

**Development Document for the Proposed Effluent Limitations  
Guidelines and Standards for the Meat and Poultry Products Industry  
Point Source Category (40 CFR 432)  
EPA-821-B-01-007**

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U.S. Environmental Protection Agency  
Office of Water (4303T)  
Washington, DC 20460

Complete proposed document available at:

<http://www.epa.gov/ost/guide/mpp/>

The Final Development Document is available as well.

## **APPENDIX D**

### **INPUT VALUES TO ESTIMATE ENERGY USAGE AND SLUDGE GENERATION**

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**ENERGY USAGE INPUT VALUES**

**Number of MPP Facilities**

40 CFR 432 Subcategory Groupings	Facility Size			
	Small		Non small	
	Direct	Indirect	Direct	Indirect
A, B, C, D	59	1003	82	70
E, F, G, H, I	48	2940	19	234
J	6	17	21	75
K	0	39	104	143
L	4	568	16	209

Data from EPA 1999 Screener Survey

**Energy Usage<sup>a</sup> for Non Small Direct Dischargers per Treatment Option**

40 CFR 432 Subcategory Groupings	BAT2	BAT3	BAT4	BAT5
A, B, C, D	316,332,807	238,067,261	226,294,728	NA <sup>b</sup>
E, F, G, H, I	7,826,280	7,338,834	7,119,912	NA
J	9,930,289	4,859,038	4,450,288	NA
K	166,178,474	100,648,346	102,658,500	103,106,497
L	4,901,141	3,125,891	3,116,588	2,437,379

<sup>a</sup> Units are in kWh/yr

<sup>b</sup> Not applicable

Estimated using CAPDET

**Energy Usage<sup>a</sup> for Non Small Indirect Dischargers per Treatment Option**

40 CFR 432 Subcategory Groupings	PSES1	PSES2	PSES3	PSES4
A, B, C, D	299,309,503	599,067,236	424,113,474	393,228,477
E, F, G, H, I	147,626,497	259,816,154	198,576,619	192,326,157
J	71,418,737	104,225,644	70,057,246	65,496,995
K	404,909,080	766,707,568	518,761,087	500,079,836
L	135,931,037	251,384,650	181,888,936	176,441,950

<sup>a</sup> Units are in kWh/yr

Estimated using CAPDE

**Total Baseline MPP Energy Usage<sup>a</sup> for Non Small Direct Dischargers**

<b>40 CFR 432 Subcategory Groupings</b>	<b>Total Baseline Energy (KWh/yr)</b>
A, B, C, D	314,521,360
E, F, G, H, I	7,793,105
J	9,930,289
K	165,853,063
L	4,867,236

<sup>a</sup> Units are in kWh/yr  
Estimated using CAPDET

**Total MPP Energy Usage<sup>a</sup> for Non Small Indirect Dischargers**

<b>40 CFR 432 Subcategory Groupings</b>	<b>Total Baseline Energy (KWh/yr)</b>
A, B, C, D	280,799,419
E, F, G, H, I	118,919,076
J	69,596,688
K	384,558,363
L	115,134,700

<sup>a</sup> Units are in kWh/yr  
Estimated using CAPDET

**Total MPI Facility Energy<sup>a</sup> Purchased**

<b>Subcategory Groupings</b>	<b>Purchased (KWH/yr)</b>	<b>Not-Small Facilities</b>	<b>Small Facilities</b>
A, B, C, D	4,751,145,000	386	1007
E, F, G, H, I	8,642,867,525	622	675
J	798,082,000	143	97
K	1,961,046,285	144	32
L	3,292,702,715	243	55

<sup>a</sup> Units are in kWH/yr

(Source: 1997 U.S. Census of Manufacturers Data)

Note: Census energy use data is not given for Group E-I

Group E-I Total Energy Purchased is based on the following calculation:

Number of Group E-I Facilities w/ 20 or more employess:	622
Number of Group E-I Facilities w/ 19 or fewer employess:	675
Total Energy (KWH/yr) purchased per Group E-I Not-Small Facility:	13,459,281
Total Energy (KWH/yr) purchased per Group E-I Small Facility:	401,770
Total Energy (KWH/yr) purchased for all Group E-I Facilities:	8,642,867,525

Note: Census data combines data for Groups K and L

Facility Counts and Energy Use for Groups K and L are estimated using ratios from Screener Survey

Subpart K Facilities from Screener Survey:	296
Subpart L Facilities from Screener Survey:	497
Number of Combination Census K&L Facilities w/ 20 or more employess:	387
Number of Combination Census K&L Facilities w/ 19 or fewer employess:	87
Total Energy (KWH/yr) purchased for Groups K and L:	5,253,749,000

**Total MPI Facility Energy Purchased per Facility**

<b>40 CFR 432 Subcategory Groupings</b>	<b>Total Energy Purchased Per Small Facility (KWH/yr)</b>	<b>Total Energy Purchased Per Non Small Facility (KWH/yr)</b>
A, B, C, D	340,877	11,419,383
E, F, G, H, I	401,770	13,459,281
J	163,290	5,470,230
K	403,840	13,528,635
L	401,770	13,459,281

<sup>a</sup> Units are in kWh/facility-yr

Ratio of Energy Use for Not-Small Facilities:Small Facilities: 33.5

Source: EPA 1974 Red Meat TDD (page 133)

Note: Assume the same Ratio of Energy Use for Not-Small Facilities:Small Facilities for Both Meat and Poultry

Note: Assume that Meat Further Processors and Poultry Further Processors have similar energy requirements

Note: Assume that direct and indirect MPP facilities have similar energy requirements

**SLUDGE GENERATION INPUT VALUES**

**Number of MPP Facilities**

40 CFR 432 Subcategory	Facility Size			
	Small		M, L, VL	
	Direct	Indirect	Direct	Indirect
A, B, C, D	59	1,003	82	70
E, F, G, H, I	48	2,940	19	234
J	6	17	21	75
K	0	39	104	143
L	4	568	16	209

Data from EPA 1999 Screener Survey

**Sludge Generation for Non Small Direct Dischargers**

40 CFR 432 Subcategory Groupings	BAT2 Nitrification	BAT3 Nit./De-Nit.	BAT4 P Removal	BAT5 Filter
A, B, C, D	353,794	347,818	348,460	NA
E, F, G, H, I	6,564	6,520	6,538	NA
J	3,655	3,531	3,531	NA
K	129,917	119,564	138,450	138,450
L	3,326	3,180	3,189	2,417

**Sludge Generation for Non Small Indirect Dischargers**

40 CFR 432 Subcategory Groupings	PSES1 DAF	PSES2 Nitrification	PSES3 Nit./De-Nit.	PSES4 P Removal
A, B, C, D	63,466	291,033	250,477	253,161
E, F, G, H, I	2,900	60,670	51,197	52,645
J	9,552	20,778	18,732	19,041
K	38,518	226,433	201,043	201,010
L	2,588	63,573	56,154	56,593

**Total Baseline MPP Sludge Generated for Non Small Direct Dischargers**

<b>40 CFR 432 Subcategory Groupings</b>	<b>Total Baseline Sludge Generated (tons/yr)</b>
A, B, C, D	353,794
E, F, G, H, I	6,564
J	3,655
K	129,917
L	3,326

**Total Baseline MPP Sludge Generated for Non Small Indirect Dischargers**

<b>40 CFR 432 Subcategory Groupings</b>	<b>Total Baseline Sludge Generated (tons/yr)</b>
A, B, C, D	63,466
E, F, G, H, I	2,599
J	9,520
K	38,422



# APPENDIX E

## ATTACHMENTS FOR COST ESTIMATION (CHAPTER 11)

## **ATTACHMENT 11-1. DEVELOPMENT OF COST FACTORS TO ESTIMATE CAPITAL COSTS FROM CONSTRUCTION COST**

Capital cost can be categorized into two categories: (1) unit process construction costs; and (2) other direct and indirect costs. The summation of the above two costs provides the total capital costs. Often other direct and indirect costs are expressed as a percentage of the construction costs to determine the capital cost. Similar approach was followed to estimate the capital costs of the treatment units for the proposed regulation. The construction cost of treatment units obtained from CAPDET model runs were multiplied by a factor to determine the capital cost. This section discusses the method used to determine the factor that converts construction cost to capital cost.

The factor is determined from the costing document of the centralized waste treatment (CWT) industry (USEPA, 1998). The breakdown of the capital costs as provided in the costing document of CWT industry (USEPA, 1998) and the selected percentage for the MPP Industry are shown in table below. The percentage selected are the average of the ranges provided for the cost items. However, for piping the selected percentage is half the average of the range provided.

Cost Factors Used in Centralized Waste Treatment Industry and the Selected Cost Factors for the MPP Industry

<b>Cost Item</b>	<b>Percentage Used in CWT Industry</b>	<b>Cost Item on which The Percentage is Based</b>	<b>Percentage Selected for MPP Industry</b>
Equipment	Technology-Specific		
Installation	25 to 55 Percent	Equipment Cost	40 Percent
Piping	31 to 66 Percent	Equipment Cost	24 Percent
Instrumentation & Control	6 to 30 Percent	Equipment Cost	18 Percent
Engineering	15 Percent	Construction Cost <sup>a</sup>	15 Percent
Contingency	15 Percent	Construction Cost <sup>a</sup>	15 Percent

<sup>a</sup> Construction cost in CWT industry = cost of equipment + installation + piping + instrumentation and control

The unit process construction cost in CAPDET is less than the construction cost for CWT industry shown in the table above. After reviewing the components that constitute unit process construction cost in CAPDET (see Section 11.5.1.1 in Chapter 11), EPA determined that the unit

process construction cost in CAPDET is at least equal to the installed equipment cost (equipment + installation) and partial cost of piping. Therefore, based on engineering judgement the Agency selected half the average of the range of percentages provided for piping to estimate capital costs. The selected percentages for the cost items were converted as a percentage of the unit process construction cost and is shown in Table 11- 3 in Chapter 11. Summation of the factors for the cost items shows that the capital cost is 1.69 times the unit process construction cost.

The method of expressing the selected percentages for the cost items shown in the table above as a percent of unit process construction cost of CAPDET is shown below:

E = Equipment Cost

I = Installation Cost  
= 0.4 \* E

Therefore,

INS = Installed Cost  
= equipment + installation cost  
= E + I  
= 1.4\* E

U = Unit Process Construction Cost

Unit process construction cost is equal to the installed cost. Therefore,

U = INS  
= 1.4\*E

and

E = U/1.4

P = Piping Cost  
= 0.24 \* E  
= 0.17\*U

$$\begin{aligned}\text{IC} &= \text{Instrumentation and control cost} \\ &= 0.18 * E \\ &= 0.13*U\end{aligned}$$

$$\begin{aligned}\text{C} &= \text{Construction Cost in CWT} \\ &= E + I + P + \text{IC} \\ &= E + 0.4*E + 0.24*E + 0.18*E \\ &= 1.82*E\end{aligned}$$

$$\begin{aligned}\text{EN} &= \text{Engineering} \\ &= 0.15*C \\ &= 0.15*1.82*E \\ &= 0.195*U\end{aligned}$$

$$\begin{aligned}\text{CONT} &= \text{Contingency} \\ &= 0.15*C \\ &= 0.15*1.82*E \\ &= 0.195*U\end{aligned}$$

$$\begin{aligned}\text{CAP} &= \text{total capital cost} \\ &= U + P + \text{IC} + \text{EN} + \text{CONT} \\ &= U + 0.17*U + 0.13*U + 0.195*U + 0.195*U \\ &= 1.69*U\end{aligned}$$

**ATTACHMENT 11-2. FREQUENCY OF OCCURRENCE OF TREATMENT UNITS AND PERFORMANCE FACTORS**

EPA received 241 of the MPP Detailed Surveys (MPP Detailed Survey, 2001) before the cut-off date of May 29, 2001. Of 241 surveys, the Agency used 200 surveys for the development of frequency of occurrence and performance factors. The rest 41 surveys were not analyzed because of one or of the following reasons:

1. some were duplicate facilities,
2. some were not meat processing facility,
3. some have insufficient data, and
4. some were not processed at the time the cost estimation was performed.

EPA will use all surveys including those that were collected after the deadlines in upcoming analyses for the forthcoming Notice of Data Availability (NODA) and final rule.

**Table E-1.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Non-Small Facilities

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>	
Meat	R1	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	0.00	
Meat	R2		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60	
Meat	R12		2	1.00	1.00	1.00	1.00	N/A	1.00	1.00	
Meat	R13		2	1.00	1.00	1.00	1.00	N/A	0.93	0.79	
Meat	R23		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60	
Meat	R123		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60	
Meat	R1		3	1.00	1.00	1.00	1.00	N/A	1.00	1.00	
Meat	R2		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38	
Meat	R12		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00	
Meat	R13		3	1.00	1.00	1.00	0.14	N/A	0.93	0.14	
Meat	R23		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38	
Meat	R123		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38	
Meat	R1		Indirect	4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat	R2			4	1.00	1.00	1.00	0.00	N/A	0.98	0.00
Meat	R12			4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat	R13			4	1.00	1.00	1.00	0.00	N/A	0.93	0.00
Meat	R23	4		1.00	1.00	1.00	0.00	N/A	0.98	0.00	
Meat	R123	4		1.00	1.00	1.00	0.00	N/A	0.98	0.00	
Meat	R1	1		1.00	0.33	0.67	N/A	N/A	N/A	0.33	
Meat	R2	1		0.57	0.43	0.00	N/A	N/A	N/A	0.00	
Meat	R12	1		1.00	0.80	0.60	N/A	N/A	N/A	0.40	
Meat	R13	1		1.00	1.00	0.33	N/A	N/A	N/A	0.33	
Meat	R23	1		0.91	0.71	0.42	N/A	N/A	N/A	0.21	
Meat	R123	1		1.00	1.00	0.50	N/A	N/A	N/A	0.00	
Meat	R1	2		1.00	0.33	0.67	0.00	N/A	N/A	0.00	
Meat	R2	2		0.57	0.43	0.00	0.00	N/A	N/A	0.00	
Meat	R12	2		1.00	0.80	0.60	0.20	N/A	N/A	0.20	
Meat	R13	2		1.00	1.00	0.33	0.00	N/A	N/A	0.00	
Meat	R23	2	0.91	0.71	0.42	0.14	N/A	N/A	0.04		
Meat	R123	2	1.00	1.00	0.50	0.50	N/A	N/A	0.00		
Meat	R1	3	1.00	0.33	0.67	0.00	N/A	N/A	0.00		
Meat	R2	3	0.57	0.43	0.00	0.00	N/A	N/A	0.00		

**Table E-1.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Non-Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Meat	R12		2	1.00	0.80	0.60	0.20	N/A	N/A	0.20
Meat	R13		2	1.00	1.00	0.33	0.00	N/A	N/A	0.00
Meat	R23		2	0.91	0.71	0.42	0.14	N/A	N/A	0.04
Meat	R123		2	1.00	1.00	0.50	0.50	N/A	N/A	0.00
Meat	R1		3	1.00	0.33	0.67	0.00	N/A	N/A	0.00
Meat	R2		3	0.57	0.43	0.00	0.00	N/A	N/A	0.00
Meat	R12		3	1.00	0.80	0.60	0.00	N/A	N/A	0.00
Meat	R13		3	1.00	1.00	0.33	0.00	N/A	N/A	0.00
Meat	R23		3	0.91	0.71	0.42	0.10	N/A	N/A	0.10
Meat	R123		3	1.00	1.00	0.50	0.50	N/A	N/A	0.50
Meat	R1		4	1.00	0.33	0.67	0.00	N/A	N/A	0.00
Meat	R2		4	0.57	0.43	0.00	0.00	N/A	N/A	0.00
Meat	R12		4	1.00	0.80	0.60	0.00	N/A	N/A	0.00
Meat	R13		4	1.00	1.00	0.33	0.00	N/A	N/A	0.00
Meat	R23		4	0.91	0.71	0.42	0.00	N/A	N/A	0.00
Meat	R123		4	1.00	1.00	0.50	0.00	N/A	N/A	0.00
Poultry	P1	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	0.77
Poultry	P2		2	1.00	1.00	1.00	1.00	N/A	0.91	0.71
Poultry	P12		2	1.00	1.00	1.00	1.00	N/A	0.75	0.50
Poultry	P13		2	1.00	1.00	1.00	1.00	N/A	0.89	0.56
Poultry	P23		2	1.00	1.00	1.00	1.00	N/A	0.91	0.71
Poultry	P123		2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Poultry	P1		3	1.00	1.00	1.00	0.23	N/A	1.00	0.15
Poultry	P2		3	1.00	1.00	1.00	0.20	N/A	0.91	0.13
Poultry	P12		3	1.00	1.00	1.00	0.25	N/A	0.75	0.25
Poultry	P13		3	1.00	1.00	1.00	0.33	N/A	0.89	0.11
Poultry	P23		3	1.00	1.00	1.00	0.20	N/A	0.91	0.13
Poultry	P123		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Poultry	P1		4	1.00	1.00	1.00	0.08	N/A	1.00	0.00
Poultry	P2		4	1.00	1.00	1.00	0.07	N/A	0.91	0.06
Poultry	P12		4	1.00	1.00	1.00	0.00	N/A	0.75	0.00
Poultry	P13		4	1.00	1.00	1.00	0.22	N/A	0.89	0.22

**Table E-1.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Non-Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>	
Poultry	P23		4	1.00	1.00	1.00	0.07	N/A	0.91	0.06	
Poultry	P123		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00	
Poultry	P1		5	1.00	1.00	1.00	0.08	0.31	1.00	0.08	
Poultry	P2		5	1.00	1.00	1.00	0.07	0.10	0.91	0.02	
Poultry	P12		5	1.00	1.00	1.00	0.00	0.00	0.75	0.00	
Poultry	P13		5	1.00	1.00	1.00	0.22	0.11	0.89	0.00	
Poultry	P23		5	1.00	1.00	1.00	0.07	0.10	0.91	0.02	
Poultry	P123		5	1.00	1.00	1.00	0.00	0.00	1.00	0.00	
Poultry	P1	Indirect	1	1.00	0.73	0.73	N/A	N/A	N/A	0.55	
Poultry	P2		1	0.67	0.33	0.33	N/A	N/A	N/A	N/A	0.33
Poultry	P12		1	1.00	1.00	1.00	N/A	N/A	N/A	N/A	0.60
Poultry	P13		1	1.00	1.00	1.00	N/A	N/A	N/A	N/A	1.00
Poultry	P23		1	0.92	0.77	0.77	N/A	N/A	N/A	N/A	0.62
Poultry	P123		1	0.92	0.77	0.77	N/A	N/A	N/A	N/A	0.62
Poultry	P1		2	1.00	0.73	0.73	0.09	0.09	N/A	N/A	0.09
Poultry	P2		2	0.67	0.33	0.33	0.00	0.00	N/A	N/A	0.00
Poultry	P12		2	1.00	1.00	1.00	0.40	0.40	N/A	N/A	0.40
Poultry	P13		2	1.00	1.00	1.00	0.00	0.00	N/A	N/A	0.00
Poultry	P23		2	0.92	0.77	0.77	0.12	0.12	N/A	N/A	0.12
Poultry	P123		2	0.92	0.77	0.77	0.12	0.12	N/A	N/A	0.12
Poultry	P1		3	1.00	0.73	0.73	0.00	0.00	N/A	N/A	0.00
Poultry	P2		3	0.67	0.33	0.33	0.00	0.00	N/A	N/A	0.00
Poultry	P12		3	1.00	1.00	1.00	0.00	0.00	N/A	N/A	0.00
Poultry	P13		3	1.00	1.00	1.00	0.00	0.00	N/A	N/A	0.00
Poultry	P23	3	0.92	0.77	0.77	0.00	0.00	N/A	N/A	0.00	
Poultry	P123	3	0.92	0.77	0.77	0.00	0.00	N/A	N/A	0.00	
Poultry	P1	4	1.00	0.73	0.73	0.00	0.00	N/A	N/A	0.00	
Poultry	P2	4	0.67	0.33	0.33	0.00	0.00	N/A	N/A	0.00	
Poultry	P12	4	1.00	1.00	1.00	0.00	0.00	N/A	N/A	0.00	
Poultry	P13	4	1.00	1.00	1.00	0.00	0.00	N/A	N/A	0.00	
Poultry	P23	4	0.92	0.77	0.77	0.00	0.00	N/A	N/A	0.00	
Poultry	P123	4	0.92	0.77	0.77	0.00	0.00	N/A	N/A	0.00	



**Table E-1.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Non-Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Mixed	M2	Direct	2	1.00	1.00	1.00	1.00	N/A	0.95	0.66
Mixed	M2		3	1.00	1.00	1.00	0.59	N/A	0.95	0.25
Mixed	M2		4	1.00	1.00	1.00	0.04	N/A	0.95	0.03
Mixed	M2	Indirect	1	1.00	0.50	0.50	N/A	N/A	N/A	0.50
Mixed	M2		2	1.00	0.50	0.50	0.00	N/A	N/A	0.00
Mixed	M2		3	1.00	0.50	0.50	0.00	N/A	N/A	0.00
Mixed	M2		4	1.00	0.50	0.50	0.00	N/A	N/A	0.00
Meat and/or Poultry	Render	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Meat and/or Poultry	Render		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat and/or Poultry	Render		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat and/or Poultry	Render	Indirect	1	0.91	0.91	0.82	N/A	N/A	N/A	0.36
Meat and/or Poultry	Render		2	0.91	0.91	0.82	0.45	N/A	N/A	0.45
Meat and/or Poultry	Render		3	0.91	0.91	0.82	0.00	N/A	N/A	0.00
Meat and/or Poultry	Render		4	0.91	0.91	0.82	0.00	N/A	N/A	0.00

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown

N/A: Not applicable

Note 1: lagoon for direct dischargers and equalization for indirect dischargers.

Note 2: N= nitrification; N+DN = nitrification and denitrification; N+DN+DP = nitrification and denitrification and phosphorus removal.

Note 3: Fraction of facilities that need performance cost.

**Table E-2.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Small Facilities

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Meat	R1	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Meat	R2		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60
Meat	R12		2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Meat	R13		2	1.00	1.00	1.00	1.00	N/A	0.93	0.79
Meat	R23		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60
Meat	R123		2	1.00	1.00	1.00	1.00	N/A	0.98	0.60
Meat	R1		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat	R2		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38
Meat	R12		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat	R13		3	1.00	1.00	1.00	0.14	N/A	0.93	0.14
Meat	R23		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38
Meat	R123		3	1.00	1.00	1.00	0.98	N/A	0.98	0.38
Meat	R1		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat	R2		4	1.00	1.00	1.00	0.00	N/A	0.98	0.00
Meat	R12	4	1.00	1.00	1.00	0.00	N/A	1.00	0.00	
Meat	R13	4	1.00	1.00	1.00	0.00	N/A	0.93	0.00	
Meat	R23	4	1.00	1.00	1.00	0.00	N/A	0.98	0.00	
Meat	R123	4	1.00	1.00	1.00	0.00	N/A	0.98	0.00	
Meat	R1	Indirect	1	0.75	0.50	0.50	N/A	N/A	N/A	0.25
Meat	R2		1	0.35	0.19	0.16	N/A	N/A	N/A	0.10
Meat	R12		1	0.67	0.33	0.33	N/A	N/A	N/A	0.00
Meat	R13		1	1.00	1.00	1.00	N/A	N/A	N/A	0.00
Meat	R23		1	0.91	0.71	0.42	N/A	N/A	N/A	0.21
Meat	R123		1	1.00	1.00	0.50	N/A	N/A	N/A	0.00
Meat	R1		2	0.75	0.50	0.50	0.00	N/A	N/A	0.00
Meat	R2		2	0.35	0.19	0.16	0.03	N/A	N/A	0.03
Meat	R12		2	0.67	0.33	0.33	0.00	N/A	N/A	0.00
Meat	R13		2	1.00	1.00	1.00	1.00	N/A	N/A	1.00
Meat	R23		2	0.91	0.71	0.42	0.14	N/A	N/A	0.04
Meat	R123		2	1.00	1.00	0.50	0.50	N/A	N/A	0.00
Meat	R1		3	0.75	0.50	0.50	0.00	N/A	N/A	0.00
Meat	R2		3	0.35	0.19	0.16	0.00	N/A	N/A	0.00
Meat	R12	3	0.67	0.33	0.33	0.00	N/A	N/A	0.00	

**Table E-2.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Meat	R13		3	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Meat	R23		3	0.91	0.71	0.42	0.10	N/A	N/A	0.10
Meat	R123		3	1.00	1.00	0.50	0.50	N/A	N/A	0.50
Meat	R1		4	0.75	0.50	0.50	0.00	N/A	N/A	0.00
Meat	R2		4	0.35	0.19	0.16	0.00	N/A	N/A	0.00
Meat	R12		4	0.67	0.33	0.33	0.00	N/A	N/A	0.00
Meat	R13		4	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Meat	R23		4	0.91	0.71	0.42	0.00	N/A	N/A	0.00
Meat	R123		4	1.00	1.00	0.50	0.00	N/A	N/A	0.00
Poultry	P1	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Poultry	P2		2	1.00	1.00	1.00	1.00	N/A	0.91	0.71
Poultry	P12		2	1.00	1.00	1.00	1.00	N/A	0.75	0.50
Poultry	P13		2	1.00	1.00	1.00	1.00	N/A	0.00	0.00
Poultry	P23		2	1.00	1.00	1.00	1.00	N/A	0.91	0.71
Poultry	P123		2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Poultry	P1		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Poultry	P2		3	1.00	1.00	1.00	0.20	N/A	0.91	0.13
Poultry	P12		3	1.00	1.00	1.00	0.25	N/A	0.75	0.25
Poultry	P13		3	1.00	1.00	1.00	0.00	N/A	0.00	0.00
Poultry	P23		3	1.00	1.00	1.00	0.20	N/A	0.91	0.13
Poultry	P123		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Poultry	P1		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Poultry	P2		4	1.00	1.00	1.00	0.07	N/A	0.91	0.06
Poultry	P12		4	1.00	1.00	1.00	0.00	N/A	0.75	0.00
Poultry	P13		4	1.00	1.00	1.00	0.00	N/A	0.00	0.00
Poultry	P23		4	1.00	1.00	1.00	0.07	N/A	0.91	0.06
Poultry	P123		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Poultry	P1		5	1.00	1.00	1.00	0.00	0.00	1.00	0.00
Poultry	P2		5	1.00	1.00	1.00	0.07	0.10	0.91	0.02
Poultry	P12		5	1.00	1.00	1.00	0.00	0.00	0.75	0.00
Poultry	P13		5	1.00	1.00	1.00	0.00	0.00	0.00	0.00
Poultry	P23		5	1.00	1.00	1.00	0.07	0.10	0.91	0.02

**Table E-2.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Poultry	P123		5	1.00	1.00	1.00	0.00	0.00	1.00	0.00
Poultry	P1	Indirect	1	0.00	0.00	0.00	N/A	N/A	N/A	0.00
Poultry	P2		1	0.33	0.00	0.00	N/A	N/A	N/A	0.00
Poultry	P12		1	1.00	1.00	1.00	N/A	N/A	N/A	0.60
Poultry	P13		1	1.00	1.00	1.00	N/A	N/A	N/A	1.00
Poultry	P23		1	0.92	0.77	0.77	N/A	N/A	N/A	0.62
Poultry	P123		1	0.92	0.77	0.77	N/A	N/A	N/A	0.62
Poultry	P1		2	0.00	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P2		2	0.33	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P12		2	1.00	1.00	1.00	0.40	N/A	N/A	0.40
Poultry	P13		2	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Poultry	P23		2	0.92	0.77	0.77	0.12	N/A	N/A	0.12
Poultry	P123		2	0.92	0.77	0.77	0.12	N/A	N/A	0.12
Poultry	P1		3	0.00	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P2		3	0.33	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P12		3	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Poultry	P13		3	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Poultry	P23		3	0.92	0.77	0.77	0.00	N/A	N/A	0.00
Poultry	P123		3	0.92	0.77	0.77	0.00	N/A	N/A	0.00
Poultry	P1		4	0.00	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P2		4	0.33	0.00	0.00	0.00	N/A	N/A	0.00
Poultry	P12		4	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Poultry	P13		4	1.00	1.00	1.00	0.00	N/A	N/A	0.00
Poultry	P23		4	0.92	0.77	0.77	0.00	N/A	N/A	0.00
Poultry	P123		4	0.92	0.77	0.77	0.00	N/A	N/A	0.00
Mixed	M2	Direct	2	1.00	1.00	1.00	1.00	N/A	0.95	0.66
Mixed	M2		3	1.00	1.00	1.00	0.59	N/A	0.95	0.25
Mixed	M2		4	1.00	1.00	1.00	0.04	N/A	0.95	0.03
Mixed	M2	Indirect	1	0.25	0.25	0.00	N/A	N/A	N/A	0.00
Mixed	M23		1	0.92	0.74	0.60	N/A	N/A	N/A	0.42
Mixed	M2		2	0.25	0.25	0.00	0.00	N/A	N/A	0.00
Mixed	M23		2	0.92	0.74	0.60	0.13	N/A	N/A	0.08

**Table E-2.** Frequency of Occurrence of Treatment Units and Performance Factors by Model Facility Category for Small Facilities (continued)

Meat Type	Model Facility Grouping Code	Discharge Type	Technology Option	Screen	DAF	Lagoon or Equalization <sup>1</sup>	N or N+DN or N+DN+DP <sup>2</sup>	Filter	Disinfection	Performance Factor <sup>3</sup>
Mixed	M2		3	0.25	0.25	0.00	0.00	N/A	N/A	0.00
Mixed	M23		3	0.92	0.74	0.60	0.05	N/A	N/A	0.05
Mixed	M2		4	0.25	0.25	0.00	0.00	N/A	N/A	0.00
Mixed	M23		4	0.92	0.74	0.60	0.00	N/A	N/A	0.00
Meat and/or Poultry	Render	Direct	2	1.00	1.00	1.00	1.00	N/A	1.00	1.00
Meat and/or Poultry	Render		3	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat and/or Poultry	Render		4	1.00	1.00	1.00	0.00	N/A	1.00	0.00
Meat and/or Poultry	Render	Indirect	1	1.00	1.00	0.00	N/A	N/A	N/A	0.00
Meat and/or Poultry	Render		2	1.00	1.00	0.00	0.00	N/A	N/A	0.00
Meat and/or Poultry	Render		3	1.00	1.00	0.00	0.00	N/A	N/A	0.00
Meat and/or Poultry	Render		4	1.00	1.00	0.00	0.00	N/A	N/A	0.00

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown

Note 1: lagoon for direct dischargers and equalization for indirect dischargers.

Note 2: N= nitrification; N+DN = nitrification and denitrification; N+DN+DP = nitrification and denitrification and phosphorus removal.

Note 3: Fraction of facilities that need performance cost.

### ATTACHMENT 11-3. MPP COST MODEL RESULTS

**Table E-3.** Incremental Capital, Retrofit, and Annual Costs by Model Facility Category for the Technology Options for Non-Small Direct Discharging Facilities

Meat Type	Model Facility Grouping Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)	Retrofit Capital Cost (1999 dollars)
Meat	R1	2	medium	\$0	\$0	
Meat	R1	3	medium	\$0	\$68,389	\$0
Meat	R1	4	medium	\$4,805,019	\$600,155	\$0
Meat	R2	2	medium	\$40,801	\$83,974	
Meat	R2	3	medium	\$219,589	\$73,742	\$98,815
Meat	R2	4	medium	\$11,298,280	\$1,190,031	\$142,733
Meat	R12	2	medium	\$0	\$0	
Meat	R12	3	medium	\$0	\$0	\$0
Meat	R12	4	medium	\$0	\$0	\$0
Meat	R13	2	medium	\$1,318,515	\$1,048,562	
Meat	R13	3	medium	\$62,407,672	\$6,029,242	\$28,083,452
Meat	R13	4	medium	\$77,759,176	\$6,922,657	\$40,564,987
Meat	R23	2	medium	\$86,867	\$195,813	
Meat	R23	3	medium	\$263,930	\$79,640	\$118,769
Meat	R23	4	medium	\$13,428,162	\$1,206,290	\$171,555
Meat	R123	2	medium	\$1,197,050	\$2,418,999	
Meat	R123	3	medium	\$3,044,534	\$856,979	\$1,370,040
Meat	R123	4	medium	\$148,196,608	\$13,012,161	\$1,978,947
Meat	R2	2	large	\$2,441	\$6,111	
Meat	R2	3	large	\$14,440	\$5,772	\$6,498
Meat	R2	4	large	\$728,549	\$94,430	\$9,386
Meat	R13	2	large	\$746,101	\$600,468	
Meat	R13	3	large	\$35,198,172	\$3,352,896	\$15,839,177
Meat	R13	4	large	\$43,338,480	\$3,811,846	\$22,878,812
Meat	R123	2	large	\$796,937	\$1,543,199	
Meat	R123	3	large	\$2,128,235	\$536,065	\$957,706
Meat	R123	4	large	\$101,300,856	\$8,111,398	\$1,383,353
Meat	R2	2	very large	\$2,441	\$5,794	
Meat	R2	3	very large	\$13,383	\$5,469	\$6,022
Meat	R2	4	very large	\$666,963	\$90,322	\$8,699
Meat	R13	2	very large	\$4,188,223	\$2,730,129	
Meat	R13	3	very large	\$171,858,096	\$15,249,847	\$77,336,143
Meat	R13	4	very large	\$191,899,520	\$16,829,802	\$111,707,762
Poultry	P1	2	medium	\$0	\$464,331	
Poultry	P1	3	medium	\$28,211,594	\$2,771,936	\$12,695,217
Poultry	P1	4	medium	\$38,423,532	\$3,388,889	\$18,337,536
Poultry	P1	5	medium	\$43,328,776	\$3,559,653	
Poultry	P2	2	medium	\$109,867	\$157,341	

*Appendix E. Attachments For Cost Estimation (Chapter 11)*

<b>Meat Type</b>	<b>Model Facility Grouping Code</b>	<b>Technology Option</b>	<b>Size</b>	<b>Incremental Capital Cost (1999 dollars)</b>	<b>Incremental Annual Cost (1999 dollars/year)</b>	<b>Retrofit Capital Cost (1999 dollars)</b>
Poultry	P2	3	medium	\$7,961,311	\$971,382	\$3,582,590
Poultry	P2	4	medium	\$11,202,192	\$1,223,752	\$5,174,852
Poultry	P2	5	medium	\$12,980,543	\$1,263,043	
Poultry	P12	2	medium	\$183,111	\$122,294	
Poultry	P12	3	medium	\$7,544,483	\$799,360	\$3,395,017
Poultry	P12	4	medium	\$12,174,484	\$1,142,777	\$4,903,914
Poultry	P12	5	medium	\$14,069,858	\$1,196,707	
Poultry	P13	2	medium	\$94,947	\$201,577	
Poultry	P13	3	medium	\$10,240,157	\$1,023,951	\$4,608,071
Poultry	P13	4	medium	\$13,578,900	\$1,268,555	\$6,656,102
Poultry	P13	5	medium	\$15,686,408	\$1,279,957	
Poultry	P23	2	medium	\$0	\$0	
Poultry	P23	3	medium	\$0	\$0	\$0
Poultry	P23	4	medium	\$0	\$0	\$0
Poultry	P23	5	medium	\$0	\$0	
Poultry	P123	2	medium	\$0	\$109,992	
Poultry	P123	3	medium	\$4,625,987	\$453,697	\$2,081,694
Poultry	P123	4	medium	\$5,060,322	\$465,764	\$3,006,892
Poultry	P123	5	medium	\$5,761,179	\$485,638	
Poultry	P1	2	large	\$0	\$771,560	
Poultry	P1	3	large	\$47,160,432	\$4,578,185	\$21,222,194
Poultry	P1	4	large	\$63,844,072	\$5,556,303	\$30,654,281
Poultry	P1	5	large	\$71,418,344	\$5,831,349	
Poultry	P2	2	large	\$10,987	\$40,757	
Poultry	P2	3	large	\$1,753,193	\$179,738	\$788,937
Poultry	P2	4	large	\$2,533,387	\$222,356	\$1,139,575
Poultry	P2	5	large	\$2,839,889	\$229,323	
Poultry	P12	2	large	\$102,003	\$78,470	
Poultry	P12	3	large	\$4,370,816	\$436,401	\$1,966,867
Poultry	P12	4	large	\$6,925,654	\$591,656	\$2,841,030
Poultry	P12	5	large	\$7,814,065	\$615,822	
Poultry	P13	2	large	\$289,556	\$630,111	
Poultry	P13	3	large	\$29,404,858	\$2,776,481	\$13,232,186
Poultry	P13	4	large	\$37,638,488	\$3,349,248	\$19,113,158
Poultry	P13	5	large	\$41,474,372	\$3,333,904	
Poultry	P23	2	large	\$0	\$0	
Poultry	P23	3	large	\$0	\$0	\$0
Poultry	P23	4	large	\$0	\$0	\$0
Poultry	P23	5	large	\$0	\$0	
Poultry	P123	2	large	\$0	\$683,867	
Poultry	P123	3	large	\$25,802,408	\$2,393,216	\$11,611,084
Poultry	P123	4	large	\$26,355,690	\$2,371,851	\$16,771,565
Poultry	P123	5	large	\$29,505,104	\$2,434,935	

Appendix E. Attachments For Cost Estimation (Chapter 11)

Meat Type	Model Facility Grouping Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)	Retrofit Capital Cost (1999 dollars)
Poultry	P1	2	very large	\$0	\$365,712	
Poultry	P1	3	very large	\$21,789,980	\$2,085,341	\$9,805,491
Poultry	P1	4	very large	\$28,721,632	\$2,487,245	\$14,163,487
Poultry	P1	5	very large	\$31,538,728	\$2,600,235	
Poultry	P2	2	very large	\$21,973	\$22,342	
Poultry	P2	3	very large	\$1,184,120	\$156,858	\$532,854
Poultry	P2	4	very large	\$1,645,928	\$197,467	\$769,678
Poultry	P2	5	very large	\$1,899,125	\$203,594	
Poultry	P12	2	very large	\$733,761	\$498,609	
Poultry	P12	3	very large	\$25,833,008	\$2,568,780	\$11,624,854
Poultry	P12	4	very large	\$41,519,708	\$3,483,518	\$16,791,455
Poultry	P12	5	very large	\$45,849,888	\$3,605,577	
Poultry	P13	2	very large	\$81,529	\$166,489	
Poultry	P13	3	very large	\$7,730,416	\$730,819	\$3,478,687
Poultry	P13	4	very large	\$9,884,025	\$880,307	\$5,024,770
Poultry	P13	5	very large	\$10,860,911	\$876,332	
Poultry	P123	2	very large	\$0	\$225,998	
Poultry	P123	3	very large	\$8,561,975	\$791,649	\$3,852,889
Poultry	P123	4	very large	\$8,713,499	\$782,255	\$5,565,284
Poultry	P123	5	very large	\$9,773,011	\$810,217	
Mixed	M2	2	medium	\$30,519	\$110,204	
Mixed	M2	3	medium	\$3,205,753	\$354,157	\$1,442,589
Mixed	M2	4	medium	\$9,742,008	\$857,795	\$2,083,739
Meat and/or Poultry	Render	2	medium	\$0	\$113,892	
Meat and/or Poultry	Render	3	medium	\$5,529,846	\$721,420	\$2,488,431
Meat and/or Poultry	Render	4	medium	\$6,387,821	\$771,669	\$3,594,400
Meat and/or Poultry	Render	2	large	\$0	\$139,221	
Meat and/or Poultry	Render	3	large	\$6,540,381	\$781,690	\$2,943,171
Meat and/or Poultry	Render	4	large	\$7,439,749	\$824,591	\$4,251,248
Meat and/or Poultry	Render	2	very large	\$0	\$259,104	
Meat and/or Poultry	Render	3	very large	\$12,165,567	\$1,310,686	\$5,474,505
Meat and/or Poultry	Render	4	very large	\$13,560,700	\$1,352,783	\$7,907,619

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown



**Table E-4.** Incremental Capital, Retrofit, and Annual Costs by Model Facility Category for the Technology Options for Non-Small Indirect Discharging Facilities

Meat Type	Model Facility Grouping Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)	Retrofit Capital Cost (1999 dollars)
Meat	R1	1	medium	\$0	\$0	
Meat	R1	2	medium	\$0	\$0	
Meat	R1	3	medium	\$0	\$0	\$0
Meat	R1	4	medium	\$0	\$0	\$0
Meat	R2	1	medium	\$38,330,452	\$7,709,886	
Meat	R2	2	medium	\$201,309,152	\$25,364,142	
Meat	R2	3	medium	\$199,300,688	\$23,456,988	\$199,300,688
Meat	R2	4	medium	\$281,684,640	\$27,090,436	\$281,684,640
Meat	R12	1	medium	\$7,674,552	\$998,181	
Meat	R12	2	medium	\$109,691,736	\$17,407,204	
Meat	R12	3	medium	\$105,932,768	\$9,853,671	\$91,985,869
Meat	R12	4	medium	\$110,184,632	\$9,662,992	\$99,994,413
Meat	R13	1	medium	\$2,287,932	\$254,753	
Meat	R13	2	medium	\$59,993,712	\$6,771,834	
Meat	R13	3	medium	\$46,611,616	\$4,199,786	\$46,611,616
Meat	R13	4	medium	\$47,687,252	\$4,048,963	\$47,687,252
Meat	R23	1	medium	\$3,588,406	\$417,189	
Meat	R23	2	medium	\$37,076,732	\$5,762,126	
Meat	R23	3	medium	\$30,127,418	\$2,774,500	\$26,398,992
Meat	R23	4	medium	\$34,521,628	\$2,955,317	\$31,268,069
Meat	R123	1	medium	\$8,745,909	\$726,438	
Meat	R123	2	medium	\$109,926,016	\$16,953,628	
Meat	R123	3	medium	\$91,036,424	\$8,076,983	\$45,518,212
Meat	R123	4	medium	\$177,182,640	\$13,376,883	\$100,133,552
Meat	R2	1	large	\$655,045	\$150,901	
Meat	R2	2	large	\$2,912,704	\$429,330	
Meat	R2	3	large	\$3,182,873	\$433,225	\$3,182,873
Meat	R2	4	large	\$3,873,326	\$476,512	\$3,873,326
Meat	R13	1	large	\$1,516,879	\$160,959	
Meat	R13	2	large	\$40,301,924	\$4,170,561	
Meat	R13	3	large	\$27,905,144	\$2,463,362	\$27,905,144
Meat	R13	4	large	\$28,278,274	\$2,360,095	\$28,278,274
Meat	R123	1	large	\$5,758,217	\$440,752	
Meat	R123	2	large	\$93,439,408	\$10,890,032	
Meat	R123	3	large	\$53,024,956	\$4,930,998	\$26,512,478
Meat	R123	4	large	\$103,721,944	\$8,166,034	\$61,672,110
Meat	R2	1	very large	\$613,868	\$141,092	
Meat	R2	2	very large	\$2,613,792	\$401,263	
Meat	R2	3	very large	\$2,917,641	\$412,937	\$2,917,641
Meat	R2	4	very large	\$3,453,399	\$448,325	\$3,453,399

Appendix E. Attachments For Cost Estimation (Chapter 11)

Meat Type	Model Facility Grouping Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)	Retrofit Capital Cost (1999 dollars)
Meat	R13	1	very large	\$6,142,098	\$552,927	
Meat	R13	2	very large	\$211,183,984	\$18,120,936	
Meat	R13	3	very large	\$135,677,312	\$10,966,498	\$135,677,312
Meat	R13	4	very large	\$135,718,432	\$10,381,650	\$135,718,432
Poultry	P1	1	medium	\$9,562,528	\$1,258,507	
Poultry	P1	2	medium	\$115,037,512	\$12,767,587	
Poultry	P1	3	medium	\$100,356,304	\$8,990,328	\$94,740,851
Poultry	P1	4	medium	\$108,674,464	\$9,147,063	\$104,484,585
Poultry	P2	1	medium	\$30,867,114	\$5,828,478	
Poultry	P2	2	medium	\$201,298,528	\$31,688,606	
Poultry	P2	3	medium	\$171,936,096	\$20,252,848	\$171,936,096
Poultry	P2	4	medium	\$231,890,656	\$23,024,832	\$231,890,656
Poultry	P12	1	medium	\$0	\$68,129	
Poultry	P12	2	medium	\$16,303,165	\$2,956,783	
Poultry	P12	3	medium	\$21,677,976	\$2,174,673	\$15,158,803
Poultry	P12	4	medium	\$24,012,522	\$2,243,099	\$17,928,997
Poultry	P13	1	medium	\$0	\$23,373	
Poultry	P13	2	medium	\$7,641,977	\$1,182,946	
Poultry	P13	3	medium	\$5,595,342	\$536,207	\$5,595,342
Poultry	P13	4	medium	\$5,986,901	\$538,194	\$5,986,901
Poultry	P23	1	medium	\$548,934	\$141,398	
Poultry	P23	2	medium	\$8,950,510	\$1,388,507	
Poultry	P23	3	medium	\$8,626,571	\$1,065,967	\$7,945,823
Poultry	P23	4	medium	\$9,794,832	\$1,129,871	\$9,199,445
Poultry	P123	1	medium	\$672,122	\$99,076	
Poultry	P123	2	medium	\$11,549,023	\$1,758,065	
Poultry	P123	3	medium	\$9,664,684	\$905,141	\$8,962,263
Poultry	P123	4	medium	\$10,266,829	\$905,079	\$9,783,186
Poultry	P1	1	large	\$16,734,425	\$2,138,543	
Poultry	P1	2	large	\$200,073,664	\$22,075,687	
Poultry	P1	3	large	\$173,983,472	\$15,252,051	\$164,267,147
Poultry	P1	4	large	\$186,381,744	\$15,435,507	\$179,330,967
Poultry	P2	1	large	\$2,567,397	\$314,432	
Poultry	P2	2	large	\$17,001,328	\$2,707,538	
Poultry	P2	3	large	\$13,121,277	\$1,241,668	\$13,121,277
Poultry	P2	4	large	\$19,517,834	\$1,414,858	\$19,517,834
Poultry	P12	1	large	\$0	\$39,040	
Poultry	P12	2	large	\$12,009,338	\$2,187,666	
Poultry	P12	3	large	\$14,762,752	\$1,387,720	\$10,442,884
Poultry	P12	4	large	\$15,789,361	\$1,391,181	\$12,067,634
Poultry	P13	1	large	\$0	\$47,540	
Poultry	P13	2	large	\$25,428,288	\$3,478,462	
Poultry	P13	3	large	\$15,341,535	\$1,376,323	\$15,341,535

*Appendix E. Attachments For Cost Estimation (Chapter 11)*

<b>Meat Type</b>	<b>Model Facility Grouping Code</b>	<b>Technology Option</b>	<b>Size</b>	<b>Incremental Capital Cost (1999 dollars)</b>	<b>Incremental Annual Cost (1999 dollars/year)</b>	<b>Retrofit Capital Cost (1999 dollars)</b>
Poultry	P13	4	large	\$15,772,579	\$1,329,077	\$15,772,579
Poultry	P23	1	large	\$2,091,418	\$262,429	
Poultry	P23	2	large	\$36,721,092	\$5,542,879	
Poultry	P23	3	large	\$29,499,260	\$2,685,068	\$27,413,504
Poultry	P23	4	large	\$30,831,876	\$2,636,290	\$29,511,578
Poultry	P123	1	large	\$6,452,889	\$659,240	
Poultry	P123	2	large	\$164,122,080	\$17,931,432	
Poultry	P123	3	large	\$101,593,832	\$8,207,464	\$95,901,807
Poultry	P123	4	large	\$102,261,784	\$7,864,861	\$100,625,481
Poultry	P1	1	very large	\$7,150,359	\$833,098	
Poultry	P1	2	very large	\$91,395,024	\$9,882,312	
Poultry	P1	3	very large	\$77,402,288	\$6,579,022	\$73,150,514
Poultry	P1	4	very large	\$81,054,640	\$6,495,908	\$78,201,521
Poultry	P2	1	very large	\$2,999,867	\$627,089	
Poultry	P2	2	very large	\$18,458,508	\$2,853,309	
Poultry	P2	3	very large	\$16,864,996	\$2,120,529	\$16,864,996
Poultry	P2	4	very large	\$20,471,944	\$2,335,519	\$20,471,944
Poultry	P12	1	very large	\$0	\$181,679	
Poultry	P12	2	very large	\$67,846,544	\$12,363,762	
Poultry	P12	3	very large	\$79,723,664	\$7,376,269	\$56,789,942
Poultry	P12	4	very large	\$83,178,600	\$7,263,729	\$64,562,014
Poultry	P13	1	very large	\$0	\$24,355	
Poultry	P13	2	very large	\$13,342,282	\$1,838,376	
Poultry	P13	3	very large	\$8,127,148	\$726,480	\$8,127,148
Poultry	P13	4	very large	\$8,339,379	\$700,884	\$8,339,379
Poultry	P123	1	very large	\$1,835,588	\$187,821	
Poultry	P123	2	very large	\$46,649,320	\$5,072,465	
Poultry	P123	3	very large	\$28,844,226	\$2,326,795	\$27,230,232
Poultry	P123	4	very large	\$29,002,166	\$2,228,601	\$28,544,782
Mixed	M2	1	medium	\$30,400,918	\$4,048,072	
Mixed	M2	2	medium	\$237,813,392	\$35,260,908	
Mixed	M2	3	medium	\$204,321,312	\$20,264,530	\$204,321,312
Mixed	M2	4	medium	\$337,282,624	\$24,807,622	\$337,282,624
Meat and/or Poultry	Render	1	medium	\$820,897	\$250,175	
Meat and/or Poultry	Render	2	medium	\$16,379,139	\$2,714,552	
Meat and/or Poultry	Render	3	medium	\$24,948,242	\$3,170,180	\$16,153,835
Meat and/or Poultry	Render	4	medium	\$27,943,370	\$3,303,252	\$19,348,984
Meat and/or Poultry	Render	1	large	\$904,249	\$239,983	

*Appendix E. Attachments For Cost Estimation (Chapter 11)*

<b>Meat Type</b>	<b>Model Facility Grouping Code</b>	<b>Technology Option</b>	<b>Size</b>	<b>Incremental Capital Cost (1999 dollars)</b>	<b>Incremental Annual Cost (1999 dollars/year)</b>	<b>Retrofit Capital Cost (1999 dollars)</b>
Meat and/or Poultry	Render	2	large	\$21,609,332	\$3,370,251	
Meat and/or Poultry	Render	3	large	\$31,996,360	\$3,541,991	\$20,806,984
Meat and/or Poultry	Render	4	large	\$34,866,372	\$3,604,617	\$24,427,572
Meat and/or Poultry	Render	1	very large	\$1,772,274	\$371,875	
Meat and/or Poultry	Render	2	very large	\$44,720,368	\$6,718,449	
Meat and/or Poultry	Render	3	very large	\$64,101,940	\$6,345,284	\$41,897,042
Meat and/or Poultry	Render	4	very large	\$68,115,184	\$6,316,723	\$48,330,401

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown

**Table E-5.** Incremental Capital and Annual Costs by Model Facility Category for the Technology Options of Small Direct Discharging Facilities

Meat Type	Model Facility Category Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)
Meat	R1	1	small	0	\$0
Meat	R1	2	small	\$0	\$178,736
Meat	R1	3	small	\$7,299,355	\$1,413,095
Meat	R2	1	small	\$104,984	\$3,486
Meat	R2	2	small	\$104,984	\$235,812
Meat	R2	3	small	\$469,743	\$228,987
Meat	R12	1	small	\$0	\$0
Meat	R12	2	small	\$0	\$0
Meat	R12	3	small	\$0	\$0
Meat	R13	1	small	\$148,233	\$4,969
Meat	R13	2	small	\$148,233	\$146,722
Meat	R13	3	small	\$7,057,751	\$1,207,726
Meat	R23	1	small	\$0	\$0
Meat	R23	2	small	\$0	\$0
Meat	R23	3	small	\$0	\$0
Meat	R123	1	small	\$61,037	\$2,033
Meat	R123	2	small	\$61,037	\$161,208
Meat	R123	3	small	\$289,539	\$131,410
Mixed	M2	1	small	\$54,933	\$1,799
Mixed	M2	2	small	\$54,933	\$64,252
Mixed	M2	3	small	\$1,665,124	\$326,958
Meat and/or Poultry	Render	1	small	\$0	\$0
Meat and/or Poultry	Render	2	small	\$0	\$172,632
Meat and/or Poultry	Render	3	small	\$8,192,232	\$909,610

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown

**Table E-6.** Incremental Capital and Annual Costs by Model Facility Category for the Technology Options of Small Indirect Discharging Facilities

Meat Type	Model Facility Grouping Code	Technology Option	Size	Incremental Capital Cost (1999 dollars)	Incremental Annual Cost (1999 dollars/year)
Readmeat	R1	1	small	\$26,895,344	\$3,873,826
Readmeat	R1	2	small	\$151,499,760	\$26,848,712
Readmeat	R1	3	small	\$152,128,864	\$23,960,492
Readmeat	R1	4	small	\$183,388,576	\$25,021,890
Readmeat	R2	1	small	\$412,294,080	\$58,444,990
Readmeat	R2	2	small	\$1,276,559,616	\$223,432,938
Readmeat	R2	3	small	\$1,578,774,784	\$238,175,152
Readmeat	R2	4	small	\$1,867,879,936	\$250,308,432
Readmeat	R12	1	small	\$91,858,632	\$12,875,693
Readmeat	R12	2	small	\$419,484,096	\$71,069,328
Readmeat	R12	3	small	\$420,050,720	\$62,482,176
Readmeat	R12	4	small	\$498,965,536	\$65,781,584
Readmeat	R13	1	small	\$0	\$0
Readmeat	R13	2	small	\$0	\$135,533
Readmeat	R13	3	small	\$6,334,605	\$988,796
Readmeat	R13	4	small	\$7,825,042	\$1,049,669
Readmeat	R23	1	small	\$2,221,331	\$418,784
Readmeat	R23	2	small	\$14,641,294	\$3,224,597
Readmeat	R23	3	small	\$15,218,554	\$3,073,139
Readmeat	R23	4	small	\$20,195,592	\$3,475,733
Readmeat	R123	1	small	\$1,073,496	\$594,234
Readmeat	R123	2	small	\$13,651,828	\$2,666,926
Readmeat	R123	3	small	\$13,717,060	\$2,593,285
Readmeat	R123	4	small	\$32,517,392	\$4,636,849
Poultry	P1	1	small	\$4,546,294	\$902,655
Poultry	P1	2	small	\$16,988,052	\$2,405,367
Poultry	P1	3	small	\$17,149,222	\$2,127,847
Poultry	P1	4	small	\$20,165,204	\$2,257,294
Poultry	P2	1	small	\$55,658,488	\$8,136,523
Poultry	P2	2	small	\$187,852,080	\$29,771,220
Poultry	P2	3	small	\$188,329,104	\$26,325,620
Poultry	P2	4	small	\$221,011,072	\$27,650,150
Poultry	P12	1	small	\$0	\$33,878
Poultry	P12	2	small	\$5,595,467	\$1,236,450
Poultry	P12	3	small	\$9,371,482	\$1,693,577
Poultry	P12	4	small	\$11,700,697	\$1,774,729
Poultry	P13	1	small	\$0	\$0
Poultry	P13	2	small	\$0	\$0
Poultry	P13	3	small	\$0	\$0
Poultry	P13	4	small	\$0	\$0
Poultry	P23	1	small	\$193,859	\$40,837

*Appendix E. Attachments For Cost Estimation (Chapter 11)*

<b>Meat Type</b>	<b>Model Facility Grouping Code</b>	<b>Technology Option</b>	<b>Size</b>	<b>Incremental Capital Cost (1999 dollars)</b>	<b>Incremental Annual Cost (1999 dollars/year)</b>
Poultry	P23	2	small	\$2,167,089	\$366,679
Poultry	P23	3	small	\$2,417,926	\$343,616
Poultry	P23	4	small	\$2,943,681	\$364,323
Mixed	P2	1	small	\$115,647,168	\$19,957,532
Mixed	P2	2	small	\$452,671,584	\$76,483,208
Mixed	P2	3	small	\$454,453,536	\$68,212,416
Mixed	P2	4	small	\$538,625,664	\$71,655,976
Mixed	P23	1	small	\$242,585	\$53,873
Mixed	P23	2	small	\$2,105,501	\$358,133
Mixed	P23	3	small	\$2,120,554	\$333,495
Mixed	P23	4	small	\$2,620,976	\$375,810
Meat and/or Poultry	Render	1	small	\$2,796,848	\$513,318
Meat and/or Poultry	Render	2	small	\$43,635,312	\$6,030,492
Meat and/or Poultry	Render	3	small	\$36,320,992	\$3,752,576
Meat and/or Poultry	Render	4	small	\$39,443,676	\$3,717,570

Note: Model facility grouping for which EPA Screener Survey did not identify any facilities are not shown