

APPENDIX E

**PUBLIC AND UTILITY VEHICLE
TOTAL FLEET EXAMPLE CALCULATIONS**

The following is five fleet size calculations to illustrate various cases a municipality or utility might experience during implementation of the proposed rule. The first example is the simplest case of a fleet that uses all retrofits, or ARB-verified DECS, for compliance and there is no turnover or retirement. The second example looks at a fleet that retires vehicles, under the ARB definition of retirements. The third example shows the case of a fleet that turns over its older vehicles but does not retire them; in other words, the owner sells the non-compliant vehicles in California. The fourth example is a fleet that complies early to take advantage of the early compliance extension. The fifth example is if a fleet elects to sell non-compliant vehicles in California, replace these vehicles with complying gasoline vehicles, and retrofit remaining fleet.

I. All Retrofits (DECS) Implementation Example

The first fleet has 30 vehicles, equally spread between each implementation group, and uses all retrofit with DECS with there is no turnover or early compliance implementation (Table 1).

Table 1. All Retrofits Implementation Example.

Group	Engine MY	January 1, 2006 Inventory (#MUV)	Number of Vehicles to Implement By December 31 st of Each Year (TotAddComp)					
			2006	2007	2008	2009	2010	2011
1	1960 –1987	10	---	2	0	4	0	4
2	1988 –2002	10	2	0	4	0	4	---
3	2003 –2006	10	---	---	---	5	5	---

The fleet inventory does not change throughout the phase-in period as all vehicles are brought into compliance by retrofitting. Therefore the number of vehicles (#MUV) remains the same each year.

For the example above, the fleet owner calculates the size of its fleet for Group 2 vehicles (#MUV) by January 1, 2006, using equation (1).

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire (Eqn. 1)}$$

$$\#MUV_{\text{group 2}} = 10 + 0 = 10$$

Using equation (2), the owner calculates the number of Group 2 vehicles that need to be brought into compliance for the first year by multiplying the percentage BACT required for the first year by the number of Group 2 vehicles (#MUV).

$$\text{TotVeh}_{\text{by group}} = \text{Group\%BACT} * (\#MUV_{\text{by group}}) \text{ (Eqn. 2)}$$

$$\text{TotVeh}_{\text{Group 2}} = 20\% * 10 = 2$$

Based upon the above calculation then two vehicles must be brought into compliance by December 31, 2006.

For the next year of compliance, 2008, there are still 10 vehicles, using equation 1. No vehicles were retired in this example; all were retrofitted. Again use equation (2) to determine how many vehicles must comply in Group 2 (TotVeh). According to the implementation schedule 60% of Group 2 must comply with BACT.

$$\text{TotVeh}_{\text{Group 2}} = \text{Group\%BACT} * (\#\text{MUV}_{\text{Group 2}}) \text{ (Eqn 2)}$$

$$\text{TotVeh}_{\text{Group 2}} = 60\% * 10 = 6$$

Equation (2) shows that six Group 2 vehicles must be in compliance with the BACT requirement. Equation (3) is now used to calculate how many additional vehicles must be brought into compliance (TotAddComp). Assuming that no vehicles are retired and no additional vehicles have been purchased, the total number of vehicles in Group 2 remains at ten.

$$\text{TotAddComp}_{\text{by group}} = \text{TotVeh}_{\text{by group}} - \text{TotBACT}_{\text{by group}} - \text{TotRetire}_{\text{by group}} \text{ (Eqn 3)}$$

$$\text{TotAddComp}_{\text{Group 2}} = 6 - 2 - 0 = 4$$

Based upon the above equation, four additional vehicles must be meet BACT. This is shown in Table 1.

The last compliance deadline for Group 2 vehicles is 2010. In this year 100 percent of Group 2 vehicles must meet the BACT requirement. In this simple example, the owner can see that, as six vehicles have been brought into compliance out of ten, an additional four vehicles need to comply by the final compliance deadline. If a owner repowers or replace these diesel vehicles with a complying gasoline engine to meet BACT requirements, then these engines are now included in the total fleet number (#MUV); however these engines count towards the number meeting BACT (TotBACT).

II. Retirement Implementation Example

For simplicity, only Group 1 (1960 to 1987 MY engines) vehicles are shown in this example. This company has a fleet of 50 Group 1 (1960-1987 MY engines) at the beginning of 2006 (Table 2). The #MUV stays the same every year because the owner can add back into the equation the number of engines that were retired since January 1, 2006. In this example, the owner purchases new 2007 MY engines and thus no other group is increased by the fleet turnover.

Table 2. Retirement Implementation Example

Group	Engine MY	January 1, 2006 Inventory (#MUV)	Number of Vehicles to Implement By December 31 st of Each Year (TotAddComp)					
			2006	2007	2008	2009	2010	2011
1	1960 –1987	50	---	10	0	20	0	20

The following sample calculations are for 2009 to illustrate how the engine retirement affects the calculations. The fleet owner calculates the size of its fleet for Group 1 vehicles (#MUV) by January 1, 2009, using equation (1).

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire} \quad (\text{Eqn. 1})$$

$$\#MUV_{\text{Group 1}} = 40 + 10 = 50$$

Ten engines were retired (scrapped or sold out of California), thus they can be added back to the total in equation (1).

Using equation (2), the owner calculates the number of Group 1 vehicles that need to be brought into compliance for the in 2009 by multiplying the percentage BACT required for the first year by the number of Group 1 vehicles (#MUV).

$$\text{TotVeh}_{\text{by group}} = \text{Group\%BACT} * (\#MUV_{\text{by group}}) \quad (\text{Eqn. 2})$$

$$\text{TotVeh}_{\text{Group 1}} = 60\% * 50 = 30$$

Equation (2) shows that 30 Group 1 vehicles must be in compliance with the BACT requirement by December 31, 2009. Equation (3) is now used to calculate how many additional vehicles must be brought into compliance (TotAddComp).

$$\text{TotAddComp}_{\text{by group}} = \text{TotVeh}_{\text{by group}} - \text{TotRetrofit}_{\text{by group}} - \text{TotRetire}_{\text{by group}} \quad (\text{Eqn 3})$$

$$\text{TotAddComp}_{\text{Group 1}} = 30 - 0 - 10 = 20$$

Thus 20 additional engines must be brought into compliance by the end of 2009. See how this compares to the next example, where the owner does not retire his engines but sells non-complying engines within California.

III. Engine Turnover without Retirement Implementation Example

Again, only Group 1 (1960 to 1987 MY engines) vehicles are shown in this example. As in the previous example, this company has a fleet of 50 Group 1 (1960-1987 MY engines) at the beginning of 2006 (Table 3). The #MUV, however, changes each year because the owner cannot add back into the equation the number of engines that were turned over since January 1, 2006, as they were sold as non-complying engines within

California. Again, in this example, the owner purchases new 2007 MY engines and thus no other group is increased by the fleet turnover.

Table 3. Engine Turnover but No Retirement Example

Group	Engine MY	January 1, 2006 Inventory (#MUV)	Number of Vehicles to Implement By December 31 st of Each Year (TotAddComp)					
			2006	2007	2008	2009	2010	2011
1	1960 –1987	50	---	10	0	24	0	16

Again, this example is for 2009 to show the difference when the engines are not retired but sold to another fleet within the state. The fleet owner calculates the size of its fleet for Group 1 vehicles (#MUV) by January 1, 2009, using equation (1).

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire} \quad (\text{Eqn. 1})$$

$$\#MUV_{\text{group 1}} = 40 + 0 = 40$$

Using equation (2), the owner calculates the number of Group 1 vehicles that need to be brought into compliance by the end of 2009 by multiplying the percentage BACT required for the first year by the number of Group 2 vehicles (#MUV).

$$\text{TotVeh}_{\text{by group}} = \text{Group\%BACT} * (\#MUV_{\text{by group}}) \quad (\text{Eqn. 2})$$

$$\text{TotVeh}_{\text{Group 1}} = 60\% * 40 = 24$$

Equation (2) shows that 24 Group 1 vehicles must be in compliance with the BACT requirement by December 31, 2009. Equation (3) does not apply as no engines have been retired or retrofitted and thus the owner must comply with four more vehicles by the end of 2009 than if he had retired those vehicles. These examples show that the owner is not required to retire engines (sell out of state or scrap) but does experience a small penalty. The difference is made up in the final year, when the owner who did not retire his engines brings four fewer engines into compliance than if he had retired all of the engines that were removed from his fleet.

IV. Early Compliance Implementation Example

This example is if a fleet takes advantage of the early compliance implementation option. This option allows a fleet to apply BACT to 50% of their vehicles in a particular model year group and delay the remaining group vehicles until the last implementation deadline. Again, only Group 1 (1960 to 1987 MY engines) vehicles are shown in this example. As in the previous example, this municipality or utility has a fleet of 50 Group 1 (1960-1987 MY engines) at the beginning of 2006 (Table 4). It is assumed that the fleet size does not change throughout the phase-in period. This owner elects to apply BACT to 50% of their vehicles by December 31, 2007.

Table 4. Early Compliance Example

Group	Engine MY	January 1, 2006 Inventory (#MUV)	Number of Vehicles to Implement By December 31 st of Each Year						
			2006	2007	2008	2009	2010	2011	2012
1	1960 –1987	50	---	25	0	0	0	0	25

The owner determines how many Group 1 vehicles are in their fleet by the following equation:

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire} \quad (\text{Eqn. 1})$$

$$\#MUV_{\text{Group 1}} = 50 + 0 = 50$$

Using equation (2), the owner calculates the number of Group 1 vehicles that need to be brought into compliance by the end of 2007 by multiplying the percentage BACT required for the early compliance option, which is 50% the number of Group 1 vehicles (#MUV).

$$\text{TotVeh}_{\text{by group}} = \text{Group\%BACT} * (\#MUV_{\text{by group}}) \quad (\text{Eqn. 2})$$

$$\text{TotVeh}_{\text{Group 1}} = 50\% * 50 = 25$$

Equation (2) shows that 25 Group 1 vehicles must be in compliance with the BACT requirement by December 31, 2007. The owner then would not have to comply with intermediate compliance deadlines for the specify Group 1 vehicles in their fleet. The TotAddComp or remaining Group 1 vehicles would have to comply with BACT by December 31, 2012, using equation 3.

$$\text{TotAddComp}_{\text{by group}} = \text{TotVeh}_{\text{by group}} - \text{TotRetrofit}_{\text{by group}} - \text{TotRetire}_{\text{by group}} \quad (\text{Eqn 3})$$

$$\text{TotAddComp}_{\text{Group 1}} = 50 - 25 - 0 = 25$$

V. Retrofit and Vehicle Replacement Implementation Example

The first fleet has 50 vehicles; 20 vehicles are gasoline fueled which do not meet the BACT requirements and 30 vehicles are diesel. Based on the definition of total fleet, these older gasoline is subtracted out of the number of vehicles over 14,000 GWVR. Therefore, we would only consider the 30 vehicles that are diesel fueled. The 30 vehicles are equally spread between each implementation group, and the owner uses a combination of retrofit, retirement and vehicle replacement to meet BACT (Table 5). For simplicity, we will examine Group 2 implementation only.

Table 5. Vehicle Replacement and Retrofit Example.

Group	Engine MY	January 1, 2006 Inventory (#MUV)	Number of Vehicles to Implement By December 31 st of Each Year (TotAddComp)					
			2006	2007	2008	2009	2010	2011
2	1988 –2002	10	2	0	4	0	4	---

The fleet inventory does change throughout the phase-in period as some vehicles are removed from the fleet, replaced or retrofitted. However in this case the number of vehicles (#MUV) stays the same each year.

For the example above, the fleet owner calculates the size of its fleet for Group 2 vehicles (#MUV) by January 1, 2006, using equation (1).

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire (Eqn. 1)}$$

$$\#MUV_{\text{group 2}} = 10 + 0 = 10$$

Using equation (2), the owner calculates the number of Group 2 vehicles that need to be brought into compliance for the first year by multiplying the percentage BACT required for the first year by the number of Group 2 vehicles (#MUV).

$$\text{TotVeh}_{\text{by group}} = \text{Group\%BACT} * (\#MUV_{\text{by group}}) \text{ (Eqn. 2)}$$

$$\text{TotVeh}_{\text{Group 2}} = 20\% * 10 = 2$$

Based upon the above calculation then two vehicles must be brought into compliance by December 31, 2006. Let's assume the owner elects to remove these two diesel vehicles from the fleet to comply with BACT and replace these vehicles with two complying gasoline vehicles.

For the next year of compliance, 2008, there are still 8 diesel vehicles and 2 gasoline vehicles used for BACT, using equation 1. The two vehicles that were removed from the fleet do not count as "retired" since they were not removed out of state. The two gasoline vehicles are added into the #MUV since they were used to replace two diesel engines.

$$\#MUV_{\text{by group}} = \#Engines + \text{TotRetire (Eqn. 1)}$$

$$\#MUV_{\text{by group}} = 10 + 0 = 10$$

Again use equation (2) to determine how many vehicles must comply in Group 2 (TotVeh). According to the implementation schedule 60% of Group 2 must comply with BACT.

$$\text{TotVeh}_{\text{Group 2}} = \text{Group\%BACT} * (\#\text{MUV}_{\text{Group 2}}) \text{ (Eqn 2)}$$

$$\text{TotVeh}_{\text{Group 2}} = 60\% * 10 = 6$$

Equation (2) shows that 6 vehicles in Group 2 vehicles must be in compliance with the BACT requirement. Equation (3) is now used to calculate how many additional vehicles must be brought into compliance (TotAddComp).

$$\text{TotAddComp}_{\text{by group}} = \text{TotVeh}_{\text{by group}} - \text{TotBACT}_{\text{by group}} - \text{TotRetire}_{\text{by group}} \text{ (Eqn 3)}$$

$$\text{TotAddComp}_{\text{Group 2}} = 6 - 2 - 0 = 4$$

Based upon the above equation, four additional vehicles must be meet BACT. This is shown in Table 5.

The last compliance deadline for Group 2 vehicles is 2010. In this year 100 percent of Group 2 vehicles must meet the BACT requirement. In this simple example, the owner can see that, as six vehicles have been brought into compliance out of ten, an additional four vehicles need to comply by the final compliance deadline. Again, if the owner repowers or replaces these diesel vehicles with a complying gasoline engine to meet BACT requirements, then these gasoline engines are now included in the total fleet number (#MUV); and count towards the number meeting BACT (TotBACT).