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Draft Regulatory Impact Analysis: Control of Hazardous Air Pollutants from Mobile Sources

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Chapter 11

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Chapter 11: Table of Contents

Chapter 11: Cost per Ton of Emissions Reduced

We have calculated the cost per ton for the proposed rule based on the net present value of all costs incurred and all emission reductions generated from 2009 out to 2030. The time window is meant to capture both the early period of the program when there are a small number of compliant vehicles and gas cans in use, and the later period when there is nearly complete turnover to compliant vehicles and gas cans. For the proposed fuel benzene standards, proposed to begin in 2011, the cost per ton estimates include costs and emission reductions that will occur from all vehicles and nonroad engines fueled with gasoline, gas cans, and gasoline distribution. We have also calculated the cost per ton of emissions reduced in the year 2030 using the annual costs and emissions reductions in that year alone. This number represents the long-term cost per ton of emissions reduced. All costs are in 2003 dollars.

To calculate the cost per ton for each pollutant reduced under the proposed program, we divided the net present value of the annual costs by the net present value of the annual emissions reductions. We have not attempted to apportion costs across these various pollutants for purposes of the cost per ton calculations since there is no distinction in the technologies, or associated costs, used to control the pollutants. Instead, we have calculated costs per ton by assigning all costs to each individual pollutant. If we apportioned costs among the pollutants, the costs per ton presented here would be proportionally lowered depending on what portion of costs were assigned to the various pollutants. Results are presented using both a 3 percent and 7 percent discount rate.

This analysis uses the aggregate costs presented in Chapters 8 through 10 for vehicles, fuels, and gas cans as well as the emissions reductions presented in Chapter 2. In Section 11.1 through 11.3 we present the cost per ton estimates for vehicles, fuels, and gas cans separately. In Section, 11.4, we present the cost per ton estimates for the combined proposal.

11.1 Cost per Ton for Vehicle Standards

We are proposing a new cold temperature NMHC standard for light-duty vehicles, including medium-duty passenger vehicles. The new standard would be phased in from 2010 through 2015. As discussed in Chapter 8, we are projecting costs for R&D and facilities upgrades. For our cost estimates, we projected that these fixed costs would be recovered over the first five years of production for R&D and the first ten years of production for facilities upgrades. We are not projecting any variable costs, so after the first ten years of production, the overall annualized costs for the proposed standards are reduced to $0. For vehicles, we are establishing NMHC standards which would also VOC-based toxics including benzene. We are also expecting direct PM reductions due to the proposed NMHC standard. We have estimated NMHC, total MSATs, benzene, and PM emissions reductions associated with the proposed cold temperature NMHC standards, as provided in Chapter 2. We have interpolated to estimate the emissions reductions for intermediate years not modeled. The annualized costs and emissions reduction estimates for 2009 through 2030 are provided in Table 11.1-1 below.

Table 11.1-1 Aggregate Annualized Vehicle Costs and Emissions Reductions

Calendar Year	Cost	NMHC Reduction	Benzene Reduction	MSAT Reduction	PM Reduction
2009	$0	0	0	0	0
2010	$11,118,971	145,934	7,799	49,607	3,211
2011	$11,772,829	180,722	9,611	61,363	3,976
2012	$12,535,232	215,510	11,423	73,118	4,741
2013	$13,297,635	250,298	13,235	84,874	5,507
2014	$13,406,181	285,086	15,047	96,629	6,272
2015	$12,860,869	319,874	16,859	108,385	7,037
2016	$12,207,011	363,196	19,108	123,010	7,990
2017	$11,444,608	406,518	21,357	137,634	8,943
2018	$10,682,205	449,840	23,606	152,259	9,897
2019	$10,573,659	493,163	25,856	166,883	10,850
2020	$0	536,485	28,105	181,508	11,803
2021	$0	574,180	30,063	194,246	12,632
2022	$0	611,876	32,022	206,984	13,462
2023	$0	649,571	33,980	219,722	14,291
2024	$0	687,267	35,939	232,460	15,120
2025	$0	724,962	37,897	245,198	15,950
2026	$0	762,658	39,856	257,935	16,779
2027	$0	800,353	41,814	270,673	17,608
2028	$0	838,049	43,773	283,411	18,437
2029	$0	875,744	45,731	296,149	19,267
2030	$0	913,440	47,690	308,887	20,096

We have calculated the costs per ton using the net present value of the annualized costs of the program from 2009 through 2030 and the net present value of the annual emission reductions through 2030. We have also calculated the cost per ton of emissions reduced in the year 2030 using the annual costs and emissions reductions in that year alone. This number represents the long-term cost per ton of emissions reduced. As noted above, we have calculated costs per ton by assigning all costs to each individual pollutant. The results for each pollutant are provided in Table 11.1-2.

Table 11.1-2. Vehicle Aggregate Cost per Ton and Long-Term Annual Cost Per Ton ($2003)

	Discounted Lifetime Cost per ton at 3%	Discounted Lifetime Cost per ton at 7%	Long-Term Cost per Ton in 2030
NMHC	$14	$18	$0
Benzene	$260	$340	$0
Total MSATs	$40	$53	$0
Direct PM	$620	$820	$0

11.2 Cost Per Ton for Fuel Benzene Standard

We are proposing a new benzene fuel content standard which would go into effect in 2011. We have estimated the costs and benzene reductions for the proposed standards, which are provided in Chapters 9 and 2, respectively. Table 11.2-1 provides the estimated annualized aggregate costs and emissions reductions associated with the proposed standard through 2030. The cost per ton estimates include costs and emission reductions that will occur from all vehicles and nonroad engines fueled with gasoline, as well as reductions from gas cans and gasoline distribution.

Table 11.2-1 Aggregate Annualized Fuels Costs and Benzene Reductions

Calendar Year	Cost	Benzene Reduction
2009	$0	0
2010	$0	0
2011	$185,533,322	19,125
2012	$188,712,850	18,852
2013	$191,873,334	18,578
2014	$195,104,654	18,305
2015	$198,282,728	18,031
2016	$201,242,062	18,054
2017	$204,211,773	18,077
2018	$207,066,724	18,099
2019	$209,874,973	18,122
2020	$212,606,389	18,145
2021	$215,507,081	18,358
2022	$218,543,629	18,570
2023	$221,783,781	18,783
2024	$225,393,594	18,996
2025	$229,077,715	19,209
2026	$232,821,990	19,421
2027	$236,627,466	19,634
2028	$240,495,142	19,847
2029	$244,426,035	20,059
2030	$248,421,178	20,272

The cost per ton of benzene reductions for fuels are shown in Table 11.2-2 using this same methodology as noted above.

Table 11.2-2. Fuel Benzene Aggregate Cost per Ton and Long-Term Annual Cost Per Ton ($2003)

	Discounted Lifetime Cost per ton at 3%	**Discounted Lifetime Cost per ton at 7%**	**Long-Term Cost per Ton in 2030**
Benzene	$11,700	$11,900	$12,300

11.3 Cost Per Ton for Gas Cans

We are proposing an HC standard for gas cans that would go into effect beginning in 2009. The estimated costs for the standard, and fuel savings, are presented in Chapter 10 and the emissions reductions are provided in Chapter 2. The new HC standard would also reduce VOC-based toxics including benzene. The stream of annualized costs, fuel savings, and emissions reduction estimates for HC, benzene, and total MSATs for gas cans are provided in Table 11.3-1.

Table 11.3-1 Aggregate Annualized Gas Can Costs and Emissions Reductions

Calendar Year	Cost	Fuel Savings	HC Reduction	Benzene Reduction	MSAT Reduction
2009	$49,122,261	$14,381,149	28,384	233	3,561
2010	$49,633,240	$29,795,152	58,806	480	7,375
2011	$50,154,439	$45,209,154	89,229	727	11,189
2012	$50,686,062	$60,623,156	119,651	974	15,002
2013	$51,228,318	$76,037,159	150,073	1,221	18,816
2014	$28,208,134	$91,451,161	180,496	1,468	22,630
2015	$28,772,297	$92,686,097	182,933	1,488	22,935
2016	$29,347,743	$93,921,033	185,370	1,508	23,241
2017	$29,934,698	$95,155,969	187,808	1,527	23,546
2018	$30,533,392	$96,390,905	190,245	1,547	23,852
2019	$31,144,060	$97,625,841	192,683	1,567	24,157
2020	$31,766,941	$98,860,777	195,120	1,588	24,475
2021	$32,402,280	$100,095,713	197,557	1,608	24,794
2022	$33,050,325	$101,330,649	199,995	1,629	25,112
2023	$33,711,332	$102,565,585	202,432	1,649	25,431
2024	$34,385,558	$103,800,521	204,869	1,670	25,749
2025	$35,073,270	$105,035,457	207,307	1,690	26,067
2026	$35,774,735	$106,270,393	209,744	1,711	26,386
2027	$36,490,230	$107,505,329	212,182	1,731	26,704
2028	$37,220,034	$108,740,265	214,619	1,752	27,023
2029	$37,964,435	$109,975,201	217,056	1,772	27,341
2030	$38,723,724	$111,210,137	219,494	1,792	27,648

Table 11.3-2 provides estimated cost per ton for both overall HC reductions, overall MSAT reductions, and for benzene reductions. As with vehicles, we have calculated costs per ton by assigning all costs to each individual pollutant. If we apportioned costs among the pollutants, the costs per ton presented here would be proportionally lowered depending on what portion of costs were assigned to the various pollutants. The cost per ton estimates are presented with and without fuel savings. Where the fuel savings outweigh the costs, the table presents cost per ton as $0, rather than calculating a negative value that has no clear meaning.

Table 11.3-2. Gas Can Aggregate Cost per Ton and Long-Term Annual Cost Per Ton ($2003)

	Discounted Lifetime Cost per ton at 3%	Discounted Lifetime Cost per ton at 7%	Long-Term Cost per Ton in 2030
HC without fuel savings	$230	$250	$180
HC with fuel savings	$0	$0	$0
Total MSATs without fuel savings	$1,800	$2,000	$1,400
Total MSATs with fuel savings	$0	$0	$0
Benzene without fuel savings	$27,800	$30,900	$21,600
Benzene with fuel saving	$0	$0	$0

11.4 Cost Per Ton for the Overall Proposal

The cost per ton estimates for each individual program are presented separately in the sections and tables above, and are part of the justification for each of the programs. For informational purposes, we also present below the cost per ton for the three programs combined. For MSATs and benzene, we have estimated overall costs by summing the cost shown above for fuels, vehicles, and gas cans, including fuel savings. For MSAT and benzene reductions, we have accounted for the interaction between reduced fuel benzene content due to a new standard and the reductions in benzene that would be provided by the vehicle and gas can proposed standards. These emissions reduction estimates are provided in Chapter 2. For HC, we have added the costs and HC reductions shown above for vehicles and gas cans, including fuel savings. Tables 11.4-1 and 11.4-2 provide the streams of costs and emissions reductions for benzene and HC, respectively.

Table 11.4-1 Aggregate Annualized Overall Costs, and Benzene and MSAT Emissions Reductions*

Calendar Year	Cost Including Fuel Savings	Benzene Reduction	MSAT Reduction
2009	$34,741,111	233	3561
2010	$30,957,060	8,279	56,982
2011	$202,251,436	28,188	90,402
2012	$191,310,988	29,856	105,580
2013	$180,362,128	31,523	120,757
2014	$145,267,808	33,191	135,935
2015	$147,229,797	34,858	147,832
2016	$148,875,783	36,935	162,569
2017	$150,435,109	39,011	177,307
2018	$151,891,416	41,088	192,045
2019	$153,966,851	43,164	206,782
2020	$145,512,553	45,241	221,532
2021	$147,813,647	47,245	234,614
2022	$150,263,305	49,249	247,695
2023	$152,929,527	51,253	260,776
2024	$155,978,631	53,257	273,858
2025	$159,115,527	55,262	286,939
2026	$162,326,332	57,266	300,021
2027	$165,612,366	59,270	313,102
2028	$168,974,910	61,274	326,183
2029	$172,415,268	63,278	339,265
2030	$175,934,765	65,282	352,335

* includes fuels, vehicles, and gas cans

Table 11.4-2 Aggregate Annualized Overall Costs and HC Emissions Reductions*

Calendar Year	Cost Including Fuel Savings	HC Reduction
2009	$34,741,111	28,384
2010	$30,957,060	204,740
2011	$16,718,114	269,951
2012	$2,598,138	335,161
2013	-$11,511,206	400,371
2014	-$49,836,846	465,582
2015	-$51,052,931	502,807
2016	-$52,366,279	548,566
2017	-$53,776,663	594,326
2018	-$55,175,309	640,086
2019	-$55,908,122	685,845
2020	-$67,093,836	731,605
2021	-$67,693,434	771,738
2022	-$68,280,324	811,870
2023	-$68,854,254	852,003
2024	-$69,414,963	892,136
2025	-$69,962,188	932,269
2026	-$70,495,658	972,402
2027	-$71,015,100	1,012,535
2028	-$71,520,231	1,052,668
2029	-$72,010,766	1,092,801
2030	-$72,486,414	1,132,934

* includes vehicles and gas cans

Table 11.4-3 provides the estimated combined cost per ton estimates for benzene, MSATs and HC. The HC estimates are reported as $0 because the fuel savings from gas cans offsets the combined costs of the proposed vehicle and gas can programs.

Table 11.4-3. Overall Aggregate Cost per Ton and Long-Term Annual Cost Per Ton ($2003)

	Discounted Lifetime Cost per ton at 3%	**Discounted Lifetime Cost per ton at 7%**	**Long-Term Cost per Ton in 2030**
Benzene for fuels, vehicles, and gas cans combined	$3,700	$4,000	$2,700

Total MSATs for fuels, vehicles, and gas cans combined	$770	$850	$500
HC for vehicles and gas cans combined	$0	$0	$0