF, -200F, -200RF; B737-200F, -300F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
B747-100, -100B, -100SR, -200, -300, -400, -SP; B767-300ER, B777's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
B747-100F, -200F, -400F; B767-300F	147% to 159%	223% to 325%	-9% to 168%	473% to 494%	107% to 513%
B747-200 (MIL)	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
B747-200C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
B757-200	87% to 90%	217% to 253%	-16% to 97%	222% to 277%	111% to 398%
B757-200F	88% to 95%	225% to 285%	7% to 166%	348% to 367%	90% to 451%
B767-200 B767-200ER B767-300	145% to 152%	212% to 278%	-30% to 104%	327% to 383%	98% to 410%
BAC-111's (except BAC-111-400F)	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
BAC-111-400F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
BAE 125-700	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Bae ATP	-4% to -1%	65% to 85%	-55% to -4%	51% to 67%	-17% to 92%
Bae Nimrod MRA4	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
BAE146's	87% to 91%	216% to 245%	-29% to 42%	118% to 171%	83% to 275%
Beechjet 400, Beechjet 400A	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Beechjet 400T	-69.0% to -68.8%	-83.3% to -82.7%	-76% to -67%	-37% to -28%	-81% to -58%
BH-1900's	81% to 82%	253% to 259%	-2% to 22%	17% to 30%	0% to 107%
Bombardier Global Ex	-4.3% to -3.5%	62% to 70%	-63% to -40%	-20% to -3%	-39% to 32%
C-101 AVIOJET, C-12A/B/C, C-130's C-135's, C-141's, C-17A, C-1A TRADER, C-5 Galaxy, C-9's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
C-21-A	-100% to -99%	-100% to -98%	-87% to -47%	232% to 236%	-76% to -27%
Canadair Regs	-4% to -2%	63% to 77%	-63% to -38%	-16% to 0%	-38% to 33%
Caraja NE-821	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
Caravelles	3937% to 3987%	491% to 537%	-52% to -4%	114% to 168%	11% to 130%
CITATION T-47A	-68.9% to -68.6%	-83% to -82%	-74% to -59%	-11% to -3%	-75% to -36%
CL600's (except CL601-3R)	-3% to 0%	69% to 104%	-37% to 76%	210% to 226%	34% to 237%
CL601-3R	-4% to -1%	67% to 98%	-37% to 75%	211% to 229%	38% to 249%
CN-235-200	-87% to -66%	-94% to -62%	-89% to -51%	52% to 59%	-59% to 7%
CONCORDEs	87% to 89%	215% to 239%	-29% to 41%	119% to 174%	87% to 287%
Convair liner	-91% to -53%	-92% to -53%	-93% to -61%	20% to 34%	-52% to 43%
Dash 7	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
DC10-10, -15, -30, -30ER, -40	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
DC10-10C, -30C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
DC10-10F, -30CF Series, -30F	84% to 95%	149% to 246%	-23% to 142%	427% to 448%	96% to 486%
DC8, -51, -52, -53, -55, -60, -61, -62, -63, -70, -71, -72	87% to 89%	216% to 242%	-26% to 51%	139% to 195%	93% to 312%
DC8-50F, -51F, -52F, -53F, -54F, -55F, -62F, -63F, -71F, -73F	88% to 96%	227% to 296%	9% to 192%	408% to 446%	150% to 613%
DC8-55C, -62C, -63C, -72C, -73C	153% to 158%	324% to 387%	12% to 191%	403% to 497%	265% to 756%
DC8-61F	-100% to -99%	-99% to -95%	-96% to -81%	-61.46%	-90% to -54%
DC9-10, -20, -30, -40, -50, -80	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
DC9-10C, -30C	87% to 91%	220% to 264%	-12% to 115%	260% to 316%	137% to 468%
DC9-10F, -15F, -30F, -40F	88% to 94%	225% to 282%	5% to 156%	328% to 346%	84% to 426%
DHC-6's	-4% to -3%	64% to 79%	-55% to -3%	56% to 76%	-7% to 110%
DHC-7; DHC-8-100, -200, -300, -400	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
DIAMOND 300	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
DO 328	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
E-2 HAWKEYE, EA-6B PROWLER, EC-135's	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
EMB-110's, -120	-4% to -3%	63% to 79%	-55% to -5%	51% to 70%	-13% to 105%
Embraer ERJ 145	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
Equator P-550 Turbo	-6.0% to -5.6%	93% to 97%	-39% to -24%	-24% to -19%	-42% to 24%
F/A-18 HORNET, F-117 Night Hawk, F-14A Tomcat, F-15's, F-16, F-4's, F-5F TIGER II	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
F-27 SERIES	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
F-28's	87% to 89%	214% to 233%	-31% to 26%	84% to 133%	62% to 205%
Falcons	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
FH-227	-4% to -3%	64% to 80%	-55% to -1%	61% to 83%	-2% to 123%
Fokker 100	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
Fokker 50	-4% to -3%	62% to 72%	-63% to -34%	-5% to 17%	-23% to 63%
Fokker 50 HI Perf	-4% to -3%	62% to 73%	-62% to -30%	2% to 24%	-21% to 72%
Fokker 60 Utility	-100% to -99%	-99% to -91%	-97% to -75%	-47% to -33%	-55% to 14%
Fokker 70	87% to 90%	217% to 250%	-18% to 87%	202% to 257%	106% to 373%
FT337P	-100% to -99%	-97% to -82%	-85% to -21%	54% to 65%	20% to 207%
Gulfstream I	-5% to -4%	86% to 92%	-43% to -21%	-20% to -6%	-27% to 51%
Gulfstream II	62% to 63%	182% to 190%	-33% to -7%	7% to 25%	-27% to 51%
Gulfstream III	-38% to -37%	2% to 14%	-74% to -37%	11% to 29%	-22% to 76%
Gulfstream IV & V	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
H-2 SEASPRITE, H-3 SEA KING, H-46 SEA KNIGHT, H-46E SEA KNIGHT, H-53D Sea Stallion	-97% to -91%	-90% to -52%	335% to 1713%	4100% to 4118%	422% to 1628%
H-60 Black Hawk, HH-3E GREEN GIANT, HH-3F	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
HS 125	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
HS 748's	16% to 17%	99% to 112%	-54% to -17%	20% to 49%	0% to 102%
IAI 1124, IAI Westwind	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
IAI-101-A, IAI-201-102, IAI-202	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
Il-62, Il-76	80% to 82%	124% to 144%	-59% to -14%	58% to 78%	-33% to 75%
Il-86	12% to 14%	43% to 63%	-70% to -25%	49% to 69%	-35% to 73%
Il-96-300	-39% to -36%	-24% to 2%	-80% to -29%	60% to 80%	-31% to 78%

Aircraft Name	CO Range	HC Range	NO_x Range	SO_x Range	PM₁₀ Range
II-96M	80% to 82%	123% to 142%	-60% to -19%	46% to 67%	-35% to 64%
Jetstar	-6% to -5%	95% to 109%	-35% to 13%	52% to 78%	56% to 324%
KC-10A, KC-135R	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
King Air 200's	-12.3% to -11.5%	62% to 75%	-48% to 8%	59% to 65%	0% to 149%
L-100's	-90% to -42%	-90% to -43%	-93% to -52%	51% to 73%	-34% to 93%
L-1011-1, -100, -50	145% to 152%	212% to 278%	-30% to 104%	327% to 383%	98% to 410%
L-1011-1F	147% to 160%	225% to 333%	-4% to 192%	524% to 544%	116% to 552%
L-1011-40	144% to 151%	204% to 267%	-34% to 92%	306% to 360%	88% to 383%
L-1011-150, -200, -250, -500's	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
L-188 A/C	16% to 18%	102% to 126%	-48% to 21%	104% to 151%	61% to 293%
Learjets	-6.1% to -5.6%	93% to 98%	-41% to -25%	-26% to -13%	-20% to 58%
MD-11, MD-11-11	145% to 151%	211% to 270%	-36% to 81%	276% to 333%	90% to 370%
MD-11-11C	146% to 156%	219% to 313%	-22% to 142%	425% to 480%	149% to 552%
MD-11-11F	147% to 159%	223% to 325%	-9% to 168%	473% to 494%	107% to 513%
MD-80's & MD-90's	34% to 37%	120% to 159%	-35% to 88%	244% to 299%	124% to 423%
Mercure-100	87% to 91%	217% to 248%	-19% to 66%	151% to 185%	44% to 262%
MIG-18-50	-99% to -96%	-98% to -89%	-14% to 258%	1972% to 1984%	30% to 342%
MU-300	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
N 22B Nomad 22C, N 24A Nomad 24A, OV-10 BRONCO, PAMPA IA.63, Porter PC6/B2	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
N262	-37% to -36%	3% to 22%	-66% to -4%	77% to 96%	-2% to 136%
PA-42 Cheyenne	-6.0% to -5.6%	93% to 97%	-39% to -24%	-24% to -19%	-42% to 24%
REG'L JET 200's	-4% to -3%	63% to 77%	-61% to -23%	19% to 45%	-9% to 128%
RF-5E TIGEREYE, S-3B Viking	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
RU-21J	-100% to -99%	-100% to -99%	-90% to -54%	192% to 204%	-76% to -35%
SA-227's, SF-340's, Swearingens	-4% to -3%	63% to 78%	-56% to -7%	47% to 64%	-18% to 92%
Sabreliner 75A, SF600 A CANGURO, SN601 Corvette	-6% to -5%	93% to 100%	-39% to -15%	-7% to 6%	-13% to 96%
SD330 Sherpa	-37% to -36%	3% to 21%	-66% to -6%	73% to 90%	-6% to 123%
SH-3E Sea King, SH-3F Sea King, SH-60B Seahawk	-97% to -90%	-90% to -48%	353% to 1787%	4282% to 4300%	458% to 1753%
Shorts 360	-4.3% to -3.5%	62% to 70%	-63% to -40%	-20% to -3%	-39% to 32%
T-1A JAYHAWK	-68.9% to -68.6%	-83% to -82%	-74% to -59%	-11% to -3%	-75% to -36%
T-2C Buckeye, T-37 Tweet, T-43A	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
T-47A	-6% to -5%	95% to 108%	-34% to 5%	30% to 43%	18% to 196%
Tu-134	87% to 91%	217% to 248%	-19% to 66%	151% to 185%	44% to 262%
Tu-154	87% to 91%	218% to 251%	-16% to 76%	172% to 205%	50% to 287%
Tu-204	87% to 91%	218% to 258%	-14% to 107%	245% to 305%	129% to 486%
UC-12's, UV-18A, VC-25A, VC-9C	-99% to -97%	-98% to -90%	-20% to 235%	1828% to 1836%	23% to 307%
VFW 614 YS-11	-4% to -3%	62% to 71%	-63% to -38%	-15% to 4%	-34% to 45%
Vickers 953 Vanguard	3937% to 3971%	489% to 519%	-51% to -19%	57% to 86%	-35% to 52%
Westwind 1 & 2	-100% to -99%	-96% to -79%	-82% to -10%	72% to 85%	29% to 242%
YAK-42	-4% to -3%	64% to 81%	-61% to -11%	47% to 83%	23% to 182%

Table 3: Percent Change in Emission Factors of Replaced GSE.

Default GSE and AGE Assigned in 4.0	Replacement GSE in 4.1 D = Diesel G = Gasoline E = Electric	Replacement Frequency (out of 2,000)	1990					2020					
			CO	HC	NOx	SOx	PM	CO	HC	NOx	SOx	PM	
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg Aircraft Tractor, Narrow Body Aircraft Tractor, Mid-Range	D	271	23%	-9%	9%	227%	158%	-69%	-83%	-75%	229%	-42%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body												
Gasoline Baggage Tug	Baggage Tractor, Commuter Baggage Tractor, Narrow Body Baggage Tractor, Wide Body	G	243	45%	218%	81%	-33%	*	45%	218%	81%	-33%	*
Diesel Belt Loader	Belt Loader, Commuter Belt Loader, Narrow Body Belt Loader, Wide Body	G	227	5927%	903%	-34%	-39%	-90%	5927%	903%	-34%	-39%	-90%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body Lavatory Truck, Wide Body	D	215	-32%	-14%	14%	391%	325%	-97%	-89%	-94%	264%	65%
Diesel Food Truck	Catering Truck, Commuter/Reg Catering Truck, Narrow Body Catering Truck, Wide Body	D	199	-48%	-28%	7%	391%	201%	-98%	-90%	-97%	253%	77%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg Cabin Service Truck, Narrow Cabin Service Truck, Wide Body	D	167	-48%	-28%	7%	391%	201%	-98%	-90%	-97%	253%	77%
Diesel Fuel Truck	Fuel Truck, Large, 8,000+ gal Fuel Truck, MidSize, 3-6,000 g Fuel Truck, Small, < 3,000 gal	D	113	4%	-12%	-31%	223%	294%	-96%	-89%	-98%	135%	72%
(Gasoline) H1 Heater	Other	D	78	-100%	-99%	-51%	-3%	-40%	-100%	-100%	-89%	-2%	-81%
(Gasoline) NF-2 Light Cart	Cart	D	77	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
(Gasoline) MJ1 Bomblift	Lift	D	69	-95%	-96%	213%	1480%	671%	-99%	-99%	-25%	1496%	131%
(Diesel) 590G20P Generator	Generator	D	66	62%	22%	41%	1247%	65%	-52%	-75%	-66%	1254%	-50%
Diesel Airstart Unit	Air Start, 180 PPM Air Start, 300 PPM	D	64	-19%	-10%	18%	223%	118%	-76%	-85%	-72%	225%	-53%
Diesel Container Loader	Cargo Loader, Narrow Body Cargo Loader, Wide, Lower Lobe	D	62	28%	83%	102%	476%	304%	-63%	-65%	-54%	482%	33%
Diesel Water Truck	Water Service	E	50	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	43	0%	145%	81%	-32%	*	-0.1%	145%	81%	-32%	*
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	G	14	628%	296%	-24%	38%	-87%	10%	-13%	-97%	81%	-88%
Diesel Belt Loader	Belt Loader, Commuter Belt Loader, Narrow Body	D	14	-12%	12%	4%	210%	58%	-36%	-81%	-70%	212%	-34%
Diesel Water Truck	Water Service	G	9	782%	369%	-18%	23%	-86%	11%	29%	-92%	81%	-88%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	D	9	-99%	-75%	196%	211%		-100%	-95%	-31%	213%	*
Diesel Transporter	Cart	D	5	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%
Diesel Water Truck	Water Service	D	5	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%

* Previously the GSE in version 4.0 had no PM emissions, but its corresponding replacement in 4.1 does; hence the percent change is undefined.

Table 4: Changes in Default Parameter Values of Replaced GSE.

Default GSE and AGE Assigned in 4.0	Replacement GSE in 4.1 D = Diesel G = Gasoline E = Electric	Replacement Frequency (out of 2,000)	Default Values in 4.0			Default Values in 4.1			Percent Change				
			Operating Time per LTO (mins)	BHP	Load Factor	Operating Time per LTO (mins)	BHP	Load Factor	Operating Time per LTO	BHP	Load Factor	Total Work Output	
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	D	131	20	172	0.2	15	56	0.25	-25%	-67%	25%	-69%
Gasoline Baggage Tug	Baggage Tractor, Narrow Body	G	115	85	100	0.55	75	107	0.55	-12%	7%	0%	-6%
Diesel Belt Loader	Belt Loader, Narrow Body	G	109	48	45	0.5	48	107	0.5	0%	138%	0%	138%
Diesel Fuel Truck	Fuel Truck, MidSize, 3-6,000 g	D	107	35	180	0.25	20	175	0.25	-43%	-3%	0%	-44%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	D	103	6	175	0.8	5	86	0.8	-17%	-51%	0%	-59%
Diesel Food Truck	Catering Truck, Narrow Body	D	95	35	184	0.25	15	210	0.53	-57%	14%	112%	4%
Diesel Lavatory Truck	Lavatory Truck, Wide Body	D	84	20	172	0.2	25	235	0.25	25%	37%	25%	113%
Diesel Cabin Service	Cabin Service Truck, Narrow	D	83	15	172	0.2	20	210	0.53	33%	22%	165%	331%
(Gasoline) H1 Heater	Other	D	78	105	2.5	0.95	0	140	0.5	-100%	5500%	-47%	-100%
(Gasoline) NF-2 Light Cart	Cart	D	77	105	10.3	0.20	10	25	0.5	-90%	143%	150%	-42%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Narrow Body	D	76	6	175	0.8	8	88	0.8	33%	-50%	0%	-33%
Diesel Belt Loader	Belt Loader, Wide Body	G	70	48	45	0.5	35	107	0.5	-27%	138%	0%	73%
Gasoline Baggage Tug	Baggage Tractor, Wide Body	G	70	85	100	0.55	120	107	0.55	41%	7%	0%	51%
(Gasoline) MJ1 Bomblift	Lift	D	69	95	30	0.59	10	115	0.5	-89%	283%	-15%	-66%
(Diesel) 590G20P Generator	Generator	D	66	20	148	0.86	120	158	0.82	500%	7%	-5%	511%
Diesel Food Truck	Catering Truck, Wide Body	D	63	35	184	0.25	20	210	0.53	-43%	14%	112%	38%
Diesel Cabin Service	Cabin Service Truck, Wide Body	D	62	15	172	0.2	35	210	0.53	133%	22%	165%	655%
Diesel Container Loader	Cargo Loader, Wide, Lower Lobe	D	59	92	172	0.2	80	80	0.5	-13%	-53%	150%	1%
Gasoline Baggage Tug	Baggage Tractor, Commuter	G	58	85	100	0.55	35	107	0.55	-59%	7%	0%	-56%
Diesel Airstart Unit	Air Start, 180 PPM	D	56	3	600	0.9	7	425	0.9	133%	-29%	0%	65%
Diesel Water Truck	Water Service	E	50	12	172	0.2	12	0	0.2	0%	-100%	0%	-100%
Diesel Belt Loader	Belt Loader, Commuter	G	48	48	45	0.5	30	107	0.5	-38%	138%	0%	49%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Mid-Range	D	47	6	175	0.8	8	190	0.8	33%	9%	0%	45%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body	D	45	8	175	0.8	8	475	0.8	0%	171%	0%	171%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	43	30	150	0.75	40	107	0.75	33%	-29%	0%	-5%
Diesel Food Truck	Catering Truck, Commuter/Reg	D	41	35	184	0.25	10	71	0.53	-71%	-61%	112%	-77%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg	D	22	15	172	0.2	10	71	0.53	-33%	-59%	165%	-27%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	G	14	20	172	0.2	15	97	0.25	-25%	-44%	25%	-47%
Diesel Belt Loader	Belt Loader, Narrow Body	D	11	48	45	0.5	48	71	0.5	0%	58%	0%	58%
Diesel Water Truck	Water Service	G	9	12	172	0.2	12	260	0.2	0%	51%	0%	51%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	D	9	30	150	0.75	40	71	0.75	33%	-53%	0%	-37%
Diesel Airstart Unit	Air Start, 300 PPM	D	8	3	600	0.9	7	850	0.9	133%	42%	0%	231%
Diesel Transporter	Cart	D	5	10	172	0.2	10	25	0.5	0%	-85%	150%	-64%
Diesel Water Truck	Water Service	D	5	12	172	0.2	12	235	0.2	0%	37%	0%	37%
Diesel Fuel Truck	Fuel Truck, Small, < 3,000 gal	D	4	35	180	0.25	10	175	0.25	-71%	-3%	0%	-72%
Diesel Belt Loader	Belt Loader, Commuter	D	3	48	45	0.5	30	71	0.5	-38%	58%	0%	-1%
Diesel Container Loader	Cargo Loader, Narrow Body	D	3	92	172	0.2	40	80	0.5	-57%	-53%	150%	-49%
Diesel Fuel Truck	Fuel Truck, Large, 8,000+ gal	D	2	35	180	0.25	45	300	0.25	29%	67%	0%	114%

Table 5: Removed Default GSE Assignments.

Frequency of Removal (out of 738)	GSE Type Removed	Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	Emission Contribution per LTO (Kilograms)				
		CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
190	Diesel Fuel Truck	4	1.2	11	0.25	0.5	180	0.25	35	0.105	0.032	0.289	0.006	0.013
78	Diesel Cabin Service	6.431	1.28	6.727	0.1647	0.498	172	0.20	15	0.055	0.011	0.058	0.002	0.004
71	(Gasoline) 9MC2A Compressor	1203.62	75.81	23.94	0.66	1.99	10.3	0.15	36	1.086	0.068	0.022	0.001	0.002
71	(Gasoline) M32T1 Pressure Tester	176	6.94	4.57	0.02	0.29	175	0.50	6	1.540	0.061	0.040	0.000	0.003
71	(Gasoline) TTU228E Hydraulic Test Stand	176	6.87	4.57	0.02	0.29	175	0.75	28	10.780	0.421	0.280	0.001	0.018
64	Diesel Airstart Transporter	6.431	1.28	6.727	0.1647	0.498	128	0.25	3	0.010	0.002	0.011	0.000	0.001
59	Diesel Transporter	6.431	1.28	6.727	0.1647	0.498	172	0.20	10	0.037	0.007	0.039	0.001	0.003
46	Diesel Food Truck	6.431	1.28	6.727	0.1647	0.498	184	0.25	35	0.172	0.034	0.180	0.005	0.013
26	Diesel Aircraft Tug Wide	4	1.2	11	0.25	0.5	500	0.80	8	0.213	0.064	0.587	0.013	0.027
16	Diesel Lavatory Truck	6.431	1.28	6.727	0.1647	0.498	172	0.20	20	0.074	0.015	0.077	0.002	0.006
12	Diesel Aircraft Tug Narrow	4	1.2	11	0.25	0.5	175	0.80	6	0.056	0.017	0.154	0.004	0.007
9	Diesel Container Loader	6.431	1.28	6.727	0.1647	0.498	172	0.20	92	0.339	0.067	0.354	0.009	0.026
7	Diesel Cargo Loader	4	1.2	11	0.25	0.5	76	0.50	92	0.233	0.071	0.641	0.015	0.029
5	(Diesel) 590G20P Generator	2	0.88	9.19	0.06	0.66	148	0.86	20	0.085	0.037	0.390	0.003	0.028
4	Diesel Belt Loader	4	1	11	0.29	0.7	45	0.50	48	0.072	0.018	0.198	0.006	0.013
3	(Gasoline) NF-2 Light Cart	1197.09	75.24	23.79	0.36	2.14	10.3	0.20	105	4.316	0.271	0.086	0.001	0.008
2	Gasoline Baggage Tug	240	4	4	0.26	0	100	0.55	85	18.700	0.312	0.312	0.020	0.000
2	(Gasoline) H1 Heater	1204.21	75.37	24	0.84	2.11	2.5	0.95	105	5.005	0.313	0.100	0.004	0.009
2	(Gasoline) MJ1 Bomblift	176.27	61.02	4.58	0.06	0.28	30	0.59	95	4.940	1.710	0.128	0.002	0.008

Table 6: Added Default GSE Assignments.

Frequency of Addition (out of 1,012)	GSE Type Added D = Diesel G = Gasoline E = Electric		1990 Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	1990 Emission Contribution per LTO (Kilograms)				
			CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
246	Service Truck	D	4.262	1.074	7.603	0.808	2.032	235	0.2	15	0.050	0.013	0.089	0.009	0.024
104	Hydrant Truck, Narrow Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	12	0.147	0.037	0.254	0.027	0.071
99	Water Service	E	0.000	0.000	0.000	0.000	0.000	0	0.2	12	0.000	0.000	0.000	0.000	0.000
93	Air Start, 180 PPM	D	3.247	1.075	12.982	0.808	1.088	425	0.9	7	0.145	0.048	0.579	0.036	0.049
86	Hydrant Truck, Wide Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	20	0.246	0.061	0.423	0.044	0.118
85	Air Conditioner, Narrow Body	E	0.000	1.112	0.000	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000
63	Air Conditioner, Wide Body	E	0.000	0.000	0.000	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000
32	Cargo Loader, Narrow Body	D	8.257	2.346	13.605	0.948	2.012	80	0.5	40	0.220	0.063	0.363	0.025	0.054
32	Ground Power Unit, 28VDC	D	3.185	0.984	11.850	0.809	0.955	71	0.75	40	0.113	0.035	0.421	0.029	0.034
25	Air Conditioner, Narrow Body	D	3.172	0.969	11.663	0.809	0.929	210	0.75	30	0.250	0.076	0.918	0.064	0.073
22	Water Service	G	56.749	5.998	5.513	0.203	0.068	260	0.2	12	0.590	0.062	0.057	0.002	0.001
17	Fuel Truck, Small, < 3,000 gal	D	4.151	1.056	7.550	0.808	1.968	175	0.25	10	0.030	0.008	0.055	0.006	0.014
16	Cargo Loader, Wide, Main Deck	D	8.257	2.346	13.605	0.948	2.012	133	0.5	100	0.915	0.260	1.508	0.105	0.223
16	Aircraft Tractor, Mid-Range	D	4.940	1.091	11.944	0.817	1.289	190	0.8	8	0.100	0.022	0.242	0.017	0.026
12	Generator	D	3.247	1.075	12.982	0.808	1.088	158	0.82	120	0.841	0.278	3.364	0.209	0.282
9	Cargo Loader, Wide, Lower Lobe	D	8.257	2.346	13.605	0.948	2.012	80	0.5	80	0.440	0.125	0.726	0.051	0.107
8	Lift	D	8.347	2.466	14.326	0.948	2.160	115	0.5	10	0.080	0.024	0.137	0.009	0.021
6	Air Conditioner, Wide Body	D	3.172	0.969	11.663	0.809	0.929	300	0.75	30	0.357	0.109	1.312	0.091	0.105
5	Aircraft Tractor, Narrow Body	D	4.940	1.091	11.944	0.817	1.289	88	0.8	8	0.046	0.010	0.112	0.008	0.012
4	Baggage Tractor, Commuter	G	347.958	12.707	7.240	0.174	0.068	107	0.55	35	11.945	0.436	0.249	0.006	0.002
4	Other	D	4.919	1.072	11.735	0.817	1.256	140	0.5	0	0.000	0.000	0.000	0.000	0.000
4	Ground Power Unit, 400 Hz	D	3.185	0.984	11.850	0.809	0.955	194	0.75	50	0.386	0.119	1.437	0.098	0.116
3	Baggage Tractor, Narrow Body	G	347.958	12.707	7.240	0.174	0.068	107	0.55	75	25.597	0.935	0.533	0.013	0.005
3	Belt Loader, Narrow Body	G	241.064	10.025	7.243	0.176	0.068	107	0.5	48	10.318	0.429	0.310	0.008	0.003
3	Aircraft Tractor, Wide Body	D	4.940	1.091	11.944	0.817	1.289	475	0.8	8	0.250	0.055	0.605	0.041	0.065
3	Cart	D	0.000	0.000	0.000	0.000	0.000	25	0.5	10	0.000	0.000	0.000	0.000	0.000
3	Fork Lift	D	8.347	2.466	14.327	0.948	2.160	55	0.3	0	0.000	0.000	0.000	0.000	0.000
2	Catering Truck, Narrow Body	D	3.367	0.926	7.180	0.809	1.501	210	0.53	15	0.094	0.026	0.200	0.023	0.042
2	Lavatory Truck, Narrow Body	D	4.404	1.098	7.672	0.808	2.114	56	0.25	15	0.015	0.004	0.027	0.003	0.007
2	Cabin Service Truck, Narrow	D	3.367	0.926	7.180	0.809	1.501	210	0.53	20	0.125	0.034	0.266	0.030	0.056
1	Ground Power Unit, 28VDC	G	239.851	9.812	7.240	0.176	0.068	107	0.75	40	12.832	0.525	0.387	0.009	0.004
1	Aircraft Tractor, Commuter/Reg	D	4.940	1.091	11.944	0.817	1.289	86	0.8	5	0.028	0.006	0.068	0.005	0.007
1	Belt Loader, Narrow Body	D	3.506	1.120	11.463	0.899	1.108	71	0.5	48	0.100	0.032	0.326	0.026	0.031

Table 7: Default GSE Assignments for B737-300 in EDMS 4.0.

Shaded Cells Indicate GSE Phased-Out in EDMS 4.1.

GSE Types Assigned	Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	Emission Contribution per LTO (Kilograms)				
	CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
Diesel Aircraft Tug Narrow	4	1.2	11	0.25	0.5	175	0.80	6	0.056	0.017	0.154	0.004	0.007
Diesel Belt Loader	4	1	11	0.29	0.7	45	0.50	48	0.072	0.018	0.198	0.006	0.013
Diesel Cabin Service	6.431	1.28	6.727	0.1647	0.498	172	0.20	15	0.055	0.011	0.058	0.002	0.004
Diesel Food Truck	6.431	1.28	6.727	0.1647	0.498	184	0.25	35	0.172	0.034	0.180	0.005	0.013
Diesel Fuel Truck	4	1.2	11	0.25	0.5	180	0.25	35	0.105	0.032	0.289	0.006	0.013
Diesel Lavatory Truck	6.431	1.28	6.727	0.1647	0.498	172	0.20	20	0.074	0.015	0.077	0.002	0.006
Gasoline Baggage Tug	240	4	4	0.26	0	100	0.55	85	18.700	0.312	0.312	0.020	0.000
TOTAL									19.234	0.439	1.268	0.045	0.056

Table 8: Default GSE Assignments for B737-300 in EDMS 4.1.

Shaded Cells Indicate New Default GSE in EDMS 4.1.

GSE Types Assigned D = Diesel G = Gasoline E = Electric		1990 Emission Factors (grams/BHP-hour)					BHP	Load Factor	Operating Time per LTO (mins)	1990 Emission Contribution per LTO (Kilograms)				
		CO	HC	NOx	SOx	PM				CO	HC	NOx	SOx	PM
Air Conditioner, Narrow Body	E	0.000	1.112	0.000	0.000	0.000	0	0.75	30	0.000	0.000	0.000	0.000	0.000
Air Start, 180 PPM	D	3.247	1.075	12.982	0.808	1.088	425	0.9	7	0.145	0.048	0.579	0.036	0.049
Aircraft Tractor, Narrow Body	D	4.940	1.091	11.944	0.817	1.289	88	0.8	8	0.046	0.010	0.112	0.008	0.012
Baggage Tractor, Narrow Body	G	347.958	12.707	7.240	0.174	0.068	107	0.55	75	25.597	0.935	0.533	0.013	0.005
Belt Loader, Narrow Body	G	241.064	10.025	7.243	0.176	0.068	107	0.5	48	10.318	0.429	0.310	0.008	0.003
Cabin Service Truck, Narrow	D	3.367	0.926	7.180	0.809	1.501	210	0.53	20	0.125	0.034	0.266	0.030	0.056
Catering Truck, Narrow Body	D	3.367	0.926	7.180	0.809	1.501	210	0.53	15	0.094	0.026	0.200	0.023	0.042
Hydrant Truck, Narrow Body	D	4.481	1.112	7.710	0.808	2.157	235	0.7	12	0.147	0.037	0.254	0.027	0.071
Lavatory Truck, Narrow Body	D	4.404	1.098	7.672	0.808	2.114	56	0.25	15	0.015	0.004	0.027	0.003	0.007
Service Truck	D	4.262	1.074	7.603	0.808	2.032	235	0.2	15	0.050	0.013	0.089	0.009	0.024
Water Service	E	0.000	0.000	0.000	0.000	0.000	0	0.2	12	0.000	0.000	0.000	0.000	0.000
TOTAL									36.537	1.536	2.37	0.157	0.269	

Table 9: Percent Change in GSE Emission Rates (i.e., kilograms/hour).

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
1H1 Heater	Other	D	56% to 438%	-50% to 168%	-36% to 182%	717% to 722%	25% to 319%
1MC1A Compressor	Other	D	11% to 283%	-71% to 56%	99% to 774%	1330% to 1338%	1217% to 4296%
590G20P Generator	Generator	D	-51% to 65%	-75% to 24%	-66% to 44%	1209% to 1216%	-50% to 68%
6AN32A60A Generator	Generator	D	-92% to -73%	116% to 971%	33% to 455%	45%	2% to 244%
9MC2A Compressor	Other	D	-94% to -81%	-88% to -34%	419% to 2182%	5621% to 5651%	778% to 2831%
DH-600 Compressor	Other	D	-81% to -35%	-94% to -68%	-92% to -66%	101% to 102%	-85% to -49%
Diesel Air Conditioning Unit	Air Conditioner, Narrow Body	D	-84% to -44%	-89% to -43%	-82% to -26%	128% to 129%	-59% to 30%
	Air Conditioner, Wide Body	D	-77% to -21%	-84% to -19%	-75% to 6%	225% to 227%	-42% to 85%
Diesel Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	D	-85% to -39%	-92% to -55%	-88% to -47%	61%	-72% to 27%
	Aircraft Tractor, Mid-Range	D	-67% to 34%	-82% to -1%	-73% to 18%	255% to 257%	-37% to 180%
	Aircraft Tractor, Narrow Body	D	-85% to -38%	-92% to -54%	-88% to -45%	64%	-71% to 30%
	Aircraft Tug Towbarless Narrow	D	-85% to -38%	-92% to -54%	-88% to -45%	64%	-71% to 30%
Diesel Aircraft Tug Wide	Aircraft Tractor, Wide Body	D	-71% to 17%	-84% to -14%	-77% to 3%	211% to 212%	-45% to 145%
	Aircraft Tug Towbarless Wide	D	-62% to 52%	-79% to 12%	-70% to 34%	303% to 306%	-29% to 218%
Diesel Airstart Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Airstart Unit	Air Start, 180 PPM	D	-83% to -43%	-89% to -37%	-80% to -16%	129% to 130%	-67% to 54%
	Air Start, 300 PPM	D	-67% to 15%	-78% to 27%	-61% to 67%	358% to 361%	-34% to 208%
Diesel Baggage Tug	Baggage Tractor, Commuter	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
	Baggage Tractor, Narrow Body	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
	Baggage Tractor, Wide Body	D	-13% to 33%	-85% to -13%	-74% to -13%	222% to 224%	-8% to 139%
Diesel Belt Loader	Belt Loader, Commuter	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
	Belt Loader, Narrow Body	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
	Belt Loader, Wide Body	D	0% to 50%	-71% to 73%	-52% to 64%	356% to 358%	-3% to 146%
Diesel Cabin Service	Cabin Service Truck, Comm/Reg	D	-98% to -35%	-87% to -11%	-97% to 31%	311% to 474%	-72% to 274%
	Cabin Service Truck, Narrow	D	-93% to 70%	-67% to 134%	-91% to 244%	980% to 1406%	-26% to 883%
	Cabin Service Truck, Wide Body	D	-93% to 70%	-67% to 134%	-91% to 244%	980% to 1406%	-26% to 883%
Diesel Cargo Loader	Cargo Loader, Narrow Body	D	-37% to 117%	-61% to 104%	-70% to 30%	279% to 283%	28% to 324%
	Cargo Loader, Wide, Lower Lobe	D	-37% to 117%	-61% to 104%	-70% to 30%	279% to 283%	28% to 324%
	Cargo Loader, Wide, Main Deck	D	5% to 261%	-36% to 239%	-51% to 116%	531% to 537%	113% to 604%
Diesel Container Loader	Cargo Loader, Narrow Body	D	-57% to 49%	-60% to 113%	-46% to 136%	532% to 539%	43% to 373%
	Cargo Loader, Wide, Lower Lobe	D	-57% to 49%	-60% to 113%	-46% to 136%	532% to 539%	43% to 373%
	Cargo Loader, Wide, Main Deck	D	-28% to 148%	-33% to 255%	-11% to 292%	951% to 962%	138% to 687%
Diesel Deicer	Deicer, Dual Engine	D	-100%	-100%	-100%	-100%	-100%
	Deicer, Single Engine	D	-100%	-100%	-100%	-100%	-100%
Diesel Food Truck	Catering Truck, Commuter/Reg	D	-98% to -52%	-91% to -33%	-98% to -1%	208% to 330%	-79% to 177%
	Catering Truck, Narrow Body	D	-95% to 27%	-75% to 75%	-93% to 159%	710% to 1030%	-45% to 626%
	Catering Truck, Wide Body	D	-95% to 27%	-75% to 75%	-93% to 159%	710% to 1030%	-45% to 626%
Diesel Forklift	Fork Lift	D	-35% to 122%	-56% to 114%	-67% to 37%	291% to 295%	31% to 346%
Diesel Fuel Truck	Fuel Truck, Ground Equipment	D	-95% to 35%	-85% to 15%	-97% to -10%	214% to 334%	-68% to 403%

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
	Fuel Truck, Large, 8,000+ gal	D	-94% to 73%	-81% to 47%	-96% to 14%	301% to 454%	-59% to 542%
	Fuel Truck, MidSize, 3-6,000 g	D	-96% to 1%	-89% to -14%	-98% to -33%	134% to 223%	-76% to 274%
	Fuel Truck, Small, < 3,000 gal	D	-96% to 1%	-89% to -14%	-98% to -33%	134% to 223%	-76% to 274%
Diesel GPU Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Ground Power Unit	Ground Power Unit, 28VDC	D	-89% to -61%	-92% to -60%	-88% to -47%	60%	-71% to -6%
	Ground Power Unit, 400 Hz	D	-69% to 7%	-79% to 9%	-66% to 44%	336% to 338%	-20% to 157%
Diesel Lavatory Truck	Lavatory Truck, Narrow Body	D	-99% to -72%	-95% to -65%	-97% to -54%	40% to 89%	-83% to 74%
	Lavatory Truck, Wide Body	D	-95% to 17%	-80% to 47%	-89% to 94%	487% to 695%	-29% to 631%
Diesel Service Truck	Service Truck	D	-94% to 47%	-84% to 23%	-96% to -4%	209% to 324%	-59% to 462%
Diesel Transporter	Cart	D	-100%	-100%	-100%	-100%	-100%
Diesel Water Truck	Water Service	D	-100%	-100%	-100%	-100%	-100%
Gasoline Aircraft Tug Narrow	Aircraft Tractor, Commuter/Reg	G	38%	205%	73%	-36%	*
	Aircraft Tractor, Narrow Body	G	38%	205%	73%	-36%	*
Gasoline Aircraft Tug Wide	Aircraft Tractor, Commuter/Reg	G	-64%	-21%	-55%	-83%	*
	Aircraft Tractor, Narrow Body	G	-64%	-21%	-55%	-83%	*
Gasoline Airstart Transporter	Cart	G	211%	-26%	13%	118%	-72%
Gasoline Baggage Tug	Baggage Tractor, Commuter	G	55%	240%	94%	-27%	*
	Baggage Tractor, Narrow Body	G	55%	240%	94%	-27%	*
	Baggage Tractor, Wide Body	G	55%	240%	94%	-27%	*
Gasoline Belt Loader	Belt Loader, Commuter	G	79%	347%	223%	17%	*
	Belt Loader, Narrow Body	G	79%	347%	223%	17%	*
	Belt Loader, Wide Body	G	79%	347%	223%	17%	*
Gasoline Cabin Service	Cabin Service Truck, Comm/Reg	G	-73% to 96%	-83% to -11%	-83% to 251%	1120% to 1591%	13% to 27%
	Cabin Service Truck, Narrow	G	-35% to 377%	-58% to 115%	-59% to 753%	2864% to 4009%	176% to 209%
	Cabin Service Truck, Wide Body	G	-35% to 377%	-58% to 115%	-59% to 753%	2864% to 4009%	176% to 209%
Gasoline Cargo Loader	Cargo Loader, Narrow Body	G	123%	395%	177%	4%	*
	Cargo Loader, Wide, Lower Lobe	G	123%	395%	177%	4%	*
Gasoline Cart	Cart	G	101%	288%	654%	118%	-15%
Gasoline Container Loader	Cargo Loader, Narrow Body	G	969%	107%	287%	832%	22%
	Cargo Loader, Wide, Lower Lobe	G	969%	107%	287%	832%	22%
Gasoline Deicer	Deicer, Dual Engine	G	190%	683%	426%	96%	*
	Deicer, Single Engine	G	15%	210%	108%	-22%	*
Gasoline Food Truck	Catering Truck, Commuter/Reg	G	-80% to 47%	-87% to -33%	-87% to 165%	510% to 746%	-15% to -5%
	Catering Truck, Narrow Body	G	-51% to 258%	-68% to 62%	-69% to 543%	1382% to 1955%	107% to 132%
	Catering Truck, Wide Body	G	-51% to 258%	-68% to 62%	-69% to 543%	1382% to 1955%	107% to 132%
Gasoline Forklift	Fork Lift	G	57%	262%	95%	-6%	*
Gasoline Fuel Truck	Fuel Truck, Ground Equipment	G	-94% to -54%	-43% to 174%	-81% to 173%	49% to 115%	*
	Fuel Truck, MidSize, 3-6,000 g	G	-90% to -26%	-7% to 342%	-69% to 341%	141% to 248%	*
	Fuel Truck, Small, < 3,000 gal	G	-90% to -26%	-7% to 342%	-69% to 341%	141% to 248%	*
Gasoline GPU Transporter	Cart	G	118%	-48%	-21%	9%	-79%
Gasoline Ground Power Unit	Ground Power Unit, 28VDC	G	-29%	75%	29%	-51%	*

GSE Name in 4.0	Replacement GSE in 4.1	Fuel	CO	HC	NO _x	SO _x	PM ₁₀
Gasoline Lavatory Truck	Lavatory Truck, Narrow Body	G	-98% to -85%	-79% to -6%	-96% to -4%	-39% to -20%	*
	Lavatory Truck, Wide Body	G	-94% to -61%	-44% to 153%	-90% to 156%	64% to 115%	*
Gasoline Service Truck	Service Truck	G	-96% to -66%	-38% to 119%	-82% to 99%	17% to 72%	*
Gasoline Transporter	Cart	G	190%	-30%	5%	118%	-72%
Gasoline Water Truck	Water Service	G	-95% to -59%	-29% to 160%	-78% to 139%	32% to 94%	*
H1 Heater	Other	D	-97% to -88%	-92% to -58%	228% to 1341%	2760% to 2775%	427% to 1658%
HF2 Pressure Tester	Other	D	-95% to -82%	-87% to -33%	379% to 2006%	5621% to 5651%	778% to 2831%
M27M1 Jacking Manifold	Other	D	-98% to -94%	-93% to -60%	33% to 487%	5621% to 5651%	193% to 877%
M32T1 Pressure Tester	Other	D	-99% to -98%	-98% to -88%	-53% to 105%	2760% to 2775%	5% to 252%
MA1A Compressor	Other	D	-90% to -66%	76% to 838%	-7% to 311%	19%	1% to 238%
MA3 Cooler	Other	D	-100% to -98%	-82% to -5%	-65% to 55%	1807% to 1817%	-23% to 159%
MC11 Compressor	Other	D	-96% to -87%	-84% to -15%	179% to 1126%	5621% to 5651%	558% to 2098%
MC1A Compressor	Other	D	-97% to -91%	-90% to -45%	81% to 697%	5621% to 5651%	339% to 1365%
MD3 Generator	Generator	D	-99% to -98%	-67% to 66%	-27% to 206%	3391% to 3409%	16% to 292%
MHU83AE Bomblift	Lift	D	-96% to -86%	-75% to 22%	127% to 847%	5350% to 5406%	510% to 1970%
MJ1 Bomblift	Lift	D	-95% to -85%	-97% to -87%	144% to 917%	5350% to 5406%	632% to 2384%
MJ1 Hydraulic Test Stand	Other	D	-99% to -98%	-98% to -88%	-54% to 102%	1807% to 1817%	1% to 238%
MJ1A Bomblift	Lift	D	-97% to -90%	-82% to -12%	62% to 575%	5350% to 5406%	357% to 1453%
MJ2A Hydraulic Test Stand	Other	D	-100%	-99% to -93%	-74% to 14%	1330% to 1338%	-43% to 91%
NF-2 Light Cart	Cart	D	-100%	-100%	-100%	-100%	-100%
TTU228E Hydraulic Test Stand	Other	D	-100% to -99%	-98% to -92%	-69% to 37%	1807% to 1817%	-31% to 131%
TTU228E1B Hydraulic Tester	Other	D	-85% to -50%	-95% to -75%	-94% to -74%	172% to 174%	-88% to -61%

* Previously this GSE in version 4.0 had no PM emissions, but its corresponding replacement in 4.1 does; hence the percent change is undefined.