$$yearly = 1996 + (29 * 1.5) - 2017 = 22.5$$

Since, in this case, yearly > 10, the vehicle would preferentially be repowered rather the replaced.

Using an input parameter set to $270 per horsepower, the calculation for the cost to repower a vehicle is shown in Equation 11.

Equation 11: $Costof\,\mathrm{Re}\,power = \$270 * Horsepower$

The equations used for calculating accelerated turnover are shown in Chapter 11.

Since tier 4s are likely to have an engine manufacturer installed retrofit to meet the new engine PM standards, turnover to a tier 4 is assumed to have a cost premium equal to the cost of a retrofit for a similar sized engine which is added to the turnover cost. These costs are shown in the next section, the discussion of retrofits.

The Turnover Procedure inserts into the Fleet table the turnover cost for each vehicle turned over and records the calendar year the vehicle is turned over. Also, the Turnover Procedure inserts new tier, PM and NOx indexes into the Fleet table looked up from EquipmentTierPMNOx table, then recalculates the fleet NOx average and resets the compliance flags after each engine is turned over or repowered. If the fleet still does not meet the fleet NOx targets and there are still vehicles eligible for turnover or repower, then the procedure repeats the turnover process until the fleet either meet the fleet NOx target, the fleet hits the maximum required turnover, or there are no more vehicles eligible for turnover or repower.

In instances where a fleet turns over more horsepower than is required, the model will accumulate and track turnover carryover for the fleet. Carryover will accrue when the last vehicle required to be turned over does not match exactly the maximum horsepower required to be turned over, i.e., the 8 or 10 percent or when a fleet for other business purposes turns over more than required. The turnover carryover can be used in subsequent years to meet the maximum horsepower required to be turned over.

Typically, the turnover carryover is negligible for medium and large fleets. Small fleets are not subject to the turnover requirements.

4. Do Retrofit Procedure

The model assumes that fleets will not retrofit any vehicles under the baseline run nor when a fleet meets the PM target. Retrofits are assumed to be driven solely by the regulation; i.e., the model assumes the fleet owner has no motivation to retrofit in the absence of the regulation. Hence, unlike the turnover rate, the retrofit rate is fixed at 20 percent. The model will retrofit eligible vehicles as long as a fleet does not meet the PM target or if it has not yet retrofit at least 20 percent of its fleet horsepower.

The model excludes vehicles that are exempt under the regulation from the pool of vehicles subject to retrofit; i.e., vehicles less than five years old, tier 4s, and vehicles already equipped with a retrofit.

The model assumes that retrofits are all Level 3 devices that achieve at least 85% PM control. The model assumes a retrofit cost as shown in Table 3; retrofit operating and maintenance cost are calculated off-model as described in Appendix J.

Table 3: Cost of Retrofits

Vehicle Horsepower	Cost of Retrofit
< 50	$8,000
50 to < 175	$12,000
175 to < 400	$18,000
400 plus	$30,000

The Retrofit Procedure inserts into the Fleet table the retrofit cost for each vehicle turned over, inserts a PM factor in a field in the Fleet table which reduces the PM attributed to the vehicle, and records the calendar year the vehicle is retrofit. The Retrofit Procedure then recalculates the fleet PM average and resets the compliance flags after each engine retrofit. If the fleet still does not meet the fleet PM targets and there are still vehicles eligible for retrofit, then the procedure repeats the retrofit process until the fleet either meet the fleet PM target, hits the maximum required retrofit, or there are no more vehicles eligible for retrofit.

Retrofit carryover, similar to turnover carryover, accumulates as the last vehicle to be retrofit exceeds the maximum required or due to business practices that retrofit more horsepower than is required. The retrofit carryover for medium and large fleets is typically negligible. On the other hand, retrofit carryover may be significant for small fleets, and indeed, the carryover provisions were developed to accommodate the needs of the small fleets.

For example, if a small fleet with just three older vehicles, all at 333 horsepower, did not meet the PM target, then in 2015 the fleet would be required to retrofit one vehicle representing approximately 33% of the fleet horsepower accruing 13% retrofit carryover in excess of the 20% required. If the fleet does not meet the PM fleet target in 2016 it will have to once again retrofit since the retrofit carryover not meet the required 20% maximum retrofit. After retrofitting a second engine in 2016, the fleet would have accrued 26% retrofit carryover credit which could be used in 2017 in lieu of meeting the PM fleet target. Although this example is not likely, it is provided to illustrate how the model would utilize retrofit carryover.

5. *Write Results and Accumulate Fleet Data Procedures*

All of the preceding turnover and retrofit would be modeled for a given calendar year on multiple vehicles for a specific fleet. All of the vehicle data would be recorded in the Fleet table.