

Strategy Used by the Farm Manure to Energy Initiative to Ensure Farm-Scale Thermal Manure to Energy Project Compliance with the Clean Air Act

Two sections of the Clean Air Act potentially apply to on-farm thermal technologies using manure or poultry litter as a fuel source. These rules fall under Section 129 of the Clean Air Act, which addresses emissions from combustion of solid waste (i.e. incineration), and Section 112 of the Clean Air Act, which addresses emissions of air toxics from the combustion of fuel in systems used to produce and capture energy. Both Section 112 and Section 129 cover combustion technologies, but Section 129 requirements for combustion of solid waste are much stricter than Section 112 requirements for the combustion of fuel in systems used to produce energy.

The key to ensuring the proposed farm-scale thermal system falls under the purview of Section 112 for combustion of fuels and not Section 129 for incineration of solid wastes is to ensure that the farm's manure or poultry litter meets EPA's fuel legitimacy criteria. Although manure and poultry litter are not "traditional fuels" like coal and wood, EPA recognized that they can have legitimate fuel value in some circumstances. The EPA Non-Hazardous Secondary Materials (NHSM) rule ([Title 40 Part 241 Subpart B § 241.3](#)) details the process for determining whether a non-hazardous secondary material meets EPA's fuel legitimacy criteria. For farm-scale thermal systems where only manure or poultry litter produced on the farm is proposed for use as a fuel, the NHSM rule is designed to be self-implementing. In other words, the farmer determines, without any EPA or other regulatory agency involvement, whether the manure meets EPA's fuel legitimacy requirements when combusted in the proposed thermal technology. (Upon request, EPA will review these determinations and issue a written opinion, but that process is not required.)

The Farm Manure to Energy Initiative partners developed a checklist to help farm partners participating in the project self-determine whether their poultry litter met EPA's fuel legitimacy criteria. The checklist was developed with feedback from USDA and U.S. EPA staff (in particular, with support from U.S. EPA Region 3 staff), but it is not an official EPA or USDA guidance document. Farmers who are interested in using this approach for the NHSM fuel-legitimacy process should [contact their regional EPA office](#) to determine whether this is acceptable in their region, or if they have questions or need more information on the self-determination or non-waste determination process.

The NHSM rule also notes that farmers who choose to use the self-determination approach should keep records documenting the rationale for their decision including any documents used in the decision making process (such as lab analysis of poultry litter heat value and contaminant levels). Written justification for the determination decision and any other documents justifying the decision process would also be appropriate.

It is also important to note that the checklist (and self-determination process) should be considered in context with other information necessary for determining whether an on-farm thermochemical energy production system is the right choice for an individual operation. Other useful tools in this decision making process include (but are not limited to) an [on-farm energy audit](#), a [comprehensive nutrient management plan](#), advice from conservation and financial professionals familiar with the farm operation, consultation with the integrator, [available funding resources](#), and information from state permitting agencies on what permits are required for on-farm thermochemical systems.

[EPA regional staff](#) can provide additional guidance on compliance with federal rules. Resources for compliance with Section 112 rules for boilers (the most common rule that would apply to farm-scale technologies) is available on EPA's website for [Boiler Compliance at Area Sources](#) (www.epa.gov/boilercompliance/). Generally, farm-scale systems require submission of an initial

notification form and biennial tune-up form. Depending on the state, these forms may need to be submitted directly to the regional EPA office or they may need to be submitted to the state air permitting agency. EPA regional staff or regional air permitting agency staff can help determine where these forms should be submitted.

According to the NHSM rule, poultry litter (or other solid manure) is not solid waste when combusted if the poultry litter is used as a fuel in a combustion unit that remains within control of the poultry litter generator¹ and that meets the legitimacy criteria as follows:

- A. The poultry litter must be managed as a valuable commodity based on the following:
 - a. Storage of poultry litter must not exceed “reasonable timeframes”.

Note: EPA recognizes that the term “reasonable timeframe” varies by industry. Typically, poultry litter is stored until the appropriate time of year for fertilizer application. Generally, litter is not stored for longer than one year. If poultry litter used in an on-farm combustion system is stored for longer than one year, the producer should document why this is a more economical approach than storing for a shorter period of time. Further, if older litter is proposed as a fuel for a thermochemical system, older litter should be used as the basis for fuel value and contaminant level laboratory analysis.

- b. The poultry litter must be managed in a manner that is similar to traditional fuels and contained to prevent releases to the environment.

Note: poultry litter is typically kept covered prior to land application – this is also important for management as a fuel. Producers should document how the litter will be stored and what methods are used to prevent water from coming into contact with the litter. Contact with water would diminish fuel value and increase risk for pollution.

- B. Poultry litter must have a meaningful heating value (as fed) and be used as fuel in a combustion unit that recovers energy. If the heating value of the poultry litter as fed to the thermochemical unit is below 5,000 Btu/lb, the farmer must document that he/she can cost-effectively recover energy from the poultry litter.

- C. Poultry litter must contain contaminants at levels comparable to or lower than traditional fuels.

Notes: If the combustion unit is capable of burning coal and wood, ranges of contaminants in coal and wood can be used as a basis for comparison. Except for nitrogen oxides (NO_x), actual air emissions of the proposed thermochemical technology are not relevant to the waste/non-waste determination. However, they may be important for state permitting and they are also necessary for determining whether the proposed technology is safe for installation on farms where families and employees live and work close by.

¹ Within control of the generator means that the material is generated and burned in combustion units at the generating facility; or the material is generated and burned in combustion units at different facilities, provided the facility combusting the material is controlled by the generator; or both the generating facility and the facility combusting the material are under the control of the same person (40 CFR 241.2).

Self-Determination Checklist

This checklist was developed with EPA and USDA feedback by the Farm Manure to Energy Initiative partners to support the self-determination process for farmers participating in the project per the EPA Non-Hazardous Secondary Materials (NHSM) rule ([Title 40 Part 241 Subpart B § 241.3](#)) for determining whether poultry litter used in an on-farm thermal manure to energy technology meets EPA's fuel legitimacy criteria. For questions regarding whether this checklist approach is acceptable for the self-determination process in your state or region, contact your regional [EPA non-hazardous secondary materials staff](#).

- Yes No The poultry litter will be generated on the farm and used on the farm (or within control of the generator) in an energy recovery unit for the purpose of generating recoverable heat or electricity for use on the farm or distribution on the grid.
- Yes No No other material feedstocks are used in the combustion except for poultry litter and/or other feedstocks recognized as traditional fuels (such as coal, wood, and clean biomass), and no poultry litter will be imported from other farms.
- Yes No Is the storage and material handling system designed to prevent releases of poultry litter to the environment? For example, is the poultry litter stored in a shed or other structure that prevents contact between poultry litter and rain, surface water, and groundwater? Are spills that may occur transporting the litter cleaned up quickly?
- Yes No Is the poultry litter used as fuel in a reasonable timeframe? Specifically, if the poultry litter is stored for longer than one-year, has an economic analysis or justification for why this is necessary been completed?
- Yes No Do the poultry litter contaminant levels proposed for use (i.e. as fed) in the on-farm energy recovery unit fall within the contaminant ranges for coal, wood or other traditional fuels that the energy recovery unit is capable of using as feedstock? (See Table 1 -3 for ranges of contaminant levels in coal and wood and notes below for further clarification).
- Yes No Poultry litter proposed for use (i.e. as fed) to create heat or electricity has an energy value of 5,000 Btu/lb or greater as fed to the energy recovery unit (i.e. high heating values for dry or dry/ash-free basis are not appropriate for this determination).

If the answer to the question above is no (i.e. if the poultry litter proposed for use as feedstock has an energy value less than 5000 Btu/lb as fed to the energy recovery unit), it is important to determine whether energy can be cost-effectively recovered from the energy recovery unit. Specifically, the preamble to the NHSM rule (76 FR 15523) indicates that a lower heating value could meet the meaningful heating value criteria if it can be demonstrated that the unit can cost effectively recover energy from the NHSM (in this case, the manure or poultry litter). Factors in making that determination include: 1) cost savings from not purchasing traditional fuels that would otherwise be needed; 2) whether the NHSM is to be used as a fuel; 3) whether the NHSM can self-sustain combustion; and 4) whether the operation produces energy that is sold for a profit.

Notes on comparing contaminants in poultry litter to contaminants in traditional fuels:

- If individual farms know that certain contaminants will not be present in poultry litter, or will be present at levels well below those found in the traditional fuel, the farms do not need laboratory testing for these contaminants. The farmers may know this based on their knowledge of the materials and/or prior testing (by either the farmer or outside parties).
- If an individual farm's poultry litter is tested for contaminants and fuel value, recurring testing is not necessary unless operations change in a way that affects the composition of the poultry litter. For example, the following scenarios could result in changes in the contaminant levels or fuel value of poultry litter (note there may be other management changes not listed here that could also warrant additional testing):
 - Change in the poultry feed (this could change contaminant concentrations associated with feed components such as trace metals);
 - Change in the bedding used (i.e. to a material that is not categorized as a traditional fuel or to a material that has a lower fuel value);
 - Change in the frequency of poultry house cleanouts etc. (older poultry litter may have a lower fuel value).
 - Change in chemical amendment added for treatment of poultry house waste (i.e. amendments added to reduce ammonia emissions or bind phosphorus).
- When comparing contaminants in poultry litter to the range of values in traditional fuels, a single data point, median, or average value for poultry litter near the maximum value for traditional fuel may not be sufficient evidence that contaminant levels are comparable. In such cases, more than one representative sample (collected according to established protocols that ensure poultry litter samples are representative of the poultry litter proposed for use as fuel) could be analyzed to show that the range of contaminant values falls within the range of contaminant values for traditional fuel(s). Note that in the [final NHSM rule²](#) (pages 9141-9142) EPA clarified that the contaminant definition does not consider nitrogen to be a contaminant if a specific combustion technology prevents NO_x from forming in the first place. Therefore, if a low NO_x emissions technology is proposed, it is possible that some portion of the total nitrogen content of the manure or poultry litter proposed for use as a fuel would not be considered a contaminant if it does not form NO_x in the combustion system.
- Coal or wood can be used as the traditional fuel for contaminant comparison purposes if the energy recovery unit is capable of using coal or wood as a feedstock (even if it is not designed or proposed to do so). EPA provides contaminant ranges for traditional fuels on their [website³](#). The contaminant ranges for coal and wood are also provided in Tables 1 through 3 below. Table 1 provides contaminant ranges for coal and wood combined. Tables 2 and 3 list ranges of contaminants for coal and wood separately. The combined solid fuel contaminant table (Table 1) can be used for contaminant comparison purposes if the proposed energy recovery unit could theoretically use either coal or wood as a fuel source.

² Published on February 7, 2013, pages 9141-9142. Accessed online on December 2, 2013: <http://www.epa.gov/osw/nonhaz/define/rulemaking.htm#122012>

³ *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011* can be found at www.epa.gov/epawaste/nonhaz/define/index.htm. Information in the tables was accessed December 2, 2013: http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf

Table 1. Ranges of contaminants in traditional solid fuels (coal and wood combined) that can typically be used as a basis for contaminant comparison for thermochemical technologies that can burn both coal and wood as well as poultry litter.⁴

Traditional Solid Fuel Contaminant	Units	Range
Metal elements – dry basis*		
Antimony (Sb)	ppm	ND - 26
Arsenic (As)	ppm	ND - 298
Beryllium (Be)	ppm	ND - 206
Cadmium (Cd)	ppm	ND - 19
Chromium (Cr)	ppm	ND - 340
Cobalt (Co)	ppm	ND - 213
Lead (Pb)	ppm	ND - 229
Manganese (Mn)	ppm	ND – 15,800
Mercury (Hg)	ppm	ND - 3.1
Nickel (Ni)	ppm	ND - 730
Selenium (Se)	ppm	ND - 74.3
Non-metal elements - dry basis*		
Chlorine (Cl)**	ppm	ND – 9,080
Flourine (F)	ppm	ND - 300
Nitrogen (N)	ppm	200 - 54,000
Sulfur (S)	ppm	ND - 61,300
Hazardous air pollutant (HAP) compounds**		
Benzene	ppm	ND - 38
Ethyl benzene	ppm	0.7 - 5.4
Formaldehyde***	ppm	1.6-27
16-PAH	ppm	6 - 253
PAH (52 extractable)	ppm	14 - 2,090
Styrene	ppm	1.0 - 26
Toluene	ppm	8.6 - 56
Xylenes	ppm	4.0 - 28
<p>* Ranges from OAQPS database. **Ranges from literature cited in EPA coal contaminant concentration in traditional fuels Tables for Comparison. Nov. 29, 2011 (except for formaldehyde – see *** below). ***Ranges for formaldehyde are for wood only and are from one literature source (T. Hunt, 2011) only.</p>		

⁴ Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011 can be found at www.epa.gov/epawaste/nonhaz/define/index.htm. Information in the tables was accessed December 2, 2013: [http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm cont tf.pdf](http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf)

Table 2. Ranges of contaminants in coal.⁵

Coal Contaminant	Units	Range
Metal elements – dry basis*		
Antimony (Sb)	ppm	ND - 6.9
Arsenic (As)	ppm	ND - 174
Beryllium (Be)	ppm	ND - 206
Cadmium (Cd)	ppm	ND - 19
Chromium (Cr)	ppm	ND - 168
Cobalt (Co)	ppm	ND - 25.2
Lead (Pb)	ppm	ND - 148
Manganese (Mn)	ppm	ND - 512
Mercury (Hg)	ppm	ND - 3.1
Nickel (Ni)	ppm	ND - 730
Selenium (Se)	ppm	ND - 74.3
Non-metal elements - dry basis*		
Chlorine (Cl)	ppm	ND - 9,080
Flourine (F)	ppm	ND - 178
Nitrogen (N)	ppm	13,600 - 54,000
Sulfur (S)	ppm	740 - 61,300
Hazardous air pollutant (HAP) compounds**		
Benzene	ppm	ND - 38
Ethyl benzene	ppm	0.7 - 5.4
16-PAH	ppm	6 - 253
PAH (52 extractable)	ppm	14 - 2,090
Styrene	ppm	1.0 - 26
Toluene	ppm	8.6 - 56
Xylenes	ppm	4.0 - 28
* Ranges from OAQPS database **Ranges from literature cited in EPA contaminant concentration in traditional fuels Tables for Comparison. Nov. 29, 2011.		

⁵ Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011 can be found at www.epa.gov/epawaste/nonhaz/define/index.htm. Information in the tables was accessed December 2, 2013: http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf

Table 3. Ranges of contaminants in wood and biomass materials.⁶

Coal Contaminant	Units	Range*
Metal elements – dry basis*		
Antimony (Sb)	ppm	ND - 26
Arsenic (As)	ppm	ND - 298
Beryllium (Be)	ppm	ND - 10
Cadmium (Cd)	ppm	ND - 17
Chromium (Cr)	ppm	ND - 340
Cobalt (Co)	ppm	ND - 213
Lead (Pb)	ppm	ND - 340
Manganese (Mn)	ppm	ND - 15,800
Mercury (Hg)	ppm	ND - 1.1
Nickel (Ni)	ppm	ND - 540
Selenium (Se)	ppm	ND - 9.0
Non-metal elements - dry basis*		
Chlorine (Cl)	ppm	ND – 9,080
Flourine (F)	ppm	ND - 300
Nitrogen (N)	ppm	200 - 39,500
Sulfur (S)	ppm	ND - 8,700
Hazardous air pollutant (HAP) compounds*		
Formaldehyde	ppm	1.6 - 27
* Ranges from OAQPS database and or literatures cited in EPA contaminant concentration in traditional fuels tables for comparison available online at: http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf		

⁶ *Contaminant Concentrations in Traditional Fuels: Tables for Comparison, November 29, 2011* can be found at www.epa.gov/epawaste/nonhaz/define/index.htm. Information in the tables was accessed December 2, 2013: http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf