Appendix B: Technical Requirements for Entering the Animal Mortality BMPs into CAST

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Background: In June, 2013 the Water Quality Goal Implementation Team (WQGIT) agreed that each BMP expert panel would work with CBPO staff and the Watershed Technical Workgroup (WTWG) to develop a technical appendix for each expert panel report. The purpose of this technical appendix is to describe how a load source reduction value for animal mortality BMPs can be incorporated as an approved BMP in CAST-23. With an expectation of full Expert Panel recommendations being approved in Fall 2021, the practices can be incorporated as planning BMPs in CAST-21. Some aspects of the panel's recommendations may not be applicable until Phase 7 of the Watershed Model.

Q1. What practices will be available for planning scenarios in CAST-21 and as approved BMPs in CAST-23? Are any current planning or approved BMPs affected or superseded by these new practices?

A1. Following adoption of the panel's recommendations the following BMPs will be available in CAST, and reportable to NEIEN, but will not be simulated as part of official Progress scenarios until 2023-2024 Progress.

The previously existing Mortality Composters BMP will be … [Editor's Note: The current Mortality Composters BMP relates to NRCS 316, is tracked by number of systems and has a 15 year credit duration. The assumption is that the new mortality composting BMP will eliminate the prior practice, but we'll want to discuss this among the WTWG.]

The current planning-only BMP for broiler mortality freezers will be eliminated and replaced in favor of the rendering BMP, which often includes the use of freezers or refrigeration units.

Animal mortality disposal – landfill or rendering is the handling, storage and disposal of poultry, livestock or other routine animal mortalities by internment in a landfill or processing at a rendering facility. Landfills may include municipal or private facilities that are willing and able to receive routine animal mortalities. Rendering is a well-established industry that recycles animal carcasses into potentially marketable products such as meal, fat, tallow and water though physical and chemical transformations. Aside from animal type, report AU of operation implementing the practice, or dry weight (lbs) of total mortalities disposed this way. [Editor's note: WTWG preference for tons or lbs?]

Animal mortality disposal – burial is the handling and disposal of poultry, livestock or other routine animal mortalities by placing the carcass or carcasses below ground into an excavated pit, hole, or trench, which is then covered or capped. Factors such as burial depth, and whether the pit is lined, will vary based on local conditions and requirements. There is possibility of some contamination of soil, groundwater or surface water within 1-2m of the pit.

Animal mortality disposal – incineration is the handling, storage and disposal of poultry, livestock or other routine animal mortalities by thermochemical conversion using combustion, gasification, pyrolysis, or some combination of those methods. The methods result in gaseous and solid byproducts. Most nitrogen is transformed and lost to the atmosphere, while all phosphorus remains available or land application or transport.

Animal mortality disposal – composting is the handling, storage and disposal of poultry, livestock or other routine animal mortalities by composting. Composting is an aerobic biological process to stabilize organic materials such as animal tissue, which requires addition of dry carbon-rich materials to control release of moisture. Composting of mortalities consists of two phases: active composting (110°F-160°F), and curing (ambient to 110°F). Additional water is generally not needed during the active phase of composting due to the high moisture content of carcasses. Methods of composting may include one or more of the following, alone or in combination: static piles and windrows (a.k.a. passive piles), turned windrows, static aerated windrows, a bin system, a tunnel composter, or in-vessel composter such as a rotating drum. Most nitrogen and all phosphorus is retained in the final compost product for field application or transport. Some nitrogen is transformed and lost to the atmosphere and some is also lost across the surface or via leaching.

Q1. What are the reductions a jurisdiction can claim for planning purposes under these practices in the Phase 6 Watershed Model?

A1. To simulate these practices in the Phase 6 watershed model, the panel's recommended estimates of TN and TP pathways are combined with the panel's estimated loads of animal mortalities, either based on AU of production or inventory (Table B.1), or the reported weight of mortalities (Table B.2). For animal types raised for meat (broilers, turkeys, beef cattle, swine) the AUs are based on production while other animals types the AUs are based on inventory (layers, dairy, equidae).

Table B.1. Estimated weight of mortality nutrients produced by farms on a per AU (1,000 pounds liveweight) basis.

Type of Farm	Characteristic Animal(s)	Weight of Mortality Nutrients Produced per Farm (Lbs. AU^{-1} $year^{-1}$)	
		TN	TP
Poultry			
Broiler	6 lb. Market Birds	1.8	0.25
Layer	Laying Hens	2.2	0.40
Tom Turkey	48 lb. Market Toms	2.5	0.33
Hen Turkey	25 lb. Market Hens	2.5	0.32
Swine	270 lb. Market Hog	1.5	0.34
Cattle			
Cow-Calf Herd	Mother Cow	0.65	0.19
Cattle Feedlot	Heifer and Steer Capacity	0.47	0.14
Dairy	Mature Cows (Milking and Dry)	1.9	0.57
Equidae	1,150 lb. Horse	0.34	0.12

Table B.2 – Estimated average carcass composition for TN and TP by animal type, for use if reporting by carcass weight

	TN	TP
Broilers	2.82%	0.375%
Layers	3.97%	0.70%
Turkeys	2.46-2.93% (2.695% average)	0.375%
Swine	2.54%	0.563%
Cattle (beef)	2.827%	0.82%
Dairy	2.827%	0.82%
Equidae	3.2%	0.95%

Using the values in Table B.1 (for AUs) or B.2 (for carcass weight) yields the total amount of TN and TP that is affected by the mortality practices. Each mortality BMP has different transfer efficiencies as described by the expert panel, as summarized in the left-side columns in Table B.3 that are taken from Table ES.3 in the panel report ("mass percentage of carcass nutrients exiting the method"). To understand the pathways of nutrients in terms of the Watershed Model, these transfer efficiencies are converted into coefficients that articulate the fate of those nutrients as they are either: (a) leftover for transport or field application; (b) removed from the overall system or the agriculture sector simulated in the model, or; (c) are lost to the environment from the conceptual "barnyard."

Table B.3. Potential movement of nutrients during implementation of a disposal method, fallback values.

	Mass Percentage of Carcass Nutrients Exiting the Method (%)					**Portion of carcass nutrients that follow one of three fates in the watershed model (a, b, or c)**		
	Nutrients recycled with end products in the farm nutrient management plan		**Nutrients emitted to the atmosphere**	**Nutrients leaving the method by all other pathways**		**(a) "Left for transport or application" coefficient**	**(b) "Removal" coefficient**	**(c) "Loss from barnyard" coefficient**
	TN	**TP**	**TN**	**TN**	**TP**	**TN/TP**	**TN/TP**	**TN/TP**
Burial	0	0	0	15	5	0/0	0.85/0.95	0.15/0.05

Composting	80	100	10	10	0	0.8/1	0.1/0	0.1/0
Incineration	25	100	75	0	0	0.25/1	0.75/0	0/0
Landfilling	0	0	0	0	0	0/0	1/1	0/0
Rendering	0	0	0	0	0	0/0	1/1	0/0

If reporting based on production or inventory (AUs): Combining the estimated weights from Table B.1 with coefficients of Table B.3 yields the values in Table B.4, which gives the pounds of TN and TP that either (a) remains for transport or field application, (b) is removed from the system, or (c) is lost to the environment, as it pertains for each of the four BMPs.

For example, … [Editor's note: Examples forthcoming]

Table B.4. Estimated amount of TN and TP remaining for transport, removed, or lost from barnyard for burial, composting, incineration or rendering/landfill, per AU of animal type

	Burial						Composting					
	Amount left for transport or application		Amount removed		Amount lost from barnyard		Amount left for transport or application		Amount removed		Amount lost from barnyard	
	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP
Broiler	0	0	1.53	0.24	0.27	0.01	1.44	0.25	0.18	0	0.18	0
Layer	0	0	1.87	0.38	0.33	0.02	1.76	0.40	0.22	0	0.22	0
Turkey	0	0	2.13	0.31	0.38	0.02	2.00	0.33	0.25	0	0.25	0
Swine	0	0	1.28	0.32	0.23	0.02	1.20	0.34	0.15	0	0.15	0
Dairy	0	0	1.62	0.54	0.29	0.03	1.52	0.57	0.19	0	0.19	0
Beef	0	0	0.40	0.13	0.07	0.01	0.38	0.14	0.05	0	0.05	0
Other Cattle	0	0	0.55	0.18	0.10	0.01	0.52	0.19	0.07	0	0.07	0
Horses	0	0	0.29	0.11	0.05	0.01	0.27	0.12	0.03	0	0.03	0

	Incineration						Rendering or Landfill					
	Amount left for transport or application		Amount removed		Amount lost from barnyard		Amount left for transport or application		Amount removed		Amount lost from barnyard	
	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP	TN	TP
Broiler	0.45	0.25	1.35	0	0	0	0	0	1.80	0.25	0	0
Layer	0.55	0.40	1.65	0	0	0	0	0	2.20	0.40	0	0
Turkey	0.63	0.33	1.88	0	0	0	0	0	2.50	0.33	0	0
Swine	0.38	0.34	1.13	0	0	0	0	0	1.50	0.34	0	0
Dairy	0.48	0.57	1.43	0	0	0	0	0	1.90	0.57	0	0
Beef	0.12	0.14	0.35	0	0	0	0	0	0.47	0.14	0	0
Other Cattle	0.16	0.19	0.49	0	0	0	0	0	0.65	0.19	0	0
Horses	0.09	0.12	0.26	0	0	0	0	0	0.34	0.12	0	0

If reporting based on known weight of carcasses, then the weight can be multiplied by the values in Table B.2. The coefficients in Table B.3 would then be applied to yield the net load reduction of TN and TP.

For example, [Editor's Note: example(s) forthcoming]

Q2. What types of projects are eligible to receive credit in the Phase 6 Watershed Model?

A2. These BMPs… [text forthcoming]

Q3. **How do the new BMPs relate to existing NEIEN practices and what will jurisdictions need to submit to NEIEN to receive credit for broiler mortality freezers upon its approval for progress?**

A3. For now, these BMPs are for planning purposes only until CAST-23, but they can be reported into NEIEN immediately, but they will not be credited for progress until 2023-2024 Progress..

The table below summarizes the new BMPs' names in NEIEN and how they relate to existing BMPs within NEIEN. Please note that each BMP is applicable to any animal type, which will also need to be specified in the NEIEN submission. Editor's Note: This will be updated based on WTWG and jurisdictional input.

Table B.5 – Comparison of existing and proposed NEIEN and CAST BMP names based on expert panel recommendations

Existing NEIEN BMP name (if applicable)	NRCS CP number or other common names if applicable	BMP name based on EP recommendations	Measurement unit(s)	Proposed NEIEN BMP name	Existing CAST BMP name (if applicable)	Proposed CAST BMP Name
Animal Mortality Facility	NRCS 316	mortality composting	Number of systems		Mortality Composters	Will become part of "Animal mortality disposal – composting"
			Tons of carcasses OR AUs treated			Animal mortality disposal – composting
			Dry tons of broiler carcasses		Broiler Mortality Freezers*	This will be part of the new rendering BMP

		Rendering	Tons of carcasses OR AUs treated		-	Animal mortality disposal – rendering or landfill
		Landfill	Tons of carcasses OR AUs treated		-	Animal mortality disposal – rendering or landfill
		Burial	Tons of carcasses OR AUs treated		-	Animal mortality disposal – burial
		Incineration	Tons of carcasses OR AUs treated		-	Animal mortality disposal - incineration

* Planning BMP only

Specifically, the jurisdictions will need to report the following into NEIEN:

- *BMP Name*: Practice name (e.g., Animal mortality disposal - incineration, Animal mortality disposal – burial, Animal mortality disposal – Composting, Animal mortality disposal – Rendering or landfill)
- *Measurement Names*:
    - Unit – Each practice can be reported in terms of the animal carcasses weight (tons) OR in terms of the animal units (AUs) serviced by the mortality BMP
    - Animal Type – You will be asked to report the animal type (e.g., "Broilers")
    - County From – FIPs code associated with the county in which the mortalities were generated (only for Animal mortality disposal – incineration and Animal mortality disposal – composting)
    - County To – FIPs code associated with the county to which mortalities were transported after treatment by the technology (only for Animal mortality disposal – incineration and Animal mortality disposal – composting)
- *Geographic Location:* Qualifying NEIEN geographies including: Latitude/Longitude; *or* County; *or* Hydrologic Unit Code (HUC12, HUC10, HUC8, HUC6, HUC4); *or* State in which the facility is located
- *Date of Implementation:* Year the mortality treatment was done (specific MM/DD/YYYY is required for NEIEN)
- *Load sources*: Permitted feeding operation, non-permitted feeding operation, feeding operation

Q4. What should a jurisdiction include in CAST in order to receive credit for these practices?

A4. Jurisdictions must include the animal type and either the production/inventory of the operation (AUs) or the weight (tons) of carcasses disposed using the BMP. Since these are also transport BMPs, the user must also know the county in which the carcasses originated and the county to which they are transported.

Q5. What should a jurisdiction report for the county where the carcasses were transported if the carcass nutrients are not reapplied to agricultural land?

A5. In these situations, jurisdictions may leave the county receiving transport field blank so it is a null value in the same way jurisdictions currently report manure that is, for example, resold as soil amendments at home improvement stores.

Q6. Which land use categories are eligible to receive nutrient reduction credit from mortality BMPs in the Phase 6 Watershed Model?

A6. In the Phase 6 Watershed Model, nutrient reductions from mortality BMPs could be applied to permitted feed operations or non-permitted feed operations. If neither land use is provided, the credit will be applied to the default category, "feed operations", and the reduction credit would be distributed proportionally between permitted and non-permitted feed operation land uses.

Q7. Are these BMPs annual or cumulative practices?

A7. These BMPs are all annual practices.

Q8. How does this relate to the previous planning BMP for "Broiler Mortality Freezers"?

A8. Back in 2019 the AgWG established a planning BMP for "broiler mortality freezers" that used value from Felton et al (2009) – part of Simpson and Weammert-Lane (2009) – to estimate a manure transport credit of 29 lbs N and 4.9 lbs P per ton of dead broiler carcass transported out of the county or watershed. The proposed new BMP for "mortality disposal – landfill or rendering " encompasses the same practice, but as part of the larger "rendering" practice that will be available as an approved BMP starting in CAST-23.

Q9. Is this practice mutually exclusive with other practices?

A9. No.

Q10. Are reported mortality BMPs assumed to have an Animal Waste Storage Facility on the property?

A10. No. Animal Waste Storage BMPs must be reported separately in order to receive simulated reductions for those practices.

Q11. How do mortality BMPs relate to other barnyard practices in the Phase 6 Model, such as Animal Waste Management Systems, Barnyard Runoff Controls and Loafing Lot Management?

A11. These practices should be tracked and reported separately. It is likely that many facilities with a mortality storage or disposal systems will also have a combination of other barnyard practices employed

on-site to control runoff from feeding and loafing lot areas. States may report multiple barnyard practices and mortality practices for the same site if applicable.