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Subject: Revised Costs for Dry Injection/Fabric Filter Controls
for MWI's
EPA Contract No. 68-D1-0115; Work Assignment No. 108
ESD Project No. 90/17; MRI Project No. 6504-08

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I. Introduction

Background documentation for the proposed NSPS and emission guidelines for medical waste incinerators (MWI's) presented costs for dry injection/fabric filter control systems in October 1989 dollars.¹ This memorandum describes the changes in the algorithm to update the costs to July 1994 dollars. The procedures were not revised, but some of the costs were scaled up. This memorandum also shows the results of the revised algorithm for a new set of model MWI's that characterize the current population of MWI's.

II. Capital Costs

In the background documentation, an equation was used to estimate the total capital investment (TCI) in October 1989 dollars.¹ To estimate the TCI in July 1994 dollars, this equation was multiplied by a ratio of Chemical Engineering Plant Cost Indexes for July 1994 and October 1989. These indexes are 368.0 and 357.5, respectively.^{2,3} The revised equation is shown in Table 1.

III. Annual Costs

Equations used to calculate each of the direct and indirect annual costs are shown in Table 1.

The equations used to calculate annual costs for electricity, makeup lime, water, labor, compressor air, and bag replacement are the same as in the background documentation.¹ These equations are unchanged because unit costs and wage rates were assumed to be unchanged.

TABLE 1. EQUATIONS USED TO ESTIMATE CAPITAL AND ANNUAL COSTS FOR DIFF CONTROL DEVICES

Parameters	Equations
1. Total APCD capital investment, \$	$65.7 * \text{dscfm} + 419466$
2. Direct annual costs, \$/yr	
a. Electricity	$(0.000355 * \text{dscfm} + 0.1573) * (\text{hr/yr})$
b. Makeup lime	$(0.00000720 * \text{ppm HCl}) * (\text{dscfm}) * (\text{hr/yr})$
c. Water	$(0.000126 * \text{dscfm} + 0.0289) * (\text{hr/yr})$
d. Operating, supervisory, and maintenance labor	$2.55 * (\text{hr/yr})$
e. Maintenance materials	$1.313 * \text{dscfm} + 8389$
f. Compressor air	$(0.000043 * \text{dscfm} + 0.00812) * (\text{hr/yr})$
g. Dust disposal	$(0.00017 * \text{PM} + 0.000000343 * \text{HCl}) * (\text{dscfm}) * (\text{hr/yr})$
h. Bag replacement	$1.0418 * \text{dscfm} + 195$
i. Cage replacement	$0.12370 * \text{dscfm} + 23.2$
3. Indirect annual costs, \$/yr	
a. Overhead	$(1.530 * \text{hr/yr}) + 0.7881 * \text{dscfm} + 5034$
b. Property tax, insurance, and administrative	$2.627 * \text{dscfm} + 16779$
c. Capital recovery (a)	$7.456 * \text{dscfm} + 49222$
4. Total annual cost, \$/yr	$([0.000171 * \text{PM} + 0.00000106 * \text{HCl} + 0.000524] * \text{dscfm} + 4.2743) * (\text{hr/yr}) + (13.350 * \text{dscfm}) + 79642$

(a) CRF is 0.11746, based on an interest rate of 10 percent and an equipment life of 20 years

Annual costs for maintenance materials; overhead; property taxes, insurance, and administrative charges; and capital recovery were estimated using equations that incorporated the TCI. Therefore, the equations used to calculate these annual costs were revised to reflect the increase in the TCI.

In the background documentation, the equation for fabric filter cage replacement costs included a capital cost for cages in October 1989 dollars. This cost was scaled up to July 1994 dollars using the same Chemical Engineering Plant Cost Indexes described above.

IV. Costs for Model MWI's

Six model MWI's were developed to characterize the population of existing MWI's. Three of the models are intermittent MWI's with design waste charging capacities of 100 pounds per hour (lb/hr), 350 lb/hr, and 1,000 lb/hr; one is an onsite continuous MWI with a design waste charging capacity of 1,000 lb/hr; one is a commercial continuous MWI with a design waste charging capacity of 1,500 lb/hr; and one is a batch MWI with a design capacity of 500 lb/batch. Procedures used to estimate the operating parameters for the model MWI's are described in a separate memorandum.⁴ The capital and annual costs for these models using the revised algorithm are shown in Table 2.

TABLE 2. DIFF ANNUAL COSTS FOR EACH MODEL COMBUSTOR

Parameters/model combustors	Continuous		Intermittent models			Batch MWI
	commercial	onsite	large	medium	small	
1. Model parameters						
a. Design capacity, lb/hr lb/batch	1,500	1,000	1,000	350	100	500
b. Flow rate into control device, dscfm	4,748	3,165	3,165	1,108	317	300
c. Operating hours, hr/yr (a)	7,776	4,050	3,500	2,533	2,363	3600
d. Inlet PM, gr/dscf at 14% O2	0.08	0.08	0.08	0.08	0.08	0.022
e. Outlet PM, gr/dscf at 14% O2	0.005	0.005	0.005	0.005	0.005	0.005
f. Inlet HCl, ppm _v at 14% O2	730	730	730	730	730	100
2. Total APCD capital investment, \$	731,253	627,324	627,324	492,217	440,252	439,169
3. Direct annual costs, \$/yr						
a. Electricity	14,326	5,187	4,482	1,394	637	950
b. Makeup lime	19,403	6,737	5,822	1,475	393	78
c. Water	4,866	1,729	1,494	426	162	240
d. Operating, supervisory, and maintenance labor	19,829	10,328	8,925	6,459	6,026	9,180
e. Maintenance materials	14,625	12,546	12,546	9,844	8,805	8,783
f. Compressor air	1,665	589	509	142	52	76
g. Dust disposal	9,712	3,372	2,914	738	197	40
h. Bag replacement	5,141	3,492	3,492	1,349	525	508
i. Cage replacement	610	415	415	160	62	60
4. Indirect annual costs, \$/yr						
a. Overhead	20,672	13,724	12,883	9,782	8,898	10,778
b. Property tax, insurance, and administrative	29,250	25,093	25,093	19,689	17,610	17,567
c. Capital recovery (b)	84,618	72,819	72,819	57,481	51,582	51,459
5. Total annual cost, \$/yr	224,718	156,031	151,395	108,940	94,949	99,718

(a) Includes preheat, charging, and burndown hours. Also includes cooldown hours for intermittent MWI's that operate combustion air blowers during cooldown.

(b) The CRF is 0.11746, based on an interest rate of 10 percent and an equipment life of 20 years.

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V. References

1. U. S. Environmental Protection Agency. Medical Waste Incinerators - Background Information for Proposed Standards and Guidelines: Model Plant Description and Cost Report for New and Existing Facilities. EPA-453/R-94-045a. July 1994. pp. D-1 through D-5.
2. Economic Indicators. Chemical Engineering. Plant Cost Index for July 1994. October 1994. p. 214.
3. Economic Indicators. Chemical Engineering. Plant Cost Index for October 1989. January 1990. p. 216.
4. Memorandum from D. Randall, MRI, to R. Copland, EPA:ESD. January 29, 1996. Operating Parameters and Costs for Model Medical Waste Incinerators.