Sausage Operations Equations/Methods/Regulatory Limits (Quick Reference)

Antioxidant and Added Water Regulatory Limits for Raw Sausages

Individual Antioxidant = .01%
Antioxidants in Combination = .02%
Added Water 3% in Total Ingredients

Antioxidants Added through a Compound Calculation Steps

Step 1: Determine fat content (target or through raw materials in the formula)
Step 2: Determine % of each antioxidant/synergist in the compound
Step 3: Determine the total % of ***antioxidants*** *(i.e., add up %)*
Step 4: Determine maximum amount of antioxidant allowed using these rules
No antioxidant or synergist > 50%, multiply fat content by .02%
One antioxidant or synergist > 50%, multiply fat content by .01%
One antioxidant or synergist = 50%, multiply fat content by .01% or .02%
Step 5: Max. antioxidant allowed ÷ by ***major*** antioxidant or synergist % (when it is over 50% of total antioxidants) = max. antioxidant compound.
OR
Max. antioxidant allowed, ÷ by total antioxidants % (when no antioxidant/synergist is over 50% of the total antioxidants) = max. antioxidant compound

Ingoing Curing Agent and Curing Accelerator PPM

$$\text{ppm} = \frac{\text{lb RI} \times 1{,}000{,}000}{\text{lb meat block}}$$

RI (Restricted Ingredient) = specific curing agent or curing accelerator
Meat block = meat, meat byproducts, poultry, and/or poultry byproducts

Curing Agent Added to the Formula in a Curing Compound or Mix

$$\text{ppm} = \frac{\text{lb of cure mix} \times \%\text{ of cure agent in mix} \times 1{,}000{,}000}{\text{lb of meat block}}$$

Maximum Curing Agent or Curing Accelerator Allowed

$$\text{Max. cure agent or (curing accelerator)} = \left(\frac{\text{lb of meat block}}{100\text{ lb}}\right) \times \text{Restricted agent/accelerator level per 100 lb of meat block}$$

Regulatory Limits

Curing Agents

(1) Nitrite - **.25 oz./100 lb** of chopped meat, meat byproduct, poultry, and poultry byproduct OR **156 ppm** ingoing

(2) Nitrate - **2.75 oz./ 100 lb** of chopped meat, meat byproduct, poultry, and poultry byproduct OR **1,718 ppm** ingoing

Cure Accelerators

(1) Ascorbate/Erythorbate - **.875 oz./100 lb** of chopped meat, meat byproduct, poultry, and poultry byproduct OR **547 ppm** ingoing

(2) Ascorbic acid/ erythorbic acid - **.75 oz/100 lb** of chopped meat, meat byproduct, poultry, and poultry byproduct OR **469 ppm** ingoing

Regulatory Limits for Additives in Cooked Sausages-Based on the Projected Finished Weight (PFW)

Binders and Extenders: Cereal, NFDM, CRDSM, and many more listed is section 424.21(c) --3.5% maximum individually or collectively

Phosphates - 0.5% (5000 ppm)

PFW Calculation Steps/Ingredient Compliance Determination based on the PFW

Step 1: Remove the weight of water from the formula (batch) weight ***and*** the target % the water represents (10, 12, 15, etc.);
Step 2: Continue by removing the weight of any ingredients with a regulatory limit based on a PFW, (e.g., binders and phosphates) from the remaining formula (batch) weight ***and*** their % regulatory limit from the remaining formula %;
Step 3: Divide the remaining weight of the formula (batch) by the % it represents to determine the PFW; and then
Step 4. Multiply the PFW by the ingredient's % regulatory limit to determine maximum amount of that ingredient allowed in the formula.

Potential Pitfalls: Not removing any rework from formula (batch) weight before starting the PFW calculation and not considering water in corn syrup.

Cured Meat and Poultry Product Operations
Calculation Equation/Regulatory Limit Quick Reference

PPM Equation

$$ppm = \frac{\text{lb RI (Restricted Ingredients)} \times \% \text{ Pump} \times 1{,}000{,}000}{\text{lb Pickle}}$$

Note: If a curing compound is used, multiple the weight of the compound by the % of nitrite/nitrate in the compound to determine the weight of the nitrite/nitrate (RI).

Pump, Pick-up, Added Solution or Gain Equation

$$\%\ \text{pump, pick-up, gain} = \frac{\text{pumped wt - green wt}}{\text{green wt}} \times 100$$

Percent Yield Equation

$$\%\ \text{yield} = \frac{\text{finished wt}}{\text{green wt}} \times 100$$

Volume of Rectangular Tank Equation

$$\text{cubic inches} = (\text{length in inches}) \times (\text{width in inches}) \times (\text{height in inches})$$

Note: 1 gallon = 231 cubic inches

TABLE II
Maximum Ingoing Nitrite and Nitrate Limits (in PPM) for Meat and Poultry Products*

Curing Agent	Curing Method			
	Immersion Cured	Massaged or Pumped	Comminuted	Dry Cured
Sodium Nitrite	200	200	156	625
Potassium Nitrite	200	200	156	625
Sodium Nitrate	700	700	1718	2187
Potassium Nitrate	700	700	1718	2187

*Except for bacon

TABLE III
Maximum Ingoing Cure Accelerators (in PPM) for Meat and Poultry Products

Cure Accelerator	Maximum Limit
Ascorbic Acid Erythorbic Acid Sodium Ascorbate Sodium Erythorbate (isoascorbate)	469 ppm* 469 ppm* 547 ppm* 547 ppm* *Except in bacon

RI Regulatory Limits for Pumped or Massaged Bacon

Establishment's written procedure:

- Must demonstrate 120 ppm ingoing sodium nitrite or 148 ppm potassium nitrite ***AND***

- Must demonstrate 550 ppm of sodium erythorbate or sodium ascorbate

Note: A plus or minus 20% allowance at the time of injecting or massaging.

Meat and Poultry Products with Added Solutions Calculation Equation/Quick Reference

Pump, Pick-up, Added Solution or Gain Equation for RAW Products

$$\% \text{ pump, pick-up, gain} = \frac{\text{pumped (treated) wt - green wt}}{\text{green wt}} \times 100$$

Pump, Pick-up, Added Solution or Gain Equation for COOKED Products

$$\% \text{ pump, pick-up, gain} = \frac{\text{finished wt - green wt}}{\text{finished wt}} \times 100$$