(9) Deep bedding systems for cattle and swine.
(10) Manure composting.

(b) A livestock facility that is subject to this rule only because of emissions from manure management system components is not required to report emissions from subparts C through PP (other than subpart JJ) of this part.

(c) A livestock facility that is subject to this part because of emissions from source categories described in subparts C through PP of this part is not required to report emissions under subpart JJ of this part unless emissions from manure management systems are 25,000 metric tons CO$_2$e per year or more.

§ 98.363 Calculating GHG emissions.

(a) For all manure management system components listed in 98.360(b) except digesters, estimate the annual CH$_4$ emissions and sum for all the components to obtain total emissions from the manure management system for all animal types using Equation JJ–1.

\[
\text{CH}_4 \text{ Emissions}_{\text{MMS}} \text{ (metric tons/yr)} = \sum_{\text{animal type}} \left[ \sum_{\text{MMS component}} \left[ \text{TVS}_{\text{AT}} \times \text{VS}_{\text{MMSC}} \times (1 - \text{VS}_{\text{ss}}) \times 365 \text{ days/yr} \times \left( \text{B}_0 \right)_{\text{AT}} \times \text{MCF}_{\text{MMSC}} \right] \times 0.662 \text{ kg CH}_4/\text{m}^3 \times 1 \text{ metric ton}/1000 \text{ kg} \right] \quad (\text{Eq. JJ–2})
\]

Where:
- **MMSC** = Manure management systems component.
- **TVS$_{\text{AT}}$** = Total volatile solids excreted by animal type, calculated using Equation JJ–3 of this section (kg/day).
- **VS$_{\text{MMSC}}$** = Fraction of the total manure for each animal type that is managed in MMS component MMSC, assumed to be equivalent to the fraction of VS in each MMS component.
- **VS$_{\text{ss}}$** = Volatile solids removal through solid separation; if solid separation occurs prior to the MMS component, use a default value from Table JJ–4 of this section; if no solid separation occurs, this value is set to 0.
- **(B$_0$)$_{\text{AT}}$** = Maximum CH$_4$-producing capacity for each animal type, as specified in Table JJ–2 of this section (m$^3$ CH$_4$/kg VS).
- **MCF$_{\text{MMSC}}$** = CH$_4$ conversion factor for the MMS component, as specified in Table JJ–5 of this section (decimal).

\[
\text{TVS}_{\text{AT}} = \text{Population}_{\text{AT}} \times \text{TAM}_{\text{AT}} \times \text{VS}_{\text{AT}}/1000 \quad (\text{Eq. JJ–3})
\]

Where:
- **TVS$_{\text{AT}}$** = Daily total volatile solids excreted per animal type (kg/day).
- **Population$_{\text{AT}}$** = Average annual animal population contributing manure to the manure management system by animal type (head) (see description in §98.363(a)(1) and (1) below).
- **TAM$_{\text{AT}}$** = Typical animal mass for each animal type, using either default values in Table JJ–2 of this section or farm-specific data (kg/head).
- **VS$_{\text{AT}}$** = Volatile solids excretion rate for each animal type, using default values in Table JJ–2 or JJ–3 of this section (kg VS/day/1000 kg animal mass).

(1) Average annual animal populations for static populations (e.g., dairy cows, breeding swine, layers) must be estimated by performing an animal inventory or review of facility records once each reporting year.

(2) Average annual animal populations for growing populations (meat animals such as beef and veal cattle, market swine, broilers, and turkeys) must be estimated each year using the average number of days each animal is kept at the facility and the number of animals produced annually, and an equation similar or equal to Equation JJ–4 below, adapted from Equation 10.1 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10.
Environmental Protection Agency § 98.363

Population\(_{AT}\) = Days onsite\(_{AT}\) \times \left( \frac{\text{NAPA}_{AT}}{365} \right) \quad \text{(Eq. JJ-4)}

Where:
- Population\(_{AT}\) = Average annual animal population (by animal type).
- Days onsite\(_{AT}\) = Average number of days the animal is kept at the facility, by animal type.
- NAPA\(_{AT}\) = Number of animals produced annually, by animal type.

(b) For each digester, calculate the total amount of CH\(_4\) emissions, and then sum the emissions from all digesters, as shown in Equation JJ-5 of this section.

\[
\text{H}_4 \text{ Emissions}_{AD} = \sum_{i=1}^{AD} (\text{CH}_4C - \text{CH}_4D + \text{CH}_4L) \quad \text{(Eq. JJ-5)}
\]

Where:
- CH\(_4\) Emissions\(_{AD}\) = CH\(_4\) emissions from anaerobic digestion (metric tons/yr).
- AD = Number of anaerobic digesters at the manure management facility.
- CH\(_4\)C = CH\(_4\) flow to digester combustion device, calculated using Equation JJ-6 of this section (metric tons CH\(_4\)/yr).
- CH\(_4\)D = CH\(_4\) destruction at digesters, calculated using Equation JJ-11 of this section (metric tons CH\(_4\)/yr).
- CH\(_4\)L = Leakage at digesters calculated using Equation JJ-12 of this section (metric tons CH\(_4\)/yr).

(1) For each digester, calculate the annual CH\(_4\) flow to the combustion device (CH\(_4\)C) using Equation JJ-6 of this section. A fully integrated system that directly reports the quantity of CH\(_4\) flow to the digester combustion device requires only summing the results of all monitoring periods for a given year to obtain CH\(_4\)C.

\[
\text{CH}_4C = \left( V \times \frac{C}{100} \times 0.0423 \times \frac{520^\circ R}{T} \times \frac{P}{1 \text{ atm}} \times \frac{0.454 \text{ metric ton}}{1,000 \text{ pounds}} \right) \quad \text{(Eq. JJ-6)}
\]

Where:
- CH\(_4\)C = CH\(_4\) flow to digester combustion device (metric tons CH\(_4\)/yr).
- V = Average annual volumetric flow rate, calculated in Equation JJ-7 of this subsection (cubic feet CH\(_4\)/yr).
- C = Average annual CH\(_4\) concentration of digester gas, calculated in Equation JJ-8 of this section (% wet basis).
- 0.0423 = Density of CH\(_4\) lb/ scf (at 520 °R or 60 °F and 1 atm).
- T = Average annual temperature at which flow is measured, calculated in Equation JJ-9 of this section (°R).
- P = Average annual pressure at which flow is measured, calculated in Equation JJ-10 of this section (atm).

(2) For each digester, calculate the average annual volumetric flow rate, CH\(_4\) concentration of digester gas, temperature, and pressure at which flow are measured using Equations JJ-7 through JJ-10 of this section.
§ 98.363

\[
V = \frac{\sum_{n=1}^{\text{OD}} V_n \times 1,440 \text{ minutes}}{\text{OD}} \quad \text{(Eq. JJ-7)}
\]

Where:
- \( V \) = Average annual volumetric flow rate (cubic feet CH\(_4\)/yr).
- \( \text{OD} \) = Operating days, number of days per year that the digester was operating (days/yr).
- \( V_n \) = Daily average volumetric flow rate for day \( n \), as determined from daily monitoring as specified in §98.364 (acfm).

\[
C = \frac{\sum_{n=1}^{\text{OD}} C_n}{\text{OD}} \quad \text{(Eq. JJ-8)}
\]

Where:
- \( C \) = Average annual CH\(_4\) concentration of digester gas (% wet basis).
- \( \text{OD} \) = Operating days, number of days per year that the digester was operating (days/yr).
- \( C_n \) = Average daily CH\(_4\) concentration of digester gas for day \( n \), as determined from daily monitoring as specified in §98.364 (% wet basis).

\[
T = \frac{\sum_{n=1}^{\text{OD}} T_n}{\text{OD}} \quad \text{(Eq. JJ-9)}
\]

Where:
- \( T \) = Average annual temperature at which flow is measured (°R).
- \( \text{OD} \) = Operating days, number of days per year that the digester was operating (days/yr).
- \( T_n \) = Temperature at which flow is measured for day \( n \) (°R).

(3) For each digester, calculate the CH\(_4\) destruction at the digester combustion device using Equation JJ–11 of this section.

\[
\text{CH}_4D = \text{CH}_4C \times \text{DE} \times \text{OH/Hours} \quad \text{(Eq. JJ-11)}
\]

Where:
- \( \text{CH}_4D \) = CH\(_4\) destruction at digester combustion device (metric tons CH\(_4\)/yr).
- \( \text{CH}_4C \) = Annual quantity of CH\(_4\) flow to digester combustion device, as calculated in Equation JJ–6 of this section (metric tons CH\(_4\)).
- \( \text{DE} \) = CH\(_4\) destruction efficiency from flaring or burning in engine (lesser of manufacturer’s specified destruction efficiency and 0.99). If the gas is transported off-site for destruction, use DE = 1.
- \( \text{OH} \) = Number of hours combustion device is functioning in reporting year.
- \( \text{Hours} \) = Hours in reporting year.

(4) For each digester, calculate the CH\(_4\) leakage using Equation JJ–12 of this section.

\[
\text{CH}_4L = \text{CH}_4C \times \left( \frac{1}{\text{CE}} - 1 \right) \quad \text{(Eq. JJ-12)}
\]
Environmental Protection Agency

§ 98.364 Monitoring and QA/QC requirements.

(a) Perform an annual animal inventory or review of facility records (for static populations) or population calculation (for growing populations) to determine the average annual animal population for each animal type (see description in §98.363(a)(1) and (2)).

(b) Perform an analysis on your operation to determine the fraction of total manure by weight for each animal type.