Development Document for the Proposed Effluent Limitations Guidelines and Standards for the Meat and Poultry Products Industry Point Source Category (40 CFR 432)

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Complete proposed document available at:
http://www.epa.gov/ost/guide/mpp/
The Final Development Document is available as well.

APPENDIX J

EXAMPLES OF CALCULATING MPP LIMITATIONS AND STANDARDS

Example 1: Determine the maximum monthly BPT BOD_5 limit for a complex slaughterhouse that operates 280 days per year and slaughters on average 700 cattle (1,000 lb/head) and 1,000 hogs (225 lb/head) on-site per day.

Solution 1: First calculate the amount of live weight killed (LWK) on-site.

On-site LWK = (700 cattle/day) x (1,000 lb/head) + (1,000 hogs/day) x (225 lb/head)

= 925,000 lb-LWK/day

= (925,000 lb-LWK/day) x (280 days/year) = 259 million lb-LWK/year

This facility is a complex slaughterhouse (Subpart B) and is subject to 432.22(b)(1) (i.e., facility slaughters on-site more than 50 million lb-LWK per year) which is set equivalent to 432.22(a)(1) for BOD_5, TSS, O&G, and fecal coliform bacteria.

The facility does not taken any material from an outside source so there is no adjustments to the maximum monthly BPT BOD_5 limit [0.21 kg-BOD_5/kkg-LWK (or lb-BOD_5/1,000 lb-LWK)]. This monthly BPT BOD_5 limit is taken from 432.22(b)(1), which is equivalent to 432.22(a)(1) for BOD_5, TSS, O&G and fecal coliform bacteria.

Example 2: Determine the maximum monthly BAT ammonia (as N) limit for a sausage processor that operates 280 days per year and produces 200,000 pounds of finished product (on average per day).

Solution 2: First calculate the annual amount of finished product (FP).

Annual FP = (200,000 lb-FP/day) x (280 days/year) = 56 million lb-FP/year

This facility is a sausage processor (Subpart G) and is subject to 432.73(b) (i.e., the facility generates more than 50 million lb-FP per year). The maximum monthly average limit for ammonia (as N) is 0.0153 kg-ammonia-N/kkg-FP (or lb-ammonia-N/1,000 lb-FP). [Note: The units for 432.63(b) and 432.73(b) were incorrectly given as "mg/L (ppm)". These units should read "Pounds per 1,000 lbs (or g/kg) of finished product."]

Example 3: What are the maximum monthly average BOD_5 and TSS BPT mass-based limits for a High-Processing Packinghouse which slaughters 100 million LWK pounds per year and that has an average processed meat products (lb) to average LWK (lb) ratio (v) of 0.65.

Solution 3: This facility is a high-processing packinghouse (Subpart D) and is subject to 432.42(b)(1) (i.e., facility slaughters more than 50 million lb-LWK per year) which is set equivalent to 432.42(a)(1) for BOD_5, TSS, O&G, and fecal coliform. Therefore, use the 432.42(a)(1) adjustment equation as follows:

$v = 0.65$

$$\text{lb-BOD}_5 \text{ / 1,000 lb-LWK} = 0.21 + 0.23\,(v - 0.4) = 0.21 + 0.23\,(0.65 - 0.4) = 0.2675$$
$$\sim 0.27 \text{ lb-BOD}_5 \text{ / 1,000 lb-LWK}$$

$$\text{lb-TSS/ 1,000 lb-LWK} = 0.28 + 0.30\,(v - 0.4) = 0.28 + 0.30\,(0.65 - 0.4) = 0.355$$
$$\sim 0.36 \text{ lb-TSS/ 1,000 lb-LWK}$$

Note: The maximum daily BOD_5 and TSS BPT limits are twice the maximum monthly average BOD_5 and TSS BPT limits.

Example 4: What are the maximum monthly average BOD_5 and TSS BPT limits for an independent rendering facility which handles 206,000 lb of raw material (RM) per day, operates 280 days per year, and also cures 100 hides.

Solution 4: This facility is a independent renderer (Subpart J) and is subject to 432.102 (i.e., facility uses raw material at rates greater than 10 million pounds per year, see 432.101(b)). As this facility also cures hides, use the incremental adjustment equations provided in 432.102(2) as follows:

Adjusted BPT Max. Monthly Limits = 432.102(a) BPT Max. Monthly Limits + 432.102(2) Incremental Hide Curing BPT Adjustments

432.102(a) BPT BOD_5 Max. Monthly Limit = 0.17 1b-BOD_5/1,000 lb-RM

432.102(a) BPT TSS Max. Monthly Limit = 0.21 1b-TSS/1,000 lb-RM

BOD_5 Incremental Hide Curing Adjustment = [17.6 x (No. of Hides)]/lb-RM
= [17.6 x 100]/206,000
= 0.0085 1b-BOD_5./1,000 lb-RM

TSS Incremental Hide Curing Adjustment = [24.2 x (No. of Hides)]/lb-RM
= [24.2 x 100]/206,000
= 0.012 1b-TSS/1,000 lb-RM

Adjusted BOD_5 BPT Max. Monthly Limit = (0.17 1b-BOD_5/1,000 lb-RM) + (0.0085 1b-BOD_5/1,000 lb-RM)
= 0.1785 1b-BOD_5/1,000 lb-RM

Adjusted TSS BPT Max. Monthly Limit = (0.21 1b-TSS/1,000 lb-RM) + (0.012 1b-TSS/1,000 lb-RM)
= 0.222 1b-TSS/1,000 lb-RM

Note: The maximum daily BOD_5 and TSS BPT limits are twice the maximum monthly average BOD_5 and TSS BPT limits.

Example 5: Determine the maximum monthly average BPT BOD_5 limit for a complex slaughterhouse that also performs hide, blood, and dry rendering. The complex slaughterhouse operates 280 days per year, slaughters on-site (on average per day) 700 cattle (1,000 lb/head) and 1,000 hogs (225 lb/head) and also processes (on average per day) 300 hides, 10,000 gallons of blood, and 200,000 lb of raw by-products (offal and bone) for dry rendering from an off-site source.

Solution 5: This facility is a complex slaughterhouse (Subpart B) and is subject to 432.22(b)(1) (i.e., the facility slaughters on-site more than 50 million lb-LWK per year) which is set equivalent to 432.22(a)(1) for BOD_5, TSS, O&G, and fecal coliform bacteria.

Because this facility also cures hides and dry renders blood and offal and bone, use the incremental adjustments provided in 432.22(b), which are set to be equivalent to the incremental adjustments provided in 432.12(a). The incremental BPT BOD_5 and TSS adjustments for Subparts A, B, C, and D are calculated using the following table.

Table EX-5. MPP BOD_5 and TSS Adjustment Factors for BPT Limits

	Daily Max BPT, kg/kkg-ELWK[b]		Monthly Max BPT, kg/kkg-ELWK[b]		
Processing	**BOD_5**	**TSS**	**BOD_5**	**TSS**	**Notes**
Hide	0.04	0.08	0.02	0.04	[a]
Blood	0.04	0.08	0.02	0.04	[a]
Wet Rendering	0.06	0.12	0.03	0.06	[a]
Dry Rendering	0.02	0.04	0.01	0.02	[a]

Source: 432.12(a)

[a] These BOD_5 and TSS BPT adjustment factors are for Subparts A, B, C, and D. They are used according to the following relationships:

Adjusted Effluent Limit = On-site Kill Effluent Limit + Incremental Adjustment to On-site Kill Limit

where:

$$\text{Incremental Adjustment to On-site Kill Limit} = (\text{Adjustment Factor from Table EX-5}) \times \frac{\text{(Total weight of source animals as kkg-ELWK)}}{\text{(On-site kkg-LWK)}}$$

[b] If the weight of the off-site source animals (i.e., equivalent live weight killed (ELWK)) which generated the materials for blood processing, rendering, or hide processing is not known, estimate the ELWK by the use of the

following relationships (Source: U.S. EPA, Red Meat Development Document, EPA-440/1-74-012-a, February, 1974, page 140):

For Blood:

Equivalent live weight killed (ELWK) in kkg = (liters of blood) x (0.028) or (gal of blood) x (0.108)

Equivalent live weight killed (ELWK) in kkg = (kg of blood) x (0.029) or (lb of blood) x (0.013)

For Rendering Material:

Equivalent live weight killed (ELWK) in kkg = (kg of rendering materials) x (0.0067) or (lb of rendering materials) x (0.003)

For Cattle Hides:

Equivalent live weight killed (ELWK) in kkg = (No. of hides) x (0.45)

Use the given values and the adjustment factors and relationships to calculate the required BPT limits.

On-site LWK = (700 cattle/day) x (1,000 lb/head) + (1,000 hogs/day) x (225 lb/head)
= 925,000 lb-LWK/day
= 419,573 kg-LWK/day = 419.6 kkg-LWK/day

$ELWK_{blood}$ = (10,000 gal) x (0.108) = 1,080 kkg-ELWK

$ELWK_{rendering}$ = (200,000 lb) x (0.003) = 600 kkg-ELWK

$ELWK_{hides}$ = (300 hides) x (0.45) = 135 kkg-ELWK

BOD_5 Incremental Adjustment = (0.02 kg-BOD_5/kkg-ELWK) x (1,080 kkg-ELWK/419.6 kkg-LWK)

for Blood Processing (BOD_5 IA_{blood})
= 0.051 kg-BOD_5/kkg-LWK

BOD_5 IA_{hides} = (0.02 kg-BOD_5/kkg-ELWK) x (135 kkg-ELWK/419.6 kkg-LWK)
= 0.006 kg-BOD_5/kkg-LWK

$BOD_5\ IA_{rendering}$ = (0.01 kg-BOD_5/kkg-ELWK) x (600 kkg-ELWK/419.6 kkg-LWK)

= 0.014 kg-BOD_5/kkg-LWK

$\sum BOD_5\ IA$ = $BOD_5\ IA_{blood}$ + $BOD_5\ IA_{hides}$ + $BOD_5\ IA_{rendering}$

= 0.051 + 0.006 + 0.014

= 0.071 kg-BOD_5/kkg-LWK (or lb-BOD_5/1,000 lb-LWK)

On-site Kill Effluent Limit for BOD_5 = 0.21 [Taken from 432.22(b)(1) which is equivalent to 432.22(a)(1) for BOD_5, TSS, O&G and fecal coliform bateria.]

Adjusted BOD_5 Effluent Limit = 0.21 + 0.071

= 0.281 kg-BOD_5/kkg-LWK (or lb-BOD_5/1,000 lb-LWK)

Example 6: Determine the maximum monthly average BAT ammonia (as N) limit for a high-processing packinghouse that operates 280 days per year, slaughters on-site (on average per day) 700 cattle (1,000 lb/head) and 1,000 hogs (225 lb/head), produces (on average per day) 200,000 pounds of final fresh products resulting from the further processing of meat carcasses, and renders (on average per day) 370,000 pounds of raw material.

Solution 6: First calculate the amount of live weight killed (LWK) on-site.

On-site LWK = (700 cattle/day) x (1,000 lb/head) + (1,000 hogs/day) x (225 lb/head)
= 925,000 lb-LWK/day
= (925,000 lb-LWK/day) x (280 days/year) = 259 million LWK pounds/year

This facility is a high-processing packinghouse (Subpart D) and is subject to 432.43 (i.e., the facility slaughters on-site more than 50 million lb-LWK per year). The 432.43 BAT limits are set to be equivalent to the 432.13 BAT limits. The incremental BAT adjustments for Subparts A, B, C, and D are calculated using the following table.

Table EX-6. MPP Adjustment Factors for BAT Limits

Regulated Parameter	Daily Max BAT		Monthly Max BAT		Notes
	Further Processing kg/kkg-FP	Rendering kg/kkg-RM	Further Processing kg/kkg-FP	Rendering kg/kkg-RM	
Ammonia (as N)	0.0704	0.0438	0.0153	0.0096	[a]
Total Nitrogen	0.0965	0.0601	0.0396	0.0247	[a]
Total Phosphorus	0.0917	0.0472	0.0439	0.0226	[a]

Source: 432.13

[a]These BAT adjustment factors are for Subparts A, B, C, and D are used according to the following relationships:

Adjusted Effluent Limit = On-site Kill Effluent Limit + Incremental Adjustment to On-site Kill Limit

where:

Incremental Adjustment to On-site Kill Limit = (Adjustment Factor from Table EX-6) x $\frac{\text{(Further Proc. Products or Rendering RM in kkg)}}{\text{(On-site kkg-LWK)}}$

On-site LWK = (700 cattle/day) x (1,000 lb/head) + (1,000 hogs/day) x (225 lb/head)
= 925,000 lb-LWK/day
= 419,573 kg-LWK/day = 419.6 kkg-LWK/day

Further Processing Products = 200,000 lb-FP/day
= 90.7 kkg-FP/day

Rendering Raw Material = 370,000 lb-RM/day
= 167.8 kkg-RM/day

Ammonia-N Incremental
Adjustment for Further = (0.0153 kg-NH_3-N/kkg-FP) x (90.7 kkg-FP/419.6 kkg-LWK)
Processing (NH_3-N IA_{FP})
= 0.003 kg-NH_3-N/kkg-LWK

NH_3-N IA_{RM} = (0.0096 kg-NH_3-N/kkg-RM) x (167.8 kkg-RM/419.6 kkg-LWK)
= 0.004 kg-NH_3-N/kkg-LWK

$\sum NH_3$-N IA = NH_3-N IA_{FP} + NH_3-N IA_{RM}
= 0.003 + 0.004
= 0.007 kg-NH_3-N/kkg-LWK (or lb-NH_3-N/1000 lb-LWK)

On-site Kill Effluent Limit = 0.0143 kg-NH_3-N/kkg-LWK
[Taken from 432.43, which is equivalent to 432.13.]

Adjusted NH_3-N Effluent Limit = 0.0143 + 0.007
= 0.0213 kg-NH_3-N/kkg-LWK (or lb-NH_3-N/1000 lb-LWK)

Example 7: Determine the maximum monthly average BAT ammonia (as N) limit for a poultry first processor that operates 280 days per year, slaughters on-site (on average per day) 100,000 chickens (5.5 lb/head), produces (on average per day) 300,000 pounds of final fresh products resulting from the further processing of poultry carcasses, and renders (on average per day) 220,000 pounds of raw material.

Solution 7: First calculate the amount of Live Weight Killed (LWK) on-site.

On-site LWK = (100,000 chicken/day) x (5.5 lb/head) = 550,000 lb-LWK/day

= (550,000 lb-LWK/day) x (280 days/year) = 154 million LWK pounds/year

This facility is a poultry first processor (Subpart K) and is subject to 432.113. The 432.113 BAT limits are set equivalent to the 432.112 BPT limits. The applicable BAT limits for this facility are found in 432.112(b), because this facility slaughters on-site more than 10 million lb-LWK per year. The incremental BAT adjustments are calculated using the following table.

Table EX-7: MPP Adjustment Factors for BAT Limits

Regulated Parameter	Daily Max BAT		Monthly Max BAT		Notes
	Further Processing kg/kkg-FP	Rendering kg/kkg-RM	Further Processing kg/kkg-FP	Rendering kg/kkg-RM	
Ammonia (as N)	0.0400	0.0771	0.0087	0.0168	[a]
Total Nitrogen	0.0548	0.0601	0.0226	0.0247	[a]
Total Phosphorus	0.0431	0.0472	0.0206	0.0226	[a]

Source: 432.112

[a] These BAT adjustment factors are used according to the following relationships:

Adjusted Effluent Limit = On-site Kill Effluent Limit + Incremental Adjustment to On-site Kill Limit

where:

Incremental Adjustment to On-site Kill Limit = (Adjustment Factor from Table EX-7) x $\frac{\text{(Further Proc. Products or Rendering RM in kkg)}}{\text{(On-site kkg-LWK)}}$

On-site LWK = 550,000 lb-LWK/day

= 249,476 kg-LWK/day = 249.5 kkg-LWK/day

Further Processing Products = 300,000 lb-FP/day
= 136.1 kkg-FP/day

Rendering Raw Material = 220,000 lb-RM/day
= 99.8 kkg-RM/day

Ammonia-N Incremental
Adjustment for Further = (0.0087 kg-NH_3-N/kkg-FP) x (136.1 kkg-FP/249.5 kkg-LWK)
Processing (NH_3-N IA_{FP})
= 0.005 kg-NH_3-N/kkg-LWK

NH_3-N IA_{RM} = (0.0168 kg-NH_3-N/kkg-RM) x (99.8 kkg-RM/249.5 kkg-LWK)
= 0.007 kg-NH_3-N/kkg-LWK

$\sum NH_3$-N IA = NH_3-N IA_{FP} + NH_3-N IA_{RM}
= 0.005 + 0.007
= 0.012 kg-NH_3-N/kkg-LWK (or lb-NH_3-N/1000 lb-LWK)

On-site Kill Effluent Limit = 0.0356 kg-NH_3-N/kkg-LWK
[Taken from 432.113 which is equivalent to 432.112(b)(1) as this facility slaughters on-site more than 10 million lb-LWK per year]

Adjusted NH_3-N Effluent Limit = 0.0356 + 0.012
= 0.0476 kg-NH_3-N/kkg-LWK (or lb-NH_3-N/1000 lb-LWK)