APPENDIX D

SUMMARY OF METHODOLOGIES FOR COST ANALYSIS

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1. GENERAL METHODOLOGIES

A. Escalation of Auxiliary Power System (APS) & Annual Maintenance Costs

The factory cost of the Auxiliary Power System (APS Factory Cost) used to power the sleeper berth ($7,419) was obtained for base year (2004) from a survey of nine (9) manufacturers of auxiliary power units, generator sets, and hybrid systems used to power sleeper vehicles independent of the main engine. The APS purchase costs were then escalated for Phase Two (Sleeper) implementation (2009-2013) to account for inflation at the 10-Year (1994 - 2003) compound annual growth rate (CAGR) for Producer Price Index Series - Turbine & Turbine Generator Set Manufacturing (as provided by the US Bureau of Labor Statistics, Series ID PCU333611333611). This rate was determined to be 0.49% per year.

2004 APS Installation Costs are based on a professional auto service wage rate of $86 per hour and a staff determination that up to 10 hours of labor will be required for a typical installation. Thereafter, adjustment to the APS Installation Costs are based on the (1994 – 2003) average annual change in the Consumer Price Index (CPI) Wages for Los Angeles and San Francisco (as provided by the US Bureau of Labor Statistics (BLS), Series ID CWURA421SA0 and CWURA422SA0). This rate was determined to be 2.38%.

TABLE D - 1

PROJECTED APS PURCHASE AND MAINTENANCE COSTS

YEAR	APS FACTORY COSTS (1)	APS INSTALLATION COSTS (2)	APS TOTAL PURCHASE COSTS (1+2)	APS ANNUAL MAINTENANCE COSTS (3)
2004	**$ 7,419**	$ 860	$ 8,279	$ 460
2005	$ 7,455	$ 880	$ 8,335	$ 467
2006	$ 7,492	$ 901	$ 8,393	$ 474
2007	$ 7,529	$ 922	$ 8,451	$ 482
2008	$ 7,566	$ 944	$ 8,510	$ 490
2009	$ 7,603	$ 966	$ 8,569	$ 498
2010	$ 7,640	$ 989	$ 8,629	$ 506
2011	$ 7,677	$ 1,013	$ 8,690	$ 514
2012	$ 7,715	$ 1,037	$ 8,752	$ 522
2013	$ 7,753	$ 1,062	$ 8,815	$ 530

The 2004 Annual APS Maintenance Cost was obtained from Pony Pack, Inc. (a manufacturer of APS[1]) and prorated for 1,500 hours of APS use per year (estimated to be $460). Thereafter, 50% of the Annual APS Maintenance Costs were escalated for each year at the same rate of inflation as the APS (0.49%), and the other 50% of the APS Maintenance Costs were escalated at the average California labor rate of inflation (2.38%).

B. Forward Price of Diesel Fuel

The 5-Year lifetime benefit (cost savings) from a reduction in idling activity is proportionately based on the price of diesel fuel. Therefore, the 53-Week Average On-Highway Retail California Diesel Price for Week Ending (1/13/04), as reported by the U.S. Department of Energy (DOE), was used as the 2003 base price to project diesel fuel prices for individual years (2005 – 2013). The price growth forecast (projected commodity price) is based on the CAGR of the (1994 – 2003) Producer Price Index Series for Number 2 Diesel Fuel (US Bureau of Labor Statistics Series ID WPU057303). This CAGR was specifically determined to be 6.02% per year.

TABLE D- 2

PRODUCER PRICE INDEX (PPI) BASED DIESEL PRICE FORECAST

YEAR	PPI BASED DIESEL PRICE FORCAST PER GALLON
2003	$ 1.66
2004	$ 1.76
2005	$ 1.87
2006	$ 1.98
2007	$ 2.10
2008	$ 2.23
2009	$ 2.36
2010	$ 2.50
2011	$ 2.65
2012	$ 2.81
2013	$ 2.98

[1] Pony Pack, 2003. Annual Pony Pack Maintenance Costs, Wear & Maintenance, from website at www.ponypack.com/savings.htm

C. Projected Price of Truck Stop Electrification (TSE/ATE Services) Hourly Power Rate

Hourly electric power charges, and hence net cost savings from reduced idling and use of Truck Stop Electrification/Advanced Truck Electrification (TSE/ATE[2]) services is dependent on the price of wholesale industrial electric power at the TSE/ATE center. The 2003 base hourly electric power charge rate of $1.25 per hour was obtained from an IdleAire service center[3] (ATE) in Ripon, California, and is consistent with SMUD's electric power charge rate of $0.126 per kilowatt-hour for the maximum load or power consumed by installed devices on a typical truck. The 2003 base price was then escalated at the CAGR of the (1994 - 2003) Producer Price Index - Industrial Electric Power Series (as provided by the US Bureau of Labor Statistics, Series ID WPU0543). This rate was determined to be 1.24% and was applied to project hourly electric power prices at TSE/ATE for individual years (2005 – 2013).

TABLE D- 3

PROJECTED TRUCK STOP ELECTRIC POWER PRICES

YEAR	TSE/ATE PROJECTED HOURLY ELECTRIC POWER RATES
2003	$1.25
2004	$1.27
2005	$1.29
2006	$1.31
2007	$1.33
2008	$1.35
2009	$1.37
2010	$1.39
2011	$1.41
2012	$1.43
2013	$1.45

D. Costs for Driver Training & Education

Staff utilized labor market information from the Employment Development Department to derive a median hourly wage rate of $15.29 (2003) for "Truck Drivers – Heavy or Tractor Trailer" (1). This wage survey detailed average hourly wages in 22 local wage areas in California. Wages reflect those earned by workers with three years experience with the firm.

[2] 49er Travel Plaza, 2004. Demonstration of Truck Stop Electrification by SMUD, West Sacramento, California, January 23, 2004.

[3] IdleAireTechnologies , 2003. Input obtained from Kevin Benninger, Operations Specialist, IdleAire Technologies Corporation, Knoxville, Tennessee (Affiliate Loves Truck Stop, Rippon, California) on July 23, 2003.

The vehicle population that is affected by this proposed ATCM include all diesel-fueled commercial vehicles with a GVWR of greater than 10,000 pounds. Public and privately owned diesel transit buses are included in this applicable base. For the purposes of estimating the 5-Year lifetime costs and savings from this regulation, staff assumed that transit bus operator wages are on parity with truck driver wages. The wages were then projected for individual years (2005-2013) to determine the applicable driver training costs for that year. The adjustment to the wage rates are based on the average annual change in the (1994 – 2003) Consumer Price Index Wages for Los Angeles and San Francisco (as provided by the US Bureau of Labor Statistics, Series ID CWURA421SA0 and CWURA422SA0). This rate was determined to be 2.38% per year.

TABLE D- 4

MEDIAN TRUCK DRIVER HOURLY WAGE PROJECTIONS

YEAR	TRUCK DRIVER MEDIAN HOURLY WAGES
2003	$ 15.29
2004	$ 15.65
2005	$ 16.02
2006	$ 16.40
2007	$ 16.79
2008	$ 17.19
2009	$ 17.60
2010	$ 18.02
2011	$ 18.45
2012	$ 18.89
2013	$ 19.34

[4] http://www.calmis.cahwnet.gov/file/occup$/ccoiswages/dclaw.cfm?occupation_code=971020)

E. Savings from Reduction in Engine Maintenance

Staff assumes that owners and operators of both sleeper and non-sleeper vehicles will reap the cost benefit of reduced maintenance on the diesel engine as a result of the proposed ATCM. Therefore, staff derived an hourly estimate of this reduction in cost benefit based on truck service, maintenance, and overhaul costs information (1).

Staff assumed that heavy-duty diesel truck engines are rebuilt/overhauled at an interval of one million miles distance traveled. The cost to rebuild/overhaul the truck engine is estimated to be $15,000 (2003 dollars) (1). Furthermore, staff estimates that vehicle oil and filter changes will occur at an interval of 25,000 miles (1), and the cost to service an oil and filter change for an affected vehicle is between $170 - $370 (or an average of $270) (1). Staff also assumes that the fuel economy for a commercial diesel fueled

[4] http://www.calmis.cahwnet.gov/file/occup$/ccoiswages/dclaw.cfm?occupation_code=971020)

vehicle will vary from 7 miles per gallon for heavy heavy-duty diesel vehicles (HHDV), to 14 miles per gallon for light heavy-duty diesel vehicles. Using the methodology developed by the Truck Maintenance Councils (TMC) Recommended Maintenance Practices Manual (2004 Analysis of Costs from Idling & Parasitic Devices for Heavy Duty Trucks), staff developed a base year (2004) cost benefit, in dollars per hour of idling reduced, from reduction in engine maintenance as a result of reduced idling activities. Staff was then able to project base year cost benefits for individual year's (2005 – 2013) during which period the benefit or savings are to be estimated. To derive a benefit escalation during the years (2005 –2013), staff assumed 50% of the cost to rebuild is associated with labor, and adjusted for inflation based on the (1994-2003) Consumer Price Index Wage inflation rates for San Francisco and Los Angeles (2.38%). Staff assumed no change in the inflation rate for parts based on the (1994-2003) Producer Price Index data for Motor Parts (as provided by the US Bureau of Labor Statistics, Series ID WPU1412). However, staff did assume that the cost of the oil and filter change would grow at the 10-Year CAGR for the (1994-2003) Producer Price Index - Petroleum Lubricating Oils & Grease Manufacturing rate (as provided by the US Bureau of Labor Statistics, Series ID PCU324191324191). This rate was determined to be 2.35% per year. The estimated hourly savings from a reduction in idling for each vehicle category was derived for the individual applicable years (2004 – 2013) and is presented in the table below:

TABLE D- 5

PROJECTED DOLLAR SAVINGS PER HOUR FROM REDUCTION IN ENGINE IDLING

YEAR	HHDV	MHDV	UTBUS	SLEEPER
2004	$ 0.18	$ 0.18	$ 0.12	$ 0.18
2005	$ 0.18	$ 0.19	$ 0.12	$ 0.18
2006	$ 0.18	$ 0.19	$ 0.12	$ 0.19
2007	$ 0.18	$ 0.19	$ 0.12	$ 0.19
2008	$ 0.19	$ 0.19	$ 0.12	$ 0.19
2009	$ 0.19	$ 0.19	$ 0.12	$ 0.20
2010	$ 0.20	$ 0.19	$ 0.12	$ 0.20
2011	$ 0.20	$ 0.19	$ 0.14	$ 0.20
2012	$ 0.20	$ 0.19	$ 0.14	$ 0.21
2013	$ 0.21	$ 0.21	$ 0.14	$ 0.21

NOTES:

(1) Truck service, maintenance, and overhaul Information was obtained from the Sacramento Truck Center, Sacramento, California, by CARB Staff Employee John Gruszecki.

(2) Information obtained from heavy-duty diesel engine and diesel vehicle manufacturers by CARB Staff John Gruszecki.

F. Diesel Vehicle Population Growth

This regulation is applicable to diesel-fueled commercial vehicles with a Gross Vehicle Weight Rating (GVWR) of greater than 10,000 pounds. The diesel vehicle population that would be affected by the proposed ATCM includes fleets of both sleeper-equipped berths and non-sleeper vehicles. The non-sleeper vehicle category includes heavy heavy-duty diesel vehicles (HHDV), medium heavy-duty diesel vehicles (MHDV), light heavy-duty diesel vehicles (LHDV), and urban transit buses (UTBUS). The estimated base year (2003) vehicle population and the vehicle population for every subsequent year thereafter was obtained from EMFAC 2002 (the California Air Resources Boards' emission factor modeling program) and is presented in the table below:

TABLE D- 6

PROJECTED DIESEL VEHICLE POPULATION GROWTH (EMFAC 2002)

YEAR	HHDV	MHDV	LHDV	UTBUS	TOTAL
1993	135,586	97,851	-	12,725	110,576
2003	170,513	166,801	-	15,345	182,146
2004	175,087	172,240	35,900	15,455	398,682
2005	179,838	177,598	36,263	15,562	409,261
2006	183,998	182,309	36,693	15,772	418,772
2007	188,356	186,905	37,148	16,101	428,510
2008	192,356	191,379	37,551	16,447	437,733
2009	196,534	195,767	37,963	16,816	447,080
2010	201,186	200,087	38,459	17,210	456,942
2011	204,532	203,814	38,882	17,529	464,757
2012	208,353	207,506	39,266	17,825	472,950
2013	212,093	211,138	39,708	18,079	481,018

Staff estimates an upper limit of 1.7 million out-of-state registered trucks operate in California every year (of which, 67,000 sleepers are in California each day). The number of out-of-state trucks comes from information given by the California Department of Motor Vehicles (DMV) detailing the number of apportioned registrations from non-California registered Class 8 trucks. The percentage of the 1.7 million out-of-state trucks that are equipped with sleeper berths is unknown. Staff further assumes that a majority of the sleepers idling will be registered as out-of-state vehicles. Staff also expects operators of out-of-state trucks (who employ an emissions control strategy such as the use of an auxiliary power system) will also utilize the emissions control strategy while out-of-state and will reap the same overall fuel and maintenance cost savings as in-state trucks by complying with this regulation.

Since the number of sleeper vehicles idling during extended rest periods in California is unknown, staff utilized the peak hour demand for commercial parking spaces along

California Interstate Highways (Federal Highway Administration report to Congress on the Adequacy of Parking Facilities, June 2002) to project a daily amount of idling that occurs in California. Using this estimate, and the net hourly cost savings per vehicle from the use of an APS, staff was able to derive an annual benefit from sleeper vehicles and also determine a minimum number of sleeper vehicles operating in California. Using information from EMFAC 2002 and truck stop field observations, staff estimates approximately 67,000 sleeper berth equipped vehicles idle during extended rest periods in California each day in 2005. Thus, 67,000 would establish a lower bound on the number of sleeper vehicles in California.

G. Other Input Parameters

In order to estimate the total costs and savings from the proposed ATCM over a lifetime or benefit period of 5 years, staff utilized the following parameters discussed below:

i. Discount and Interest Rates

Discount Rates are used to discount a future amount or payoff in time to present value. All reported costs and benefits represent the value as of December 31, 2003, or simply stated as 2003 dollars. The nominal and real (without inflation component) discount rates used in the lifetime cost-benefit analyses were provided by the Research Division of the California Air Resources Board (CARB) and are 7% and 5%, respectively. Staff does not expect long-term interest rates to change significantly over the course of the benefit estimation period (2005 –2013). Should interest rates increase significantly, then the cost savings reported in this analysis might be overstated.

The applicable interest rate for purchases of capital equipment such as auxiliary power systems (APS) was assumed to be 7%.

ii. Fuel Savings from Idle Elimination:

Staff has determined that heavy heavy-duty diesel fueled vehicles (HHDV, accompanied by a GVWR of at least 28,000 pounds) consume the greatest amount of fuel at typical idle conditions (1,000 rpm). Correspondingly, this class of vehicles stands to benefit the most from idle reduction or elimination. EPA estimates that 1.0 gallon of diesel fuel is saved by eliminating one-hour of idling at 1,000 rpm (Study of Exhaust Emissions from Idling Heavy-Duty Diesel Trucks and Commercially Available Idle-Reducing Devices, October 2002, EPA420-R-02-025). This category of diesel vehicles includes both sleeper and non-sleeper vehicles.

Other vehicle classes that will be impacted by the proposed regulation consume less fuel at idle conditions, and correspondingly save less fuel by elimination of idling. Staff has determined that medium heavy-duty diesel vehicles (MHDV, accompanied by a GVWR of at least 14,000 pounds) and urban transit buses (UTBUS, accompanied by a GVWR of at least 10,000 pounds) save 0.7 gallon per hour by eliminating idling, and light heavy-duty diesel vehicles (LHDV, accompanied by a GVWR of at least 10,000

pounds) save 0.5 gallon per hour by eliminating idling. The primary differential in fuel savings between the vehicle categories is determined by vehicle weight (GVWR) and engine size (hp). Idle operating conditions are expected to remain the same across all vehicle categories (800 – 1,000 rpm).

iii. Estimated Amount of Diesel Vehicle Idling By Category

Long haul or long duration truck drivers idle their trucks during rest periods to provide heat or air conditioning for the sleeper compartment, to keep the engine warm during cold weather, and to provide electrical power for their truck appliances. US EPA estimates (http://www.epa.gov/otaq/retrofit/idling.htm) that rest periods last from 6-8 hours per day, and over 300 days per year. Argonne National Laboratory Transportation Technology R&D Center estimates that a sleeper truck on average idles for over 1,830 hours per year (Mid-America Truck Show, March 2003). For the purposes of estimating cost benefits from a reduction in idling activity for an individual sleeper, staff has therefore conservatively assumed that a sleeper vehicle will idle for 6 hours per day, 5 days per week, and 50 weeks per year, or 1,500 hours per year.

Staff has obtained data from EMFAC/CARB Mobile Source Control Division (MSCD) that indicates that non-sleeper diesel fueled vehicles idle to a lesser extent than sleeper vehicles. It has been estimated that non-sleeper heavy heavy-duty diesel vehicles (HHDV) will idle for an estimated 36 minutes per day, 365 days per year, medium heavy-duty diesel vehicles (MHDV) will idle for an estimated 12 minutes per day, 365 days per year, and urban transit diesel buses (UTBUS) will idle for an estimated 12 minutes per day, 365 days per year. Light heavy-duty diesel vehicles (LHDV) are not expected to idle beyond the limits imposed by the proposed ATCM, and hence no benefits were estimated for this category.

2. 5-YEAR LIFETIME COST-BENEFIT ANALYSIS FOR PHASE ONE IMPLEMENTATION (2005 –2009)

Business compliance costs are determined for two phases of program (rule) implementation. Phase One will go into effect January 1, 2005, and affects heavy-duty diesel fueled vehicles with a GVWR of greater than 10,000 pounds. Phase Two will go into effect January 1, 2009, and affects heavy-duty diesel fueled vehicles equipped with sleeper berths and a GVWR of greater than 10,000 pounds.

ARB expects owners of vehicles will comply with the regulation by simply shutting off their engine after the idling time limit has been reached during Phase One implementation. The proposed ATCM is expected to significantly reduce the amount of diesel fuel used in California for the affected vehicle population as a whole, and also reduce a significant amount of particulate matter (PM) emissions as a result of an overall reduction in idling activity. It is estimated that approximately 258 million gallons of diesel fuel will be saved during the Phase One period (2005 –2009).

TABLE D- 7

ANNUAL FUEL SAVINGS (GALLONS) FOR PHASE ONE IMPLEMENTATION

YEAR	HHDV	MHDV	UTBUS	TOTAL
2005	39,384,522	9,075,258	795,218	**49,254,998**
2006	40,295,562	9,315,990	805,949	**50,417,501**
2007	41,249,964	9,550,846	822,761	**51,623,571**
2008	42,125,964	9,779,467	840,442	**52,745,873**
2009	43,040,946	10,003,694	859,298	**53,903,938**
TOTAL	**206,096,958**	**47,725,255**	**4,123,668**	**257,945,881**

Staff Assumptions:
(1) Fuel consumed during idle:
HHDV – 1.0 gal/hr
MHDV – 0.7 gal/hr
UTBUS – 0.7 gal/hr
(2) Minutes reduced idle per day (365 days per year)
HHDV – 36 min/day
MHDV – 12 min/day
UTBUS – 12 min/day

Annual fuel savings are derived from projected heavy-duty diesel vehicle population for each year during Phase One implementation, estimated hours of idle reduction per year, and the amount of fuel consumed by a particular category heavy-duty diesel vehicle at idle conditions.

Staff has also estimated that during Phase One, 166 tons of PM emissions will be removed annually from the atmosphere as a consequence of the proposed ATCM.

Although not required by the regulation, staff estimates that a typical business would allocate one hour of resources per driver for the initial training of the vehicle operator, for explaining their company's compliance strategy, and for providing any additional training specific to the use of an APS device or idle reduction technology. The cost of this training is estimated to be the median California truck driver hourly wage (apportioned to be $15.29 in 2003 dollars). Staff expects any subsequent training to be incorporated into the existing driver training and education programs (e.g. safety meetings), and be in the form of reminders.

Phase One Cost Savings: $477.43 Million:

The regulation specifies a maximum idling time limit and does not specify the specific use of any idle reduction technology or procedure (other than shutting of the engine) for compliance. Staff expects all non-sleeper vehicles to comply with the regulation by simply shutting off their engines. The amount of savings will depend on the actual amount of reduced idling that occurs. For purposes of the economic analysis, it was estimated that heavy heavy-duty vehicles (HHDV) reduced idling by 36 minutes each day, medium heavy-duty diesel vehicles (MHDV) reduced idling by 12 minutes each day, and urban transit buses (UTBUS) reduced idling by 12 minutes each day. Light heavy-duty diesel vehicles (LHDV) are not expected to benefit from idle reduction beyond the limits imposed by the regulation. All reductions are assumed to occur 365 days per year.

Table D - 8 below illustrates the annual cost savings for a 5-Year Lifetime Cost-Benefit Analysis for a vehicle in the heavy heavy-duty category (starting in 2005 with Phase One program implementation). The methodology used to calculate the 5-Year lifetime benefit of a particular vehicle is a discounted cash flow (DCF) analysis of the annual fuel and reduction in engine maintenance savings for the years 2005 – 2009. Staff does not expect a typical business owner of a non-sleeper vehicle to allocate capital equipment resources for compliance with the proposed ATCM.

TABLE D- 8

5-YEAR LIFETIME COST-BENEFIT ANALYSIS FOR A HHDV NON-SLEEPER (2005 PHASE ONE IMPLEMENTATION)

YEAR	ANNUAL FUEL SAVINGS (2)	ANNUAL ENGINE MAINTENANCE SAVINGS (3)	SUM TOTAL SAVINGS	2003 PRESENT VALUE (4)
2005 (1)	$ 410	$ 39	$ 449	$ 420
2006	$ 434	$ 39	$ 473	$ 413
2007	$ 460	$ 39	$ 499	$ 407
2008	$ 488	$ 42	$ 530	$ 404
2009	$ 517	$ 42	$ 559	$ 399
			5-Year Lifetime Benefit Per Vehicle of Proposed ATCM:	**$ 2,043**

NOTES:

(1) Staff assumes that in the first year a typical business will allocate one hour of resources for driver training & education. Expected training costs of $15.29 (2003) are not factored into the cost savings but are considered separately in Table 2 below.

(2) Annual Fuel Savings are based on a saving of 1.0 gallon per hour and a projected 2005 diesel price of $1.87 per gallon. Diesel prices are projected to increase 6% a year thereafter. For 2005, Fuel

Savings are 219 hours (36 min/day x 365 day/year) reduced idling per year x $1.87/gallon, or $410 per year.

(3) Annual Engine Maintenance Savings: Multiply the Year 2005 maintenance savings rate of $0.18 per hour by 219 of hours reduced idling per year, or $39 per year.

(4) 2003 Present Value (PV) is the discounted value on December 31, 2003, of the Annual Fuel & Engine Maintenance Savings (discounted at the nominal discount rate of 7%).

Table D - 9 below details the regulatory cost savings for the entire non-sleeper heavy heavy-duty (HHDV) fleet during Phase One implementation (2005 – 2009). An annually increasing vehicle population is used to derive the 5-year lifetime cost savings. The total lifetime benefit for HHDVs during the first five years (2005-2009) of the regulation is approximately $381.25 million.

TABLE D- 9

5-YEAR LIFETIME COST-BENEFIT ANALYSIS FOR ENTIRE HHDV FLEET (2005 - PHASE ONE IMPLEMENTATION)

YEAR	EMFAC 2002 POPULATION PROJECTION (1)	ANNUAL FUEL & MAINTENANCE COST SAVINGS PER VEHICLE	TOTAL BENEFITS	DRIVER TRAINING & EDUCATION COSTS (2)	2003 PRESENT VALUE OF NET HHDV FLEET SAVINGS (3)
2005	179,838	$ 449	$ 80,747,262	$ 2,881,005	$ 72,772,203
2006	183,998	$ 473	$ 87,031,054	$ 68,224	$ 75,956,704
2007	188,356	$ 499	$ 93,989,644	$ 73,171	$ 76,663,818
2008	192,356	$ 530	$ 101,948,680	$ 68,760	$ 77,723,703
2009	196,534	$ 558	$ 109,665,972	$ 73,533	$ 78,137,894
		5-Year Lifetime Benefit of Idling Regulation:	**$473,382,612**	**($ 3,164,693)**	**$ 381,254,322**

Notes:

(1) Populations account for fleet growth and are projected by EMFAC 2002

(2) Driver training costs assume 1 driver per vehicle and assume 1 hour of training time per driver in 2005 and only include additional drivers resulting from fleet growth in subsequent years.

(3) The sum of Total Benefits and Driver Training & Education Costs were discounted at the nominal discount rate of 7% for each year.

Using the same methodology, the 5-year lifetime benefits for non-sleeper vehicles other than the HHDV fleets are estimated to be $89.35 million for MHDV, ($0.57) million for LHDV, and $7.39 million for UTBUS. Table D-10 below sums up the cost and cost savings for all four vehicle categories (UTBUS, LHDV, MHDV, HHDV), and results in a total lifetime cost savings of $477.43 million in 2003 dollars for Phase One (2005-2009). The LHDV analysis is not cost positive because staff assumes no idling reduction from this category but still assumes driver training will be needed.

TABLE D- 10

TOTAL REGULATORY 5-YEAR LIFETIME COST-BENEFIT ANALYSIS
(2005-2009 PHASE ONE IMPLEMENTATION)
Yearly Cost & Cost Savings by Vehicle Class and Year

YEAR	HHDV	MHDV	LHDV	UTBUS	2003 PV
2005	$ 72,772,203	$ 15,432,768	$ (543,945)	$ 1,279,575	$ 88,940,601
2006	$ 75,956,704	$ 18,244,628	$ (6,020)	$ 1,512,338	$ 95,707,650
2007	$ 76,663,818	$ 18,397,997	$ (6,370)	$ 1,520,103	$ 96,575,548
2008	$ 77,723,703	$ 18,629,599	$ (5,239)	$ 1,538,785	$ 97,886,848
2009	$ 78,137,894	$ 18,648,545	$ (5,356)	$ 1,542,025	$ 98,323,108
TOTAL (2003)	**$ 381,254,322**	**$ 89,353,537**	**$ (566,930)**	**$ 7,392,826**	**$477,433,755**

3. 5-YEAR LIFETIME COST-BENEFIT ANALYSIS FOR PHASE TWO (SLEEPER) IMPLEMENTATION (2009 –2013)

Phase Two of the proposed ATCM is expected to go into effect January 1, 2009, and affects all heavy-duty diesel fueled vehicles equipped with sleeper berths, and a GVWR of greater than 10,000 pounds. The cost-benefit methodologies for Phase Two (Sleeper) implementation are the same as the methodologies used to calculate costs-benefits for Phase One, with the exception that the discounted cash flow analysis (DCF) involves the additional purchase (annual capitalization costs) and maintenance costs of the auxiliary power device.

Phase Two Cost Savings: $97.5 Million

Phase Two, which limits idling of trucks and the operation of diesel-fueled auxiliary power systems during extended rest periods, will be implemented starting January 1, 2009. Staff expects a wide range of strategies to supply power to the sleeping berth to be implemented depending on the individual needs of the driver. A truck driver may employ any strategy he/she chooses so long as he/she complies with the regulation. Strategies include shutting off the engine when weather conditions allow, staying in a hotel room, purchase and installation of battery packs, non diesel-fueled auxiliary power systems, and the use of truck stop electrification services. Also, ARB staff intends to return to the Board in 2005 to establish procedures and specifications under which diesel-fueled APS units would be allowed to operate beyond January 1, 2009. There are many compliance alternatives with costs ranging from less than one hundred dollars to many thousands of dollars. Because it is not known to what degree different strategies will be chosen, staff chose to provide cost-benefit economic analysis assuming all sleepers will be equipped with an APS and assumes the costs of an APS will be a realistic average cost of compliance. However, staff expects not all trucks will install an APS (~$8,600) and many will choose less expensive alternatives and the economic cost-benefit analysis is expected to under-estimate the costs savings of the regulation.

Cost savings are generated by the reduction of main engine idling during extended driver rest periods. In order to provide power to the sleeper berth, and for the purposes of this economic analysis, staff assumes vehicle operators will install and operate an auxiliary power system (APS). Staff also assumes that a vehicle owner or operator will finance the purchase of the installation over a period of five years.

Table D -11 below shows an example of the cost analysis for a sleeper truck installing an APS in 2009. An APS is projected to cost $8,569 in the Year 2009 (equipment and installation) and is expected to use one-fifth the fuel of an idling main engine.

Main Engine: 1.0 gal/hr
APS: 0.2 gal/hr

Factoring in APS costs, training costs, fuel savings, and maintenance savings, staff has determined that an average sleeper truck that idles 1,500 hours per year will realize a payback period of 3-5 years, and a net 5-year cost savings of $1,562 (2003 dollars).

The methodology used to calculate the 5-Year lifetime benefit of a particular vehicle is a discounted cash flow (DCF) analysis of the annual fuel and reduction in engine maintenance savings, less APS capitalization and maintenance costs, for the years 2009 - 2013.

TABLE D- 11

EXAMPLE: 5-YEAR LIFETIME COST-BENEFIT ANALYSIS FOR THE PURCHASE OF AUXILIARY POWER SYSTEM (APS) FOR SLEEPER BERTH EQUIPPED VEHICLES

Year 2009 APS Purchase	APS (2) Annual Capital-ization	Annual Fuel Savings (3)	Annual Engine Maintenance Savings (4)	APS Maintenance Costs (5)	Sum Total Of All Cash Flows	2003 Present Value (6)
2009 (1)	($2,090)	$ 2,832	$ 300	$ (498)	$ 544	$ 196
2010	($2,090)	$ 3,000	$ 300	$ (506)	$ 704	$ 255
2011	($2,090)	$ 3,180	$ 300	$ (514)	$ 876	$ 312
2012	($2,090)	$ 3,372	$ 315	$ (522)	$1,075	$ 374
2013	($2,090)	$ 3,576	$ 315	$ (530)	$1,271	$ 425
					5-Year Lifetime Benefit of APS Purchase:	**$ 1,562**

NOTES:
1. Start of Phase Two (2009).
2. APS costs $8,569 in 2009 and is capitalized over 5 years at a rate of 7%. $2,090 is the annual amortized cost of the APS (5-Year Schedule) and is derived from the following equation:

Annual Amortized Cost (A) = Principal (P) x [(r)*(1+r)^n/(1+r)^n – 1], where "r" is the interest rate per period, and "n" is the number of payments to be made.

3. Fuel Savings are based on savings of 0.8 gallon per hour (1.0 gal/hr main engine – 0.2 gal/hr APS) and a projected 2009 diesel price of $2.36 per gallon. Staff estimates an average sleeper will reducing idling during rest periods by 1,500 hours / year.
4. Reduction in Engine Maintenance Savings (Year 2009) was estimated to be $0.20 per hour.
5. APS Maintenance Costs were obtained from Pony Pack, Inc. for 2003 and projected for estimated APS use in the Year 2009.
6. 2003 Present Value is the discounted value on December 31, 2003, of the Annual Fuel & Maintenance Savings (discounted at the applicable rate).

There is no information detailing the actual number of sleeper vehicles operating, and their related idling patterns, in California. To compute a minimum cost savings for the entire sleeper fleet population, staff derived an estimated daily amount of idling that would be reduced in California based on the number of parking spaces and space usage data in a Federal Highway Commission (FHC) study. Staff was then able to calculate an estimated annual cost benefit from a reduction in idling in California.

Since the amount of reduced idling by sleepers during Phase Two is stated in hours idling reduced per year, staff determined the cost savings on an hourly basis for an average sleeper using an APS. Staff then multiplied the result by total fleet hours idling reduced in California to get total annual cost savings for the sleeper fleet. Similar to the cost savings methodology detailed in Table D-11 (which is calculated yearly), staff determined all costs and cost savings on an hourly basis (Table D-12)

Table D -12 Methodology:

- All hourly costs and cost savings are grown by individual sector inflation components to determine the hourly costs and cost savings for each year (2009 – 2013).
- The 'Net Present Value of Hourly Benefit of Operating an APS' is the sum of all the hourly cost and cost saving components by year.
- The 'Estimate Total Annual Benefit of Idle Reduction' is the product of the hourly benefit and the idling hours reduced by day. The result is then multiplied by 365 to get the yearly cost savings.
- 'Estimate Total Annual Benefit of Idle Reduction' states the total annual benefit in 2003 dollars.

TABLE D-12

ANNUAL SLEEPER / APS COST SAVINGS DURING PHASE TWO (2009 – 2013)

	2009	2010	2011	2012	2013
Hourly Amortized Cost of APS ($/Hour) (1)	$ (1.3467)	$ (1.3561)	$ (1.3657)	$ (1.3754)	$ (1.3853)
Hourly Fuel Savings (Fuel Savings Less APS Fuel Consumption - $/Hour)	$ 1.8880	$ 2.0000	$ 2.1200	$ 2.2480	$ 2.3840
Hourly Savings from Reduction in Engine Maintenance ($/Hour)	$ 0.2000	$ 0.2000	$ 0.2000	$ 0.2100	$ 0.2100
Hourly Cost of APS Maintenance (Pony Pack) ($/Hour)	$ (0.3320)	$ (0.3373)	($ 0.3427)	$ (0.3480)	$ (0.3533)
Driver Training (2)	-	-	-	-	-
Net Present Value of Hourly Benefit of Operating an APS	$ 0.4093	$ 0.5066	$ 0.6116	$ 0.7346	$ 0.8554
Estimate of Truck Idling Hours Per Day Reduced(3)	**244,710**	**240,478**	**236,901**	**231,731**	**226,561**
Estimate Total Annual Benefit of Idle Reduction	$25,039,951	$ 30,456,539	$ 36,222,163	$ 42,557,398	$ 48,450,070
2003 NET PRESENT VALUE OF ANNUAL APS COSTS SAVINGS (4)	$14,755,524	$ 17,221,351	$ 19,576,551	$ 22,084,312	$ 23,865,709
Total 2003 Phase Two Savings:	**$97,503,447**				

NOTES:

1. Assume that the APS is capitalized in the first year of purchase (2009) for five years at the nominal interest rate of 7%.
2. Driver training component was not included in the overall sleeper costs savings analysis (Table 4) because the actual number of affected sleeper berth equipped vehicles is not known. The estimated range of affected sleeper vehicles is from 67,000 to 1.7 million. While the regulation does not specifically mandate training, staff expects training will be implemented. Training is estimated to take an hour and cost approximately $15 per driver.
3. Derived by staff from a Study of Adequacy of Parking Facilities, FHC, Report to Congress, June 2002, Projected for Years 2009 - 2013.
4. APU prices essentially have a zero inflation component. As a result, future cash outflows were discounted to present value (2003) at the real discount rate of 5%. All other costs, which have inflation components, and savings, are discounted to present value (2003) at 7%.

Cost savings for the sleeper fleet during the lifetime of the cost benefit analysis (2009 - 2013) is estimated to be approximately $97.5 million.

4. SUMMARY OF TOTAL REGULATION COSTS AND BENEFITS

A. Implementation Cost to The State of California

The ARB will be primarily responsible for enforcement. Occasionally the services of the California Highway Patrol may be utilized for assistance. Any CHP costs are expected to be minor and either reimbursed from the ARB or absorbed within CHP's operating budget.

The ARB is expected to be able absorb enforcement costs within existing budgets and resources. CARB also estimates that $25,000 will be needed for public outreach efforts (to design, reproduce, and distribute informational material during the first year).

B. Summary of Total Benefits to Business & Industry from Proposed ATCM

A summary of the total cost savings to Business and Industry from the Proposed ATCM for the 5-Year lifetime (benefit analysis period) is presented in Table D -13 below. Since all values are reported in 2003 dollars, we can conclude that the Proposed ATCM will yield a net cost savings to business and industry of $575 million over the 5-Year lifetime (benefit analysis period).

TABLE D-13

SUMMARY OF 5-YEAR LIFETIME COST SAVINGS FROM PROPOSED ATCM

5-YEAR (2005 - 2009) LIFETIME BENEFITS FOR PHASE ONE	
NON-SLEEPERS, HHDV	$381,254,322
NON-SLEEPERS, MHDV	$89,353,537
NON-SLEEPERS, LHDV	($566,930)
NON-SLEEPERS, UTBUS	$7,392,826
TOTAL PHASE ONE (2005 –2009):	**$477,433,755**
5-YEAR (2009 - 2013) LIFETIME BENEFITS FOR PHASE TWO	
TOTAL PHASE TWO (2009 - 2013), SLEEPERS	**$97,503,447**
TOTAL PHASE ONE & TWO COST SAVINGS (2003):	**$ 574,937,202**

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