

# Appendix A: Livestock Emissions

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**Appendix Table A-1 Population of Animals by State in 2005**

State	Beef Cattle	Dairy Cattle	Swine	Sheep	Goat	Horse	Poultry
	<i>Head</i>						
Alabama	1,488,231	24,645	180,000	9,000	50,574	95,250	205,538,724
Alaska	12,839	1,675	1,700	9,000	277	2,795	948,000
Arizona	728,823	190,158	136,000	114,000	35,374	68,159	948,000
Arkansas	2,028,200	37,494	325,000	9,000	32,580	105,115	258,289,270
California	3,178,735	2,392,859	140,000	680,000	103,122	191,901	48,152,594
Colorado	2,188,237	140,706	740,000	360,000	18,561	155,746	5,761,302
Connecticut	27,134	30,963	4,200	7,167	2,586	13,815	3,618,498
Delaware	15,557	10,659	15,000	9,000	1,521	5,022	45,481,936
Florida	1,720,948	177,992	20,000	9,000	39,964	145,304	27,359,730
Georgia	1,281,592	108,691	275,000	9,000	69,498	107,632	265,515,640
Hawaii	162,904	7,900	22,000	9,000	5,364	6,664	597,996
Idaho	1,470,310	582,838	21,000	260,000	11,520	121,033	1,247,005
Illinois	1,220,447	157,347	3,962,500	63,000	17,192	86,750	24,664,590
Indiana	693,035	195,211	3,175,000	50,000	27,801	143,098	53,551,586
Iowa	3,232,628	286,151	16,050,000	250,000	18,898	112,163	79,080,596
Kansas	6,467,615	185,885	1,737,500	100,000	24,763	98,063	1,718,300
Kentucky	2,365,975	149,975	350,000	26,000	68,412	217,372	59,830,731
Louisiana	865,129	50,502	16,000	9,000	14,633	69,500	2,573,997
Maine	45,549	51,554	5,000	7,167	3,162	18,525	4,250,995
Maryland	144,092	105,478	26,000	25,000	9,601	37,740	56,611,457
Massachusetts	24,979	26,541	12,000	7,167	6,022	22,539	327,995
Michigan	668,630	423,384	930,000	83,000	21,094	152,631	29,682,591
Minnesota	1,818,803	730,645	6,550,000	140,000	19,768	134,919	36,833,186
Mississippi	1,074,181	40,390	315,000	9,000	26,738	97,170	161,657,090
Missouri	4,522,610	181,939	2,912,500	60,000	48,654	205,588	34,730,594
Montana	2,351,195	25,593	165,000	300,000	8,613	137,283	480,000
Nebraska	5,993,940	80,991	2,850,000	102,000	11,718	85,701	15,524,115
Nevada	504,961	34,493	5,500	75,000	6,506	23,448	948,000
New Hampshire	18,145	23,591	3,600	7,167	3,774	11,527	252,198
New Jersey	30,957	17,694	11,000	9,000	8,312	39,116	2,095,098
New Mexico	1,186,612	396,272	2,500	160,000	19,128	67,897	948,000
New York	567,912	942,712	84,000	70,000	33,130	109,468	6,144,725
North Carolina	891,708	83,624	10,050,000	20,000	67,276	93,351	160,365,455
North Dakota	1,697,117	46,288	169,000	100,000	2,523	63,140	1,248,000
Ohio	941,581	367,144	1,487,500	140,000	45,061	195,416	45,333,636
Oklahoma	5,274,643	99,002	2,412,500	75,000	82,792	218,357	50,537,573
Oregon	1,304,208	183,411	27,000	215,000	30,628	134,415	23,286,889
Pennsylvania	939,772	829,702	1,045,000	90,000	39,932	164,922	55,804,732
Rhode Island	3,810	1,964	2,000	7,167	468	2,843	948,000
South Carolina	450,832	23,644	300,000	9,000	41,192	59,226	47,824,820
South Dakota	3,571,022	112,218	1,257,500	370,000	7,021	101,175	5,073,004
Tennessee	2,331,568	110,217	215,000	22,000	114,664	216,191	38,018,180
Texas	14,227,217	421,439	955,000	1,100,000	1,194,289	541,508	138,184,844
Utah	765,189	126,962	690,000	265,000	9,092	89,250	4,647,302
Vermont	93,688	209,585	2,000	7,167	4,133	16,351	240,603
Virginia	1,549,754	141,076	375,000	55,000	41,275	118,301	58,634,184
Washington	818,636	330,177	26,000	46,000	23,217	110,458	24,779,588
West Virginia	385,280	17,799	10,000	34,000	17,484	46,325	18,932,092
Wisconsin	1,697,521	1,880,727	440,000	83,000	35,179	148,336	13,395,760
Wyoming	1,404,635	6,845	114,000	430,000	5,380	91,501	17,000
<b>Total</b>	<b>86,449,086</b>	<b>12,804,752</b>	<b>60,620,500</b>	<b>6,105,000</b>	<b>2,530,466</b>	<b>5,300,000</b>	<b>2,122,636,203</b>

Source: EPA 2007

**Appendix Table A-2 U.S. Livestock Population, 1990-2005**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Animal Type	<i>1,000,000 head</i>															
<b>Dairy Cattle</b>	<b>2</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>	<b>13</b>
Dairy Cows	10	10	10	10	10	9	9	9	9	9	9	9	9	9	9	9
Dairy Heifers	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<b>Swine</b>	<b>54</b>	<b>56</b>	<b>59</b>	<b>58</b>	<b>60</b>	<b>59</b>	<b>56</b>	<b>59</b>	<b>62</b>	<b>60</b>	<b>59</b>	<b>59</b>	<b>60</b>	<b>60</b>	<b>61</b>	<b>61</b>
Market																
<60 lbs.	18	19	20	19	20	20	19	20	21	20	20	20	20	20	20	20
Market																
60-119 lbs.	12	12	13	13	13	13	12	13	14	13	13	13	13	13	13	14
Market																
120-179 lbs.	10	10	10	10	11	11	10	10	11	11	11	11	11	11	11	11
Market																
>180 lbs.	8	8	8	8	9	9	8	9	10	10	9	9	10	10	10	10
Breeding																
Swine	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	6
<b>Beef cattle</b>	<b>86</b>	<b>87</b>	<b>89</b>	<b>90</b>	<b>93</b>	<b>94</b>	<b>94</b>	<b>92</b>	<b>91</b>	<b>90</b>	<b>89</b>	<b>89</b>	<b>88</b>	<b>87</b>	<b>86</b>	<b>87</b>
Feedlot																
Steers	7	8	8	8	8	8	7	8	8	8	8	9	8	8	8	8
Feedlot																
Heifers	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
Bulls NOF <sup>1</sup>	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Calves NOF	24	24	24	24	25	25	25	24	24	24	24	23	23	22	22	22
Heifers NOF	9	9	10	10	10	11	11	10	10	10	9	9	9	9	9	9
Steers NOF	7	7	8	8	8	9	9	8	8	8	7	7	7	7	7	7
Cows NOF	33	33	33	34	35	36	36	35	34	34	34	34	33	33	33	33
<b>Sheep</b>	<b>11</b>	<b>11</b>	<b>11</b>	<b>10</b>	<b>10</b>	<b>9</b>	<b>8</b>	<b>8</b>	<b>8</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>6</b>	<b>6</b>	<b>6</b>
<b>Goats</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Poultry</b>	<b>1,537</b>	<b>1,595</b>	<b>1,650</b>	<b>1,707</b>	<b>1,769</b>	<b>1,827</b>	<b>1,882</b>	<b>1,927</b>	<b>1,965</b>	<b>2,009</b>	<b>2,033</b>	<b>2,060</b>	<b>2,098</b>	<b>2,085</b>	<b>2,131</b>	<b>2,151</b>
Hens >1 yr.	273	280	285	291	299	299	304	312	322	330	334	340	340	341	344	348
Pullets	73	77	80	82	80	81	82	90	96	98	95	96	95	100	101	97
Chickens	7	7	7	7	7	8	7	8	8	10	8	8	8	8	8	8
Broilers	1,066	1,116	1,164	1,217	1,276	1,332	1,381	1,412	1,443	1,481	1,506	1,525	1,562	1,544	1,589	1,613
Turkeys	118	116	114	111	107	107	108	105	97	90	90	91	92	91	88	85
<b>Horses</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>

Source: EPA 2007

Note: Totals may not sum due to independent rounding.

<sup>1</sup>(NOF) Not on feed.

**Appendix Table A-3 State-Level Methane Emissions from Enteric Fermentation in 1990-2005**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2004	2005
	<i>Tg CO<sub>2</sub> eq.</i>													
Alabama	1.79	1.74	1.77	1.78	1.84	1.94	1.91	1.74	1.70	1.64	1.62	1.51	1.58	1.50
Alaska	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.02
Arizona	1.10	1.10	1.15	1.14	1.14	1.12	1.11	1.07	1.11	1.11	1.08	1.08	1.09	1.14
Arkansas	2.05	1.95	1.97	1.95	2.12	2.24	2.17	2.15	2.06	2.05	2.07	2.07	2.17	2.07
California	6.61	6.42	6.51	6.17	6.44	6.50	6.06	6.21	6.20	6.50	6.59	6.72	7.53	7.80
Colorado	3.15	2.99	3.26	3.18	3.20	3.22	3.25	3.30	3.32	3.26	3.18	3.12	2.41	2.49
Connecticut	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.10	0.09	0.09
Delaware	0.04	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Florida	2.52	2.53	2.54	2.52	2.59	2.64	2.50	2.45	2.34	2.28	2.29	2.26	2.30	2.23
Georgia	1.64	1.66	1.67	1.65	1.69	1.72	1.65	1.60	1.50	1.47	1.48	1.44	1.55	1.49
Hawaii	0.25	0.27	0.24	0.23	0.22	0.23	0.22	0.23	0.24	0.23	0.22	0.20	0.19	0.18
Idaho	2.26	2.30	2.38	2.33	2.37	2.51	2.52	2.56	2.63	2.67	2.77	2.83	2.64	2.69
Illinois	2.12	2.09	2.14	2.14	2.08	2.00	1.87	1.82	1.80	1.82	1.80	1.74	1.59	1.64
Indiana	1.50	1.44	1.42	1.37	1.42	1.42	1.34	1.34	1.27	1.28	1.23	1.16	1.18	1.21
Iowa	5.05	4.95	5.01	4.79	4.67	4.75	4.43	4.32	4.21	4.34	4.27	4.15	4.05	4.13
Kansas	5.70	5.56	5.55	5.62	5.70	6.01	5.95	5.94	5.82	5.97	5.94	5.98	5.81	5.75
Kentucky	2.89	2.94	3.01	2.97	2.99	3.03	3.00	2.90	2.80	2.69	2.52	2.57	2.82	2.70
Louisiana	1.34	1.28	1.21	1.24	1.20	1.22	1.20	1.19	1.17	1.14	1.14	1.10	1.10	1.07
Maine	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.14	0.14
Maryland	0.47	0.47	0.45	0.46	0.45	0.45	0.42	0.39	0.38	0.38	0.37	0.35	0.36	0.36
Massachusetts	0.13	0.12	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.10	0.10	0.08	0.08	0.08
Michigan	1.52	1.47	1.49	1.50	1.52	1.52	1.46	1.41	1.37	1.37	1.34	1.31	1.43	1.46
Minnesota	3.37	3.42	3.44	3.45	3.25	3.38	3.34	3.30	3.18	3.15	3.20	3.16	3.01	3.02
Mississippi	1.51	1.50	1.52	1.57	1.56	1.51	1.53	1.43	1.36	1.31	1.24	1.25	1.24	1.25
Missouri	5.08	5.10	5.14	5.24	5.46	5.42	5.39	5.32	5.11	5.10	4.98	4.94	5.06	4.99
Montana	3.11	3.25	3.49	3.44	3.43	3.63	3.60	3.56	3.49	3.49	3.53	3.48	3.07	2.93
Nebraska	5.74	5.84	5.91	5.82	6.10	6.21	6.43	6.49	6.62	6.69	6.58	6.39	5.90	5.99
Nevada	0.69	0.69	0.72	0.70	0.69	0.71	0.68	0.71	0.70	0.70	0.72	0.73	0.62	0.60
New Hampshire	0.07	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.08	0.07	0.07	0.07
New Jersey	0.13	0.13	0.13	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08
New Mexico	1.91	1.88	1.92	1.99	2.03	2.12	2.22	2.24	2.30	2.33	2.35	2.35	2.15	2.10
New York	2.49	2.50	2.54	2.43	2.40	2.37	2.27	2.29	2.32	2.34	2.35	2.26	2.35	2.35
North Carolina	1.15	1.22	1.29	1.31	1.39	1.49	1.53	1.52	1.39	1.40	1.38	1.39	1.38	1.34
North Dakota	2.19	2.25	2.28	2.34	2.46	2.53	2.42	2.41	2.29	2.39	2.40	2.55	2.12	2.07
Ohio	1.96	1.95	1.92	1.81	1.78	1.79	1.79	1.70	1.67	1.60	1.59	1.59	1.67	1.75
Oklahoma	5.49	5.53	5.59	5.50	5.40	5.83	5.70	5.57	5.63	5.49	5.48	5.40	5.37	5.48
Oregon	2.02	2.02	2.01	1.99	2.11	2.21	2.24	2.22	2.17	2.15	2.11	2.01	1.78	1.80
Pennsylvania	2.67	2.66	2.74	2.60	2.53	2.53	2.45	2.43	2.42	2.40	2.39	2.37	2.40	2.43
Rhode Island	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
South Carolina	0.67	0.59	0.62	0.63	0.61	0.61	0.61	0.59	0.56	0.56	0.55	0.53	0.54	0.53
South Dakota	4.20	4.18	4.35	4.62	4.49	4.80	4.59	4.47	4.32	4.52	4.62	4.91	4.21	4.20
Tennessee	2.61	2.59	2.59	2.58	2.72	2.80	2.76	2.56	2.48	2.38	2.35	2.39	2.61	2.50
Texas	14.78	14.53	15.27	15.53	16.22	16.47	16.11	15.16	15.12	15.03	14.59	14.33	14.80	14.39
Utah	1.23	1.24	1.23	1.30	1.30	1.34	1.36	1.39	1.39	1.35	1.40	1.42	1.15	1.13
Vermont	0.52	0.51	0.51	0.51	0.49	0.50	0.48	0.48	0.50	0.51	0.50	0.49	0.49	0.49
Virginia	1.97	1.98	2.00	1.94	1.93	1.96	1.95	1.95	1.86	1.84	1.76	1.81	1.86	1.90
Washington	1.96	1.99	1.98	2.00	2.02	1.94	1.85	1.79	1.76	1.73	1.77	1.70	1.51	1.43
West Virginia	0.57	0.59	0.60	0.59	0.58	0.59	0.57	0.53	0.52	0.51	0.49	0.47	0.47	0.48
Wisconsin	5.64	5.59	5.51	5.36	5.13	5.11	4.98	4.88	4.85	4.79	4.83	4.77	4.83	4.89
Wyoming	1.66	1.66	1.78	1.86	2.00	1.95	1.94	2.09	2.13	2.01	2.03	1.98	1.71	1.66
<b>Total</b>	<b>117.85</b>	<b>117.10</b>	<b>119.39</b>	<b>118.82</b>	<b>120.40</b>	<b>122.96</b>	<b>120.47</b>	<b>118.33</b>	<b>116.70</b>	<b>116.58</b>	<b>115.68</b>	<b>114.82</b>	<b>112.61</b>	<b>112.13</b>

Source: EPA 2007

**Appendix Table A-4 State-Level Methane Emissions from Enteric Fermentation by Livestock Category in 2005**

State	Beef cattle	Dairy cattle	Swine	Sheep	Goats	Horses	Total
	<i>Tg CO<sub>2</sub> eq.</i>						
Alabama	1.405	0.049	0.005	0.002	0.005	0.036	<b>1.50</b>
Alaska	0.013	0.004	0.000	0.002	0.000	0.001	<b>0.02</b>
Arizona	0.581	0.507	0.004	0.017	0.004	0.026	<b>1.14</b>
Arkansas	1.932	0.080	0.009	0.002	0.003	0.040	<b>2.07</b>
California	2.251	5.350	0.005	0.113	0.011	0.073	<b>7.80</b>
Colorado	2.029	0.311	0.026	0.061	0.002	0.059	<b>2.49</b>
Connecticut	0.020	0.061	0.000	0.001	0.000	0.005	<b>0.09</b>
Delaware	0.012	0.025	0.001	0.002	0.000	0.002	<b>0.04</b>
Florida	1.739	0.424	0.001	0.002	0.004	0.055	<b>2.23</b>
Georgia	1.174	0.258	0.009	0.002	0.007	0.041	<b>1.49</b>
Hawaii	0.160	0.018	0.001	0.002	0.001	0.003	<b>0.18</b>
Idaho	1.262	1.338	0.001	0.045	0.001	0.046	<b>2.69</b>
Illinois	1.145	0.323	0.127	0.012	0.002	0.033	<b>1.64</b>
Indiana	0.569	0.477	0.097	0.008	0.003	0.054	<b>1.21</b>
Iowa	2.952	0.575	0.513	0.041	0.002	0.042	<b>4.13</b>
Kansas	5.297	0.338	0.054	0.018	0.003	0.037	<b>5.75</b>
Kentucky	2.255	0.338	0.012	0.005	0.007	0.082	<b>2.70</b>
Louisiana	0.930	0.111	0.000	0.002	0.002	0.026	<b>1.07</b>
Maine	0.032	0.101	0.000	0.001	0.000	0.007	<b>0.14</b>
Maryland	0.111	0.224	0.001	0.004	0.001	0.014	<b>0.36</b>
Massachusetts	0.018	0.052	0.000	0.001	0.001	0.009	<b>0.08</b>
Michigan	0.408	0.944	0.029	0.014	0.002	0.058	<b>1.46</b>
Minnesota	1.333	1.414	0.207	0.024	0.002	0.051	<b>3.02</b>
Mississippi	1.118	0.080	0.012	0.002	0.003	0.037	<b>1.25</b>
Missouri	4.441	0.366	0.089	0.011	0.005	0.078	<b>4.99</b>
Montana	2.768	0.366	0.006	0.051	0.001	0.052	<b>2.93</b>
Nebraska	5.666	0.188	0.088	0.016	0.001	0.032	<b>5.99</b>
Nevada	0.498	0.077	0.000	0.012	0.001	0.009	<b>0.60</b>
New Hampshire	0.012	0.049	0.000	0.001	0.000	0.004	<b>0.07</b>
New Jersey	0.024	0.037	0.000	0.002	0.001	0.015	<b>0.08</b>
New Mexico	1.070	0.978	0.000	0.024	0.002	0.026	<b>2.10</b>
New York	0.293	1.999	0.003	0.013	0.003	0.041	<b>2.35</b>
North Carolina	0.815	0.169	0.311	0.003	0.007	0.035	<b>1.34</b>
North Dakota	1.922	0.101	0.005	0.018	0.000	0.024	<b>2.07</b>
Ohio	0.781	0.818	0.049	0.024	0.005	0.074	<b>1.75</b>
Oklahoma	5.075	0.231	0.075	0.012	0.009	0.083	<b>5.48</b>
Oregon	1.336	0.369	0.001	0.038	0.003	0.051	<b>1.80</b>
Pennsylvania	0.570	1.740	0.034	0.017	0.004	0.062	<b>2.43</b>
Rhode Island	0.004	0.003	0.000	0.001	0.000	0.001	<b>0.01</b>
South Carolina	0.438	0.055	0.010	0.002	0.004	0.022	<b>0.53</b>
South Dakota	3.812	0.246	0.044	0.063	0.001	0.038	<b>4.20</b>
Tennessee	2.174	0.221	0.006	0.004	0.012	0.082	<b>2.50</b>
Texas	12.873	0.978	0.030	0.180	0.125	0.205	<b>14.39</b>
Utah	0.761	0.271	0.022	0.045	0.001	0.034	<b>1.13</b>
Vermont	0.043	0.440	0.000	0.001	0.000	0.006	<b>0.49</b>
Virginia	1.507	0.323	0.015	0.010	0.004	0.045	<b>1.90</b>
Washington	0.656	0.723	0.001	0.008	0.002	0.042	<b>1.43</b>
West Virginia	0.410	0.040	0.000	0.005	0.002	0.018	<b>0.48</b>
Wisconsin	1.006	3.798	0.013	0.014	0.004	0.056	<b>4.89</b>
Wyoming	1.529	0.012	0.004	0.076	0.001	0.035	<b>1.66</b>
<b>Total</b>	<b>79.23</b>	<b>27.69</b>	<b>1.92</b>	<b>1.03</b>	<b>0.27</b>	<b>2.00</b>	<b>112.13</b>

Source: EPA 2007

**Appendix Table A-5 Cattle Population Categories Used for Estimating Methane Emissions**

<i>Dairy Cattle</i>	<i>Beef Cattle</i>
Calves	Calves
Heifer Replacements	Heifer Replacements
Cows	Heifer and Steer Stockers
	Animals in Feedlots (Heifers and Steers)
	Cows
	Bulls

Source: EPA 2007

**Appendix Table A-6 Dairy Lactation by Region<sup>1</sup>**

Year	Northern Great						
	California	West	Plains	Southcentral	Northeast	Midwest	Southeast
	<i>(lbs * year)/cow</i>						
1990	18,443	17,293	13,431	13,399	14,557	14,214	12,852
1991	18,522	17,615	13,525	13,216	14,985	14,446	13,053
1992	18,709	18,083	13,998	13,656	15,688	14,999	13,451
1993	18,839	18,253	14,090	14,027	15,602	15,086	13,739
1994	20,190	18,802	14,686	14,395	15,732	15,276	14,111
1995	19,559	18,708	14,807	14,294	16,254	15,680	14,318
1996	19,148	19,076	15,040	14,402	16,271	15,651	14,232
1997	19,815	19,537	15,396	14,330	16,519	16,116	14,517
1998	19,437	19,814	15,919	14,722	16,864	16,676	14,404
1999	20,767	20,477	16,325	14,990	17,246	16,966	14,840
2000	21,116	20,781	17,205	15,363	17,482	17,426	15,176
2001	20,890	20,775	17,242	14,952	17,603	17,217	15,304
2002	21,263	21,073	18,079	15,746	18,001	17,576	15,451
2003	20,979	21,132	18,550	16,507	17,727	18,048	15,113
2004	21,125	21,140	18,746	17,567	17,720	18,176	15,696
2005	21,389	21,742	19,627	18,589	18,446	18,839	16,045

Source: USDA 2005d, 2004d, 2003d, 2002d, 2001d, 2000d, 1999a, 1995a.

<sup>1</sup> Beef lactation data developed using methodology described in EPA 2007.

### **Appendix Table A-7 Typical Livestock Weights**

Cattle Type	lbs.
<b>Beef Replacement Heifer</b>	
Replacement Weight, 15 Months	715
Replacement Weight, 24 Months	1,078
Mature Weight, 36 Months	1,172
<b>Dairy Replacement Heifer</b>	
Replacement Weight, 15 months	800
Replacement Weight, 24 Months	1,225
Mature Weight, 36 Months	1,350
<b>Stockers– Grazing/Forage Based Only</b>	
Steer Weight Gain/Month to 12 Months	45
Steer Weight Gain/Month to 24 Months	35
Heifer Weight Gain/Month to 12 Months	35
Heifer Weight Gain/Month to 24 Months	30

Source: Feedstuffs (1998), Western Dairyman (1998), Johnson (1999), NRC (1999), EPA 2007.

### **Appendix Table A-8 U.S. Feedlot Placement in 2005**

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
<b>Weight Placed</b>	<i>Number of animals placed, 1,000 head</i>												
< 600 lbs.	367	319	347	315	495	460	445	506	628	912	590	465	<b>5,849</b>
600 - 700 lbs.	466	351	347	304	493	359	324	416	475	764	557	558	<b>5,414</b>
700 - 800 lbs.	579	548	646	566	772	453	499	565	552	529	326	489	<b>6,524</b>
> 800 lbs.	342	394	470	415	610	375	451	615	720	496	270	322	<b>5,480</b>
<b>Total</b>	<b>1,754</b>	<b>1,612</b>	<b>1,810</b>	<b>1,600</b>	<b>2,370</b>	<b>1,647</b>	<b>1,719</b>	<b>2,102</b>	<b>2,375</b>	<b>2,701</b>	<b>1,743</b>	<b>1,834</b>	<b>23,267</b>

Source: USDA (2002f, 2001f, 2000f, 1999a, 1995a), EPA 2007.

Note: Totals may not sum due to independent rounding.

**Appendix Table A-9 Regional Estimates of Digestible Energy and Methane Conversion Rates for Enteric Fermentation**

Livestock Category	Data	Northern						
		California	West	Great Plains	Southcentral	Northeast	Midwest	Southeast
<b>Beef Replacement</b>								
Heifer	DE <sup>1</sup>	65	59	66	64	65	65	64
	Y <sub>m</sub> <sup>2</sup>	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
	Pop. <sup>3</sup>	3%	10%	31%	23%	2%	14%	17%
<b>Dairy Replacement</b>								
Heifer	DE	66	66	66	64	68	66	66
	Y <sub>m</sub>	5.9%	5.9%	5.6%	6.4%	6.3%	5.6%	6.9%
	Pop.	18%	12%	5%	4%	18%	36%	7%
Steer Stockers	DE	65	59	66	64	65	65	64
	Y <sub>m</sub>	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
	Pop.	4%	8%	42%	22%	2%	18%	5%
Heifer Stockers	DE	65	59	66	64	65	65	64
	Y <sub>m</sub>	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
	Pop.	2%	7%	50%	22%	1%	15%	4%
Steer Feedlot	DE	85	85	85	85	85	85	85
	Y <sub>m</sub>	3%	3%	3%	3%	3%	3%	3%
	Pop.	3%	8%	48%	24%	1%	16%	1%
Heifer Feedlot	DE	85	85	85	85	85	85	85
	Y <sub>m</sub>	3%	3%	3%	3%	3%	3%	3%
	Pop.	3%	8%	48%	24%	1%	16%	1%
Beef Cows	DE	63	57	64	62	63	63	62
	Y <sub>m</sub>	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%	6.5%
	Pop.	2%	8%	28%	26%	2%	14%	19%
Dairy Cows	DE	69	66	69	68	69	69	68
	Y <sub>m</sub>	4.8%	5.8%	5.8%	5.7%	5.8%	5.8%	5.6%
	Pop.	17%	13%	5%	6%	18%	33%	8%
Steer Step-Up	DE	73	73	73	73	73	73	73
	Y <sub>m</sub>	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%
Heifer Step-Up	DE	73	73	73	73	73	73	73
	Y <sub>m</sub>	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%	4.8%

Source: EPA 2007

<sup>1</sup> (DE) Digestible energy; in units of percent gross energy (GE) in MJ/Day.

<sup>2</sup> (Y<sub>m</sub>) Methane conversion rate is the fraction of gross energy (GE) in feed converted to methane.

<sup>3</sup> (Pop.) Percent of each subcategory population present in each region.



## Appendix Table A-10 Definition of Regions in the Enteric Fermentation Model

Region & State(s)				
<b>California</b>	<b>Northern Great Plains</b>	<b>Northeast</b>	<b>Southeast</b>	<b>West</b>
California	Colorado	Connecticut	Alabama	Alaska
<b>Midwest</b>	Kansas	Delaware	Florida	Arizona
Illinois	Montana	Maine	Georgia	Hawaii
Indiana	Nebraska	Maryland	Kentucky	Idaho
Iowa	North Dakota	Massachusetts	Mississippi	Nevada
Michigan	South Dakota	New Hampshire	North Carolina	New Mexico
Minnesota	Wyoming	New Jersey	South Carolina	Oregon
Missouri	<b>South Central</b>	New York	Tennessee	Utah
Ohio	Arkansas	Pennsylvania	Virginia	Washington
Wisconsin	Louisiana	Rhode Island		
	Oklahoma	Vermont		
	Texas	West Virginia		

Source: EPA 2007

## Appendix Table A-11 Methane Emissions from Cattle Enteric Fermentation, 1990-2005

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Animal Type	<i>Gg CH<sub>4</sub></i>															
<b>Dairy</b>	<b>1,375</b>	<b>1,378</b>	<b>1,375</b>	<b>1,316</b>	<b>1,314</b>	<b>1,320</b>	<b>1,254</b>	<b>1,255</b>	<b>1,251</b>	<b>1,265</b>	<b>1,283</b>	<b>1,280</b>	<b>1,288</b>	<b>1,299</b>	<b>1,285</b>	<b>1,319</b>
Cows	1,142	1,148	1,143	1,082	1,082	1,088	1,024	1,028	1,026	1,037	1,058	1,053	1,060	1,070	1,058	1,086
Replacements																
7-11 mo.	49	49	49	49	49	49	48	48	48	48	48	48	49	48	48	50
Replacements																
12-23 mo.	184	181	183	185	183	183	181	179	177	180	177	179	179	181	178	182
<b>Beef</b>	<b>3,859</b>	<b>3,817</b>	<b>3,927</b>	<b>3,965</b>	<b>4,039</b>	<b>4,160</b>	<b>4,117</b>	<b>4,015</b>	<b>3,942</b>	<b>3,940</b>	<b>3,869</b>	<b>3,825</b>	<b>3,821</b>	<b>3,832</b>	<b>3,730</b>	<b>3,772</b>
Cows	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457	2,457
Replacements																
7-11 mo.	52	54	57	60	62	61	60	56	54	53	53	54	54	53	54	56
Replacements																
12-23 mo.	190	196	203	216	229	232	225	216	206	198	198	200	200	201	198	204
Steer Stockers	431	403	465	483	436	480	459	430	418	400	362	352	355	361	325	337
Heifer	232	220	234	241	232	250	241	241	236	229	207	203	205	210	188	199
Feedlot Cattle	412	396	383	352	373	382	368	374	378	420	426	408	421	429	399	406
Bulls	116	116	118	119	122	127	127	123	118	119	116	116	115	115	113	114
<b>Total</b>	<b>5,234</b>	<b>5,195</b>	<b>5,302</b>	<b>5,280</b>	<b>5,353</b>	<b>5,480</b>	<b>5,372</b>	<b>5,270</b>	<b>5,192</b>	<b>5,204</b>	<b>5,153</b>	<b>5,105</b>	<b>5,110</b>	<b>5,131</b>	<b>5,014</b>	<b>5,091</b>

Source: EPA 2007.

Note: Totals may not sum due to independent rounding.

## Appendix Table A-12 IPCC Emission Factors for Livestock

Animal Type	Emission Factors ( <i>kg CH<sub>4</sub>/head/year</i> )
Bulls	100
Calves	0
Swine	1.5
Sheep	8
Goats	5
Horses	18

Source: EPA 2007, IPCC 2000.

**Appendix Table A-13 Summary of Greenhouse Gas Emissions from Managed<sup>1</sup> Waste by State**

State	CH <sub>4</sub>	N <sub>2</sub> O	Total
	<i>Tg CO<sub>2</sub> eq.</i>		
Alabama	0.37	0.45	<b>0.82</b>
Alaska	0.01	0.04	<b>0.04</b>
Arizona	0.92	0.17	<b>1.09</b>
Arkansas	0.32	0.01	<b>0.32</b>
California	6.49	0.74	<b>7.23</b>
Colorado	0.60	0.52	<b>1.12</b>
Connecticut	0.03	0.01	<b>0.04</b>
Delaware	0.03	0.01	<b>0.04</b>
Florida	0.58	0.03	<b>0.61</b>
Georgia	0.67	0.02	<b>0.69</b>
Hawaii	0.05	0.05	<b>0.10</b>
Idaho	1.75	0.28	<b>2.03</b>
Illinois	1.18	0.17	<b>1.36</b>
Indiana	0.98	0.13	<b>1.12</b>
Iowa	5.83	0.57	<b>6.40</b>
Kansas	0.86	1.11	<b>1.97</b>
Kentucky	0.26	0.02	<b>0.28</b>
Louisiana	0.11	0.01	<b>0.13</b>
Maine	0.03	0.01	<b>0.04</b>
Maryland	0.09	0.02	<b>0.12</b>
Massachusetts	0.01	0.01	<b>0.03</b>
Michigan	0.73	0.19	<b>0.93</b>
Minnesota	1.96	0.38	<b>2.34</b>
Mississippi	0.47	0.02	<b>0.50</b>
Missouri	0.91	0.13	<b>1.04</b>
Montana	0.13	0.04	<b>0.18</b>
Nebraska	0.91	1.09	<b>2.00</b>
Nevada	0.12	0.02	<b>0.14</b>
New Hampshire	0.01	0.00	<b>0.02</b>
New Jersey	0.01	0.00	<b>0.02</b>
New Mexico	1.37	0.12	<b>1.49</b>
New York	0.52	0.14	<b>0.66</b>
North Carolina	4.45	0.05	<b>4.51</b>
North Dakota	0.11	0.08	<b>0.18</b>
Ohio	0.66	0.19	<b>0.85</b>
Oklahoma	1.46	0.19	<b>1.64</b>
Oregon	0.40	0.08	<b>0.47</b>
Pennsylvania	0.61	0.16	<b>0.76</b>
Rhode Island	0.00	0.01	<b>0.02</b>
South Carolina	0.30	0.00	<b>0.30</b>
South Dakota	0.53	0.22	<b>0.75</b>
Tennessee	0.17	0.01	<b>0.18</b>
Texas	2.20	1.24	<b>3.44</b>
Utah	0.50	0.08	<b>0.58</b>
Vermont	0.11	0.03	<b>0.14</b>
Virginia	0.31	0.03	<b>0.34</b>
Washington	0.75	0.16	<b>0.91</b>
West Virginia	0.03	0.01	<b>0.04</b>
Wisconsin	1.41	0.56	<b>1.97</b>
Wyoming	0.06	0.04	<b>0.10</b>
<b>Total</b>	<b>42.39</b>	<b>9.65</b>	<b>52.04</b>

Source: EPA 2007

<sup>1</sup>Methane totals include emissions from grazed land manure.

**Appendix Table A-14 Methane Emissions from Manure Management by State and Animal in 2005**

State	Dairy cattle	Beef cattle	Poultry	Swine	Goats	Horses	Sheep	Total
	<i>Tg CO<sub>2</sub> eq.</i>							
Alabama	0.0009	0.0023	0.0114	0.0029	0.0000	0.0005	0.0000	<b>0.0180</b>
Alaska	0.0001	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	<b>0.0003</b>
Arizona	0.0394	0.0014	0.0007	0.0026	0.0000	0.0004	0.0001	<b>0.0444</b>
Arkansas	0.0010	0.0032	0.0053	0.0055	0.0000	0.0006	0.0000	<b>0.0156</b>
California	0.2976	0.0042	0.0049	0.0024	0.0000	0.0010	0.0005	<b>0.3107</b>
Colorado	0.0145	0.0028	0.0032	0.0081	0.0000	0.0006	0.0002	<b>0.0294</b>
Connecticut	0.0009	0.0000	0.0006	0.0000	0.0000	0.0000	0.0000	<b>0.0016</b>
Delaware	0.0004	0.0000	0.0010	0.0002	0.0000	0.0000	0.0000	<b>0.0016</b>
Florida	0.0165	0.0028	0.0080	0.0001	0.0000	0.0008	0.0000	<b>0.0282</b>
Georgia	0.0056	0.0019	0.0197	0.0049	0.0000	0.0006	0.0000	<b>0.0327</b>
Hawaii	0.0014	0.0003	0.0002	0.0003	0.0000	0.0000	0.0000	<b>0.0023</b>
Idaho	0.0804	0.0019	0.0008	0.0001	0.0000	0.0004	0.0001	<b>0.0839</b>
Illinois	0.0066	0.0014	0.0006	0.0477	0.0000	0.0003	0.0000	<b>0.0566</b>
Indiana	0.0099	0.0007	0.0015	0.0347	0.0000	0.0005	0.0000	<b>0.0473</b>
Iowa	0.0107	0.0038	0.0021	0.2609	0.0000	0.0004	0.0001	<b>0.2780</b>
Kansas	0.0117	0.0073	0.0001	0.0219	0.0000	0.0004	0.0001	<b>0.0415</b>
Kentucky	0.0018	0.0025	0.0015	0.0064	0.0000	0.0008	0.0000	<b>0.0131</b>
Louisiana	0.0014	0.0015	0.0023	0.0001	0.0000	0.0004	0.0000	<b>0.0057</b>
Maine	0.0011	0.0000	0.0004	0.0000	0.0000	0.0001	0.0000	<b>0.0016</b>
Maryland	0.0027	0.0001	0.0012	0.0004	0.0000	0.0001	0.0000	<b>0.0046</b>
Massachusetts	0.0005	0.0000	0.0000	0.0001	0.0000	0.0001	0.0000	<b>0.0007</b>
Michigan	0.0238	0.0006	0.0009	0.0097	0.0000	0.0005	0.0000	<b>0.0355</b>
Minnesota	0.0229	0.0017	0.0018	0.0667	0.0000	0.0005	0.0001	<b>0.0937</b>
Mississippi	0.0010	0.0018	0.0113	0.0084	0.0000	0.0005	0.0000	<b>0.0231</b>
Missouri	0.0050	0.0048	0.0011	0.0325	0.0000	0.0007	0.0000	<b>0.0442</b>
Montana	0.0016	0.0029	0.0003	0.0015	0.0000	0.0005	0.0002	<b>0.0070</b>
Nebraska	0.0050	0.0075	0.0008	0.0303	0.0000	0.0003	0.0001	<b>0.0439</b>
Nevada	0.0050	0.0007	0.0000	0.0000	0.0000	0.0001	0.0000	<b>0.0059</b>
New Hampshire	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	<b>0.0006</b>
New Jersey	0.0004	0.0000	0.0002	0.0001	0.0000	0.0001	0.0000	<b>0.0008</b>
New Mexico	0.0629	0.0015	0.0006	0.0000	0.0000	0.0002	0.0001	<b>0.0654</b>
New York	0.0233	0.0004	0.0005	0.0007	0.0000	0.0004	0.0000	<b>0.0254</b>
North Carolina	0.0017	0.0009	0.0133	0.1961	0.0000	0.0005	0.0000	<b>0.2126</b>
North Dakota	0.0015	0.0020	0.0001	0.0015	0.0000	0.0002	0.0001	<b>0.0054</b>
Ohio	0.0132	0.0010	0.0012	0.0159	0.0000	0.0007	0.0001	<b>0.0322</b>
Oklahoma	0.0104	0.0059	0.0046	0.0484	0.0000	0.0012	0.0001	<b>0.0707</b>
Oregon	0.0154	0.0019	0.0014	0.0001	0.0000	0.0005	0.0001	<b>0.0194</b>
Pennsylvania	0.0141	0.0007	0.0015	0.0125	0.0000	0.0006	0.0001	<b>0.0295</b>
Rhode Island	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	<b>0.0001</b>
South Carolina	0.0008	0.0007	0.0061	0.0065	0.0000	0.0003	0.0000	<b>0.0145</b>
South Dakota	0.0054	0.0042	0.0003	0.0152	0.0000	0.0004	0.0002	<b>0.0258</b>
Tennessee	0.0017	0.0024	0.0008	0.0032	0.0000	0.0008	0.0000	<b>0.0089</b>
Texas	0.0555	0.0235	0.0067	0.0192	0.0004	0.0029	0.0008	<b>0.1090</b>
Utah	0.0138	0.0011	0.0029	0.0060	0.0000	0.0003	0.0001	<b>0.0243</b>
Vermont	0.0050	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000	<b>0.0052</b>
Virginia	0.0024	0.0017	0.0019	0.0089	0.0000	0.0004	0.0000	<b>0.0153</b>
Washington	0.0332	0.0010	0.0012	0.0002	0.0000	0.0004	0.0000	<b>0.0361</b>
West Virginia	0.0004	0.0005	0.0005	0.0001	0.0000	0.0002	0.0000	<b>0.0016</b>
Wisconsin	0.0613	0.0013	0.0005	0.0041	0.0000	0.0005	0.0000	<b>0.0678</b>
Wyoming	0.0003	0.0016	0.0000	0.0011	0.0000	0.0003	0.0002	<b>0.0036</b>
<b>Total</b>	<b>0.8929</b>	<b>0.1108</b>	<b>0.1265</b>	<b>0.8882</b>	<b>0.0009</b>	<b>0.0223</b>	<b>0.0037</b>	<b>2.0454</b>

Source: EPA 2007

**Appendix Table A-15 Nitrous Oxide Emissions from Manure Management by State and Animal in 2005**

State	Beef cattle	Dairy cattle	Poultry	Swine	Total
	<i>Tg CO<sub>2</sub> eq.</i>				
Alabama	0.002	0.002	0.444	0.001	<b>0.448</b>
Alaska	0.000	0.000	0.035	0.000	<b>0.036</b>
Arizona	0.139	0.030	0.000	0.001	<b>0.170</b>
Arkansas	0.004	0.003	0.000	0.002	<b>0.009</b>
California	0.225	0.459	0.052	0.001	<b>0.737</b>
Colorado	0.462	0.033	0.012	0.008	<b>0.515</b>
Connecticut	0.000	0.005	0.001	0.000	<b>0.006</b>
Deleware	0.000	0.001	0.004	0.000	<b>0.005</b>
Florida	0.001	0.020	0.009	0.000	<b>0.030</b>
Georgia	0.002	0.009	0.004	0.001	<b>0.017</b>
Hawaii	0.000	0.001	0.045	0.000	<b>0.047</b>
Idaho	0.126	0.150	0.000	0.000	<b>0.276</b>
Illinois	0.088	0.042	0.000	0.044	<b>0.174</b>
Indiana	0.053	0.044	0.005	0.033	<b>0.135</b>
Iowa	0.387	0.071	0.014	0.101	<b>0.573</b>
Kansas	1.034	0.037	0.019	0.020	<b>1.109</b>
Kentucky	0.004	0.011	0.001	0.002	<b>0.019</b>
Louisiana	0.001	0.003	0.011	0.000	<b>0.014</b>
Maine	0.000	0.008	0.003	0.000	<b>0.011</b>
Maryland	0.005	0.015	0.001	0.000	<b>0.021</b>
Massachusetts	0.000	0.004	0.009	0.000	<b>0.013</b>
Michigan	0.080	0.103	0.000	0.009	<b>0.192</b>
Minnesota	0.122	0.189	0.006	0.066	<b>0.383</b>
Mississippi	0.002	0.003	0.018	0.002	<b>0.025</b>
Missouri	0.029	0.044	0.028	0.029	<b>0.130</b>
Montana	0.025	0.006	0.011	0.002	<b>0.044</b>
Nebraska	1.038	0.019	0.000	0.030	<b>1.086</b>
Nevada	0.004	0.007	0.004	0.000	<b>0.015</b>
New Hampshire	0.000	0.004	0.000	0.000	<b>0.004</b>
New Jersey	0.000	0.003	0.000	0.000	<b>0.003</b>
New Mexico	0.053	0.067	0.000	0.000	<b>0.120</b>
New York	0.010	0.130	0.000	0.001	<b>0.141</b>
North Carolina	0.002	0.007	0.001	0.044	<b>0.054</b>
North Dakota	0.025	0.013	0.036	0.002	<b>0.076</b>
Ohio	0.084	0.090	0.001	0.015	<b>0.190</b>
Oklahoma	0.149	0.016	0.011	0.012	<b>0.188</b>
Oregon	0.034	0.034	0.009	0.000	<b>0.077</b>
Pennsylvania	0.032	0.112	0.003	0.011	<b>0.158</b>
Rhode Island	0.000	0.000	0.015	0.000	<b>0.015</b>
South Carolina	0.001	0.002	0.000	0.002	<b>0.004</b>
South Dakota	0.168	0.030	0.010	0.015	<b>0.223</b>
Tennessee	0.002	0.009	0.002	0.001	<b>0.014</b>
Texas	1.143	0.088	0.007	0.004	<b>1.242</b>
Utah	0.015	0.031	0.026	0.007	<b>0.079</b>
Vermont	0.000	0.027	0.001	0.000	<b>0.029</b>
Virginia	0.013	0.012	0.000	0.002	<b>0.026</b>
Washington	0.082	0.061	0.015	0.000	<b>0.159</b>
West Virginia	0.003	0.002	0.004	0.000	<b>0.009</b>
Wisconsin	0.095	0.461	0.004	0.004	<b>0.563</b>
Wyoming	0.034	0.002	0.004	0.001	<b>0.040</b>
<b>Total</b>	<b>5.776</b>	<b>2.516</b>	<b>0.887</b>	<b>0.475</b>	<b>9.655</b>

Source: EPA 2007

**Appendix Table A-16 Waste Characteristics Data**

	Average		Nitrogen,		Max Methane		Volatile	
	TAM <sup>1</sup>	Source	N <sub>ex</sub> <sup>2</sup>	Source	Generation Potential	Source	Solids (VS)	Source
<b>Livestock</b>	<i>kg</i>		<i>kg/day per 1,000 kg mass</i>		<i>B<sub>o</sub> (m<sup>3</sup> CH<sub>4</sub>/kg VS added)</i>		<i>kg/day per 1,000 kg mass</i>	
Dairy Cows	604	Safley 2000	0.44	USDA 1996a	0.24	Morris 1976	8.8	Lieberman and Pape, 2005
Dairy Heifers	476	Safley 2000	0.31	USDA 1996a	0.17	Bryant et. al. 1976	6.7	Lieberman and Pape, 2005
Feedlot Steers	420	USDA 1996a	0.3	USDA 1996a	0.33	Hashimoto 1981	3.86	Lieberman and Pape, 2005
Feedlot Heifers	420	USDA 1996a	0.3	USDA 1996a	0.33	Hashimoto 1981	3.98	Lieberman and Pape, 2005
Bulls NOF <sup>3</sup>	750	Safley 2000	0.31	USDA 1996a	0.17	Hashimoto 1981	6.04	USDA 1996a
Calves NOF	118	ERG 2003	0.3	USDA 1996a	0.17	Hashimoto 1981	6.41	USDA 1996a
Heifers NOF	420	USDA 1996a	0.31	USDA 1996a	0.17	Hashimoto 1981	7.09	Lieberman and Pape, 2005
Steers NOF	318	Safley 2000	0.31	USDA 1996a	0.17	Hashimoto 1981	7.93	Lieberman and Pape, 2005
Cows NOF	533	NRC 2000	0.33	USDA 1996a	0.17	Hashimoto 1981	6.97	Lieberman and Pape, 2005
Market Swine								
<60 lbs.	16	Safley 2000	0.6	USDA 1996a	0.48	Hashimoto 1984	8.8	USDA 1996a
Market Swine								
60-119 lbs.	41	Safley 2000	0.42	USDA 1996a	0.48	Hashimoto 1984	5.4	USDA 1996a
Market Swine								
120-179 lbs.	68	Safley 2000	0.42	USDA 1996a	0.48	Hashimoto 1984	5.4	USDA 1996a
Market Swine								
>180 lbs.	91	Safley 2000	0.42	USDA 1996a	0.48	Hashimoto 1984	5.4	USDA 1996a
Breeding Swine	198	Safley 2000	0.24	USDA 1996a	0.48	Hashimoto 1984	2.6	USDA 1996a
Feedlot Sheep	25	EPA 1992	0.42	ASAE 1999	0.36	EPA 1992	9.2	EPA 1992
Sheep NOF	80	EPA 1992	0.42	ASAE 1999	0.19	EPA 1992	9.2	EPA 1992
Goats	64	ASAE 1999	0.45	ASAE 1999	0.17	EPA 1992	9.5	EPA 1992
Horses	450	ASAE 1999	0.3	ASAE 1999	0.33	EPA 1992	10	EPA 1992
Hens ? 1 yr	1.8	ASAE 1999	0.83	USDA 1996a	0.39	Hill 1982	10.8	USDA 1996a
Pullets	1.8	ASAE 1999	0.62	USDA 1996a	0.39	Hill 1982	9.7	USDA 1996a
Other Chickens	1.8	ASAE 1999	0.83	USDA 1996a	0.39	Hill 1982	10.8	USDA 1996a
Broilers	0.9	ASAE 1999	1.1	USDA 1996a	0.36	Hill 1984	15	USDA 1996a
Turkeys	6.8	ASAE 1999	0.74	USDA 1996a	0.36	Hill 1984	9.7	USDA 1996a

Source: EPA 2007.

<sup>1</sup>(TAM) Typical animal mass.

<sup>2</sup>Nitrogen excretion source.

<sup>3</sup>(NOF) Not on feed.

**Appendix Table A-17 State Volatile Solids Production Rates in 2005**

State	Dairy Cow	Dairy Heifer	Cow NOF <sup>1</sup>	Heifer NOF	Steer NOF	Feedlot Heifer	Feedlot Steer
	<i>kg/day/1000 kg mass</i>						
Alabama	8.76	6.81	6.74	7.21	7.76	3.91	3.78
Alaska	11.03	6.81	8.71	9.47	10.27	3.90	3.77
Arizona	11.03	6.81	8.71	9.53	10.27	3.90	3.77
Arkansas	9.19	7.56	6.72	7.19	7.74	3.94	3.81
California	9.47	6.81	6.57	7.06	7.55	3.89	3.76
Colorado	8.97	6.81	6.19	6.66	7.08	3.92	3.78
Connecticut	8.62	6.13	6.62	7.09	7.62	3.89	3.76
Delaware	8.62	6.13	6.62	7.13	7.62	3.89	3.76
Florida	8.76	6.81	6.74	7.19	7.76	3.91	3.78
Georgia	8.76	6.81	6.74	7.22	7.76	3.91	3.78
Hawaii	11.03	6.81	8.71	9.49	10.27	3.90	3.77
Idaho	11.03	6.81	8.71	9.58	10.27	3.90	3.77
Illinois	8.74	6.81	6.63	7.14	7.62	3.92	3.79
Indiana	8.74	6.81	6.63	7.13	7.62	3.92	3.79
Iowa	8.74	6.81	6.63	7.16	7.62	3.92	3.79
Kansas	8.97	6.81	6.19	6.67	7.08	3.92	3.78
Kentucky	8.76	6.81	6.74	7.23	7.76	3.91	3.78
Louisiana	9.19	7.56	6.72	7.18	7.74	3.94	3.81
Maine	8.62	6.13	6.62	7.08	7.62	3.89	3.76
Maryland	8.62	6.13	6.62	7.11	7.62	3.89	3.76
Massachusetts	8.62	6.13	6.62	7.07	7.62	3.89	3.76
Michigan	8.74	6.81	6.63	7.13	7.62	3.92	3.79
Minnesota	8.74	6.81	6.63	7.14	7.62	3.92	3.79
Mississippi	8.76	6.81	6.74	7.21	7.76	3.91	3.78
Missouri	8.74	6.81	6.63	7.11	7.62	3.92	3.79
Montana	8.97	6.81	6.19	6.59	7.08	3.92	3.78
Nebraska	8.97	6.81	6.19	6.66	7.08	3.92	3.78
Nevada	11.03	6.81	8.71	9.54	10.27	3.90	3.77
New Hampshire	8.62	6.13	6.62	7.08	7.62	3.89	3.76
New Jersey	8.62	6.13	6.62	7.10	7.62	3.89	3.76
New Mexico	11.03	6.81	8.71	9.55	10.27	3.90	3.77
New York	8.62	6.13	6.62	7.13	7.62	3.89	3.76
North Carolina	8.76	6.81	6.74	7.20	7.76	3.91	3.78
North Dakota	8.97	6.81	6.19	6.63	7.08	3.92	3.78
Ohio	8.74	6.81	6.63	7.11	7.62	3.92	3.79
Oklahoma	9.19	7.56	6.72	7.23	7.74	3.94	3.81
Oregon	11.03	6.81	8.71	9.54	10.27	3.90	3.77
Pennsylvania	8.62	6.13	6.62	7.12	7.62	3.89	3.76
Rhode Island	8.62	6.13	6.62	7.08	7.62	3.89	3.76
South Carolina	8.76	6.81	6.74	7.21	7.76	3.91	3.78
South Dakota	8.97	6.81	6.19	6.64	7.08	3.92	3.78
Tennessee	8.76	6.81	6.74	7.21	7.76	3.91	3.78
Texas	9.19	7.56	6.72	7.24	7.74	3.94	3.81
Utah	11.03	6.81	8.71	9.55	10.27	3.90	3.77
Vermont	8.62	6.13	6.62	7.10	7.62	3.89	3.76
Virginia	8.76	6.81	6.74	7.23	7.76	3.91	3.78
Washington	11.03	6.81	8.71	9.59	10.27	3.90	3.77
West Virginia	8.62	6.13	6.62	7.09	7.62	3.89	3.76
Wisconsin	8.74	6.81	6.63	7.12	7.62	3.92	3.79
Wyoming	8.97	6.81	6.19	6.62	7.08	3.92	3.78

Source: EPA 2007.

<sup>1</sup>(NOF) Not on feed.

**Appendix Table A-18 State-Based Methane Conversion Factors<sup>1</sup> by Waste Management System in 2005**

State	Liquid/Slurry and Deep Pit	Anaerobic Lagoon
	%	
Alabama	38.5	75.8
Alaska	13.8	48.3
Arizona	53.2	79.3
Arkansas	36.1	75.9
California	37.7	76.2
Colorado	22.2	66.7
Connecticut	23.9	69.4
Delaware	29.7	73.9
Florida	52.2	77.8
Georgia	38.3	75.6
Hawaii	59.7	77.1
Idaho	23.2	68.3
Illinois	26.9	71.5
Indiana	26.0	70.6
Iowa	24.7	69.7
Kansas	31.9	74.5
Kentucky	30.4	73.2
Louisiana	46.1	77.2
Maine	19.5	63.3
Maryland	27.6	72.1
Massachusetts	23.2	68.7
Michigan	22.0	66.7
Minnesota	22.8	67.9
Mississippi	40.1	76.1
Missouri	30.4	73.8
Montana	21.1	65.9
Nebraska	26.7	71.5
Nevada	25.7	70.5
New Hampshire	21.0	65.5
New Jersey	26.4	71.9
New Mexico	32.6	74.4
New York	21.7	66.6
North Carolina	33.7	74.6
North Dakota	21.7	66.9
Ohio	24.8	69.5
Oklahoma	36.5	76.1
Oregon	22.8	67.0
Pennsylvania	25.2	70.4
Rhode Island	24.6	70.4
South Carolina	37.8	75.8
South Dakota	24.2	69.6
Tennessee	32.6	74.2
Texas	41.6	77.0
Utah	26.2	71.1
Vermont	20.2	64.5
Virginia	27.9	72.0
Washington	23.4	67.9
West Virginia	25.3	69.8
Wisconsin	22.4	67.7
Wyoming	21.3	66.0

Source: EPA 2007, IPCC 2000.

<sup>1</sup>(MCF) Methane conversion factors represent weighted average of multiple animal types.

**Appendix Table A-19 Additional Nitrous Oxide  
and Methane Emission Factors**

	<b>Methane</b>	<b>Nitrous Oxide</b>
<b>Manure Management System</b>		
Pasture	0.0015	
Daily spread	0.005	
Solid storage	0.015	
Dry lot	0.015	
Poultry with bedding	0.015	
Poultry without bedding	0.015	
Liquid systems		0.001
Dry systems		0.02

Source: IPCC 2000.



**Appendix Table A-20 State-Weighted Methane Conversion Factors for Livestock Waste Emissions 2005<sup>1</sup>**

State	Beef Feed	Beef Feed	Dairy	Dairy	Swine	Swine	Layer	Broiler	Turkey
	Lot Heifer	Lot Steer	Cow	Heifer	Market	Breeding			
	%								
Alabama	2.0	1.5	18.3	1.9	54.4	54.2	32.6	1.5	1.5
Alaska	1.2	1.0	20.8	1.2	10.5	10.5	13.7	1.5	1.5
Arizona	1.7	1.5	61.4	1.7	51.4	50.9	46.7	1.5	1.5
Arkansas	2.0	1.5	11.4	1.9	53.7	53.7	1.5	1.5	1.5
California	2.0	1.5	51.1	1.8	46.1	46.7	10.3	1.5	1.5
Colorado	1.1	1.0	45.4	1.1	29.7	29.6	39.3	1.5	1.5
Connecticut	1.3	1.0	14.5	1.2	15.0	15.0	5.0	1.5	1.5
Delaware	1.3	1.0	15.1	1.3	34.4	34.4	5.2	1.5	1.5
Florida	2.2	1.5	38.5	2.0	16.9	16.9	33.5	1.5	1.5
Georgia	2.0	1.5	21.5	1.9	52.0	52.0	32.3	1.5	1.5
Hawaii	2.3	1.5	64.9	2.1	48.1	48.1	20.4	1.5	1.5
Idaho	1.1	1.0	47.5	1.1	15.6	15.6	39.0	1.5	1.5
Illinois	1.2	1.0	20.2	1.2	34.6	34.7	2.9	1.5	1.5
Indiana	1.2	1.0	20.5	1.1	33.0	33.0	1.5	1.5	1.5
Iowa	1.2	1.0	18.4	1.1	46.4	46.4	1.5	1.5	1.5
Kansas	1.2	1.0	33.5	1.2	35.3	35.3	3.0	1.5	1.5
Kentucky	1.3	1.0	5.2	1.3	48.8	48.7	5.2	1.5	1.5
Louisiana	2.1	1.5	11.5	2.0	25.3	25.3	47.2	1.5	1.5
Maine	1.2	1.0	10.5	1.2	8.3	8.3	4.6	1.5	1.5
Maryland	1.3	1.0	12.1	1.3	30.6	30.6	5.2	1.5	1.5
Massachusetts	1.2	1.0	9.1	1.2	22.8	22.8	4.9	1.5	1.5
Michigan	1.1	1.0	25.0	1.1	30.7	30.7	2.9	1.5	1.5
Minnesota	1.1	1.0	15.9	1.1	30.8	30.8	1.5	1.5	1.5
Mississippi	2.0	1.5	12.6	1.9	58.9	58.9	46.5	1.5	1.5
Missouri	1.2	1.0	13.6	1.2	35.7	35.7	1.5	1.5	1.5
Montana	1.1	1.0	27.9	1.1	23.7	23.7	37.6	1.5	1.5
Nebraska	1.2	1.0	25.9	1.1	32.3	32.2	2.9	1.5	1.5
Nevada	1.1	1.0	51.3	1.1	33.8	32.3	1.5	1.5	1.5
New Hampshire	1.2	1.0	11.0	1.2	13.9	13.9	4.8	1.5	1.5
New Jersey	1.3	1.0	10.0	1.2	26.0	26.0	5.1	1.5	1.5
New Mexico	1.1	1.0	50.9	1.1	3.9	3.9	42.7	1.5	1.5
New York	1.2	1.0	11.6	1.2	24.5	24.6	4.9	1.5	1.5
North Carolina	1.3	1.0	9.6	1.3	59.4	59.4	32.2	1.5	1.5
North Dakota	1.1	1.0	14.4	1.1	25.7	25.7	2.8	1.5	1.5
Ohio	1.2	1.0	16.0	1.1	31.3	31.3	1.5	1.5	1.5
Oklahoma	1.1	1.0	43.0	1.6	57.1	57.2	46.8	1.5	1.5
Oregon	1.3	1.0	32.8	1.2	12.7	12.7	17.1	1.5	1.5
Pennsylvania	1.3	1.0	8.0	1.2	32.9	32.9	1.5	1.5	1.5
Rhode Island	1.3	1.0	7.5	1.2	15.5	15.5	5.0	1.5	1.5
South Carolina	2.0	1.5	15.0	1.9	54.5	54.5	46.4	1.5	1.5
South Dakota	1.2	1.0	21.4	1.1	31.4	31.4	2.9	1.5	1.5
Tennessee	1.3	1.0	7.3	1.3	47.5	47.2	5.1	1.5	1.5
Texas	1.6	1.5	53.8	1.6	57.5	57.6	10.7	1.5	1.5
Utah	1.1	1.0	40.4	1.1	26.6	26.7	39.6	1.5	1.5
Vermont	1.2	1.0	11.4	1.2	5.0	5.0	4.7	1.5	1.5
Virginia	1.3	1.0	7.3	1.2	53.1	53.2	5.1	1.5	1.5
Washington	1.3	1.0	36.3	1.2	18.2	18.2	9.0	1.5	1.5
West Virginia	1.3	1.0	10.7	1.2	15.1	15.1	5.0	1.5	1.5
Wisconsin	1.1	1.0	15.9	1.1	27.9	27.9	2.9	1.5	1.5
Wyoming	1.1	1.0	23.3	1.1	25.9	25.9	38.1	1.5	1.5

Source: EPA 2007

<sup>1</sup>(MCFs) Methane conversion factors are weighted by the distribution of waste management systems for each animal type within a state.

**Appendix Table A-21**  
**Nitrogen in Livestock Waste**  
**on Grazed Lands**

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<b>Year</b>	<i>Tg N</i>
1990	3.9
1991	3.9
1992	4.0
1993	4.0
1994	4.1
1995	4.2
1996	4.2
1997	4.0
1998	3.9
1999	3.9
2000	3.8
2001	3.8
2002	3.8
2003	3.8
2004	3.7
2005	3.7

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Source: EPA 2007