

# Appendix

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# Parameters Used To Calculate Volatile Organic Compound Emissions Reduction Potential and Associated Costs of Control for Stationary Sources

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The equation used to calculate total annual cost is given by:

$$\text{Annual cost} = (A * CC * U^{CE}) + (OC * U^{OE}) - (RI + U * RS)$$

where, A = annualization factor (assume 10% annual interest; incineration—15-year equipment life, others-10-year life),

U = uncontrolled VOC emissions, and other parameters defined in the column headings below.

Control Strategy/Source Description	Control Technique	Control Efficiency (percent)	(CC) Capital Cost:		(CE) Exoon.:		(OC) O&M Cost:		(OE) Exoon.:		(RI) Recovery Credit: tercep	(RS) Slope
			Constant	Exoon.	Constant	Exoon.	Constant	Exoon.				
<b>FACT:</b>												
Solvent metal cleaning: large source <sup>a</sup> small source <sup>a</sup>	Carbon adsorb	54	14,989	0.368	293.0	0.623	0.0	0.0	0.0	0.0	3.6	340
Printing and publishing: large source small source	Carbon adsorb	83	214	1.000	0.0	1.000	0.0	0.0	0.0	0.0	0.0	21
Dry cleaning: large source	Carbon adsorb	85	29,002	0.579	453.0	0.819	0.0	0.0	0.0	0.0	0.0	263
	Recovery dryers	70	8,597	0.568	1,204.0	0.659	0.0	(286.0)	0.0	0.0	0.0	283
	Recovery dryers	70	9,551	1.000	1,385.0	1.000	0.0	0.0	0.0	0.0	0.0	441
Fixed roof tanks-crude oil	Internal floating roof	98	21,112	0.328	1,311.0	0.328	0.0	(52.8)	0.0	0.0	0.0	184
Fixed roof tanks-gasoline	Internal floating roof	96	12,228	0.321	759.0	0.321	0.0	(504.0)	0.0	0.0	0.0	276
External floating roof tanks-crude oil	Secondary seal	90	15,821	1.104	982.0	1.104	0.0	30.0	0.0	0.0	0.0	148
External floating roof tanks-gasoline	Secondary seal	95	1,094	1.160	68.0	1.160	0.0	10.9	0.0	0.0	0.0	262
Bulk gasoline terminals-splash loading	Submerged load, balanced service	91	175,323	0.248	3,534.0	0.3	0.0	158.0	0.0	0.0	0.0	254
Bulk gasoline terminals-submerged loading, balanced service: large <sup>a</sup>	Carbon adsorb, truck test	87	89,862	0.189	3,954.0	0.314	0.0	(132.0)	0.0	0.0	0.0	224
Bulk gasoline terminals-submerged loading, not balanced: large <sup>a</sup>	Balanced serv, truck test	79	99,188	0.89	4,663.0	0.3	0.0	(6.6)	0.0	0.0	0.0	220
	Balanced serv, truck test	51	8,052	1.000	212.0	1.000	0.0	0.0	0.0	0.0	0.0	257
Service stations-Stage I	Vapor balance	95	1,748	0.000	51.3	0.000	0.0	0.0	0.0	0.0	0.0	0
Ethylene oxide manufacture	Incinerator	98	1,908	0.924	223.0	0.959	0.0	0.0	0.0	0.0	0.0	0
Phenol manufacture	Incinerator	98	28,147	0.627	2,762.0	0.787	0.0	0.0	0.0	0.0	0.0	0
Terephthalic acid manufacture	Incinerator	98	2,331	0.985	663.0	0.994	0.0	0.0	0.0	0.0	0.0	0
Acrylonitrile manufacture	Incinerator	98	1,310	0.915	129.0	0.994	0.0	0.0	0.0	0.0	0.0	0
SOCMI fugitives: large source	Equipment & maintenance	37	1,523	0.675	538.0	0.773	0.0	1,581.0	0.0	0.0	0.0	128
SOCMI fugitives: small source	Equipment & maintenance	37	249	1.000	152.0	1.000	0.0	0.0	0.0	0.0	0.0	134
Petroleum refinery fugitives: large	Equipment & maintenance	69	1,397	0.513	1,048.0	0.481	0.0	242.0	0.0	0.0	0.0	137
Petroleum refinery fugitives: small	Equipment & maintenance	29	1,042	1.000	105.0	1.000	0.0	0.0	0.0	0.0	0.0	0
Cellulose acetate manufacture	Carbon adsorb	72	115,789	0.600	12,110.0	0.600	0.0	0.0	0.0	0.0	0.0	448
Styrene-butadiene rubber manufacture	Incinerator	20	10,018	0.600	761.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Polypropylene manufacture	Flare	98	1,877	0.600	1,040.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Polyethylene manufacture	Flare	98	1,890	0.600	1,343.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Ethylene manufacture	Flare	98	593	0.806	18.7	0.965	0.0	0.0	0.0	0.0	0.0	0
Petroleum refinery wastewater separators	Firebox covers	95	751	0.600	76.3	0.600	0.0	0.0	0.0	0.0	0.0	154
Petroleum refinery vacuum distillation	Firebox piping	100	1,401	0.600	107.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Vegetable oil processing	Stripper & equipment	42	22,033	0.192	1,992.0	0.462	0.0	(57.3)	0.0	0.0	0.0	118
Paint and varnish manufacture	Afterburner	92	7,597	0.600	1,617.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Rubber and plastics manufacture <sup>b</sup>	Carbon adsorb	83	2,664	1.000	239.0	1.000	0.0	0.0	0.0	0.0	0.0	200
Rubber tire manufacture	Carbon adsorb	83	28,163	0.664	2,249.0	0.682	0.0	373.0	0.0	0.0	0.0	191
Green tire spray	Solvent change	90	94	0.665	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0
Carbon black manufacture	Flare	90	12,757	0.600	12,877.0	0.600	0.0	0.0	0.0	0.0	0.0	0
Automobile surface coating	Higher solids coating	88	8,464	0.953	2,287.0	1.102	0.0	0.0	0.0	0.0	0.0	0
Beverage can surface coating	Incinerator	57	278,756	0.048	2,636.0	0.762	0.0	0.0	0.0	0.0	0.0	0
General surface coating	Process change	70	89,874	0.000	271.0	1.003	0.0	0.0	0.0	0.0	0.0	0

Control Strategy/Source Description	Control Technique	control Efficiency (percent)	(cc) Capital Cost:		(OE) O&M Cost:		(RI) Recovery	(RS) Credit:
			Constant	Expon.	Constant	Expon.	Intercept	slope
Paper surface coating: large source	Incinerator . . . . .	90	31,532	0.406	2,164.0	0.654	(5,914.0)	325
small source	Incinerator . . . . .	91	4,334	1.000	3,664.0	1.000	0.0	<b>342</b>
Miscellaneous surface coating	Incinerator . . . . .	90	117,482	0.539	2,371.0	0.877	0.0	0
Pharmaceutical manufacture <sup>a</sup>	Equipment & maintenance . . . . .	37	424	1.000	220.0	1.000	0.0	159
Synthetic fiber manufacture	Carbon adsorber . . . . .	54	4,501	1.000	526.0	1.000	0.0	320
Crude oil/natural gas production	Equipment & maintenance . . . . .	37	549	1.000	264.0	1.000	0.0	196
Cutback asphalt	Emulsified asphalt . . . . .	100	0	1.000	0.0	1.000	0.0	0
Misc. (includes: industrial solvent use and miscellaneous surface coating) <sup>a</sup>	Incinerator . . . . .	75	31,911	1.000	1,595.0	1.000	0.0	0
New CTG's;								
Plastic parts coating <sup>b</sup>	Incinerator . . . . .	90			(No cost coefficients used. Assumed \$2,000/ton) <sup>c</sup>			
Wood furniture Coating <sup>b</sup>	Incinerator . . . . .	90			(No cost coefficients used. Assumed \$2,000/ton) <sup>c</sup>			
Coke-oven by-product plants	Incinerator . . . . .	90			(No cost coefficients used. Assumed \$2,000/ton) <sup>c</sup>			
Automobile refinishing	<b>Incinerator</b> . . . . .	75	31,911					0
Publicly-owned treatment Works <sup>b</sup>		90			(No cost coefficients used. Assumed \$2,000/ton) <sup>c</sup>			
Bakeries <sup>b</sup>	Afterburner . . . . .	90	0	1.000	1,150.0	1.000	0.0	0
<b>Hazardous waste treatment, storage, and disposal facilities<sup>d</sup></b>	Covers, carbon absorber. . . . .	90			(No cost coefficients used. Assumed \$900/ton) <sup>e</sup>			
<b>Architectural surface coating</b>	Water-base coating . . . . .	25	0	0.000	287.0	1.000	0.0	0
<b>Stage II:<sup>f</sup></b>	Vapor balance . . . . .	79			(No cost coefficients used. Assumed \$1,000/ton)			

NOTES:  
**a** Large sources\* emit more than 50 tons per year of VOC. \*Small sources\* emit less than 50 tons per year of VOC. Unless otherwise specified, all categories above are for sources emitting more than 50 tons per year.  
**b** Sources that emit less than 50 tons per year of VOC.  
**c** Cost-effectiveness assumed by OTA  
 Derived from:  
 (1) Batty, W. H., M.G. Smith, and M. Deasa, Cost Assessment of Alternative National Ambient Air Quality Standards For Ozone, Draft Report, prepared by Alliance Technology Corporation, Contract No. 66-02-4317 (Research Triangle Park, NC: U.S. Environmental Protection Agency, October 1957).  
 (2) E.H. Pechan and Associates, Inc., National Assessment of VOC, CO, and NOx Controls, Emissions, and Costs, Contract No. 68-W8-0038 (Washington, D.C.: Office of Policy, Planning and Standards, U.S. Environmental Protection Agency, September 1955).

## Related OTA Report

- *Acid Rain and Transported Air Pollutants: Implications for Public Policy.*  
OTA-O-204, 6/84; 324 pages. GPO stock #052-003-O0956-1; \$9.50.  
NTIS order #PB 84-222 967/AS.

NOTE: Reports are available from the U.S. Government Printing Office, Superintendent of Documents, Washington, D.C. 20402-9325 (202-783-3238); and the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161 -O(X) I (703-4874650).