Business Meeting Agenda
2022 AAFCO Annual Meeting
Hilton at the Ballpark | St. Louis, MO
Thursday, August 4, 2022
8:30 am–10:00 am (CT)

1. **Convene Business Session of the Association:** George Ferguson, President
    a. Welcome & Opening Remarks
    b. Announcement of New Life Members
    c. Presentation of Awards

2. **Acceptance of Committee Reports From:** Current Issues and Outreach, Education and Training, Feed and Feed and Feed Ingredient Manufacturing, Feed Labeling, Inspection & Sampling, Ingredient Definitions, Ingredient Definitions eMeeting 03/23/22, Ingredient Definitions eMeeting 05/03/22, Laboratory Methods & Services, Model Bills and Regulations, Pet Food, Proficiency Testing Program, Strategic Affairs – Austin Therrell, President-Elect

    (Reports are published on the AAFCO website on the 2022 Annual Meeting page, right side, under the heading "Committee Reports.")

    Board Recommends Acceptance.

3. **Acceptance of Committee Recommendations:** Austin Therrell, President-Elect

    a. Pet Food Committee:
        i. Replace the current "Human Grade" Guidelines which start on page 158 of the electronic 2022 OP, with the revised Guidelines for "Human Grade" Claims

        Guidelines for "Human Grade" Pet and Specialty Pet Food Claims
        AAFCO recommends and supports the following guidelines for the use of the term "human grade" in the labeling of pet foods and specialty pet foods. Pet and specialty pet foods using the labeling claim "human grade" are first and foremost animal food products and subject to inspection under 21 CFR part 507. In order to substantiate that a human grade claim is truthful and not misleading, these guidelines describe how all human grade pet food products should be manufactured in accordance with the applicable human food regulations for a ready-to-eat human food.

        1. In the AAFCO defined feed term "human grade", the use of the term "human grade" is only acceptable in reference to the product as a whole. The feed term specifies that every ingredient and the resulting product must be stored, handled, processed, and transported in a manner that is consistent and compliant with 21 CFR part 117 and those applicable federal human food laws as required by ingredient, process and/or facility type.

        2. All facilities that process or package a final "human grade" pet food product that is considered ready-to-eat must register with FDA as a food facility operating under both General Product Categories (Food for Human Consumption & Food for Animal Consumption) as found in Section 9a of the U.S. Food and Drug Administration Food Facility Registration.

            It shall be the manufacturing firm's responsibility to ensure it is able to manufacture in a human food facility and be licensed/registered and inspected by the authorized agency

for human food production. Human Grade Pet Food claims are voluntary, and as such, no feed control official, neither state nor federal, can mandate that a human food authority license a facility that is only manufacturing a pet food product.

3. The firm must maintain written procedures to help ensure "human grade" products are stored, transported, and handled throughout the distribution channel in a manner that maintains the product's "human grade" status.

4. In order to substantiate that a "human grade" pet food claim is truthful and not misleading on products under the federal authority of FDA for human food production and subject to 21 CFR Part 117, the firm must maintain and make available upon request, documentation (e.g., affidavits) sufficient to show that:
    a. All individual ingredients supplied to the manufacturer that are further utilized in the manufacture of human grade pet food, are fit for human consumption.
    b. Every ingredient and the resulting product are stored, handled, processed, and transported in a manner that is consistent and compliant with 21 CFR part 117 and the final product is considered ready-to-eat.
    c. The manufacturing facility is licensed to produce human food by all appropriate/required authorities.
5. In order to substantiate that a "human grade" pet food claim is truthful and not misleading, on products that are under the federal authority of an agency other than FDA for human food production (e.g., USDA FSIS):
    a. a. Where final processing (i.e., mixing, blending) and/or packaging occurs in a registered FDA Human Food Facility subject to 21 CFR Part 117, the firm must maintain and make available upon request, documentation (e.g., affidavits) sufficient to verify that:
        i. The product is ready-to-eat with all included ingredients processed, packed, held, and shipped in compliance with the applicable federal regulations for the manufacture of human foods prior to final mixing/blending and/or packaging.
        ii. All facilities utilized in the manufacture of the included ingredients are authorized by the appropriate regulatory authority to produce human food.
        iii. The FDA facility that processes and/or packs the "Human Grade" Pet Food is licensed to produce human food by all appropriate/required authorities.
    b. Where final processing (i.e., mixing, blending) and/or packaging occurs in a non-FDA food facility producing human food (e.g., slaughter plant), the firm must maintain and make available upon request, documentation sufficient to verify that:
        i. The product is ready-to-eat with all included ingredients processed, packed, held, and shipped in compliance with the applicable federal regulations for the manufacture of human foods prior to final mixing/blending and/or packaging.
        ii. All facilities utilized in the manufacture of the included ingredients are authorized by the appropriate regulatory authority to produce human food.
        iii. The processing and/or packing of the final product is conducted in an area/room identified within the facility's required HACCP/Food Safety Plan as an area/room that can be used for the blending, packaging, repackaging and/or labeling of an edible ready-to-eat food.
        iv. The non-FDA facility that processes and/or packs the "Human Grade" Pet Food is licensed to produce human food by all appropriate/required authorities.
    c. The manufacturer of a pet food or specialty pet food product with "human grade" claims must ensure:

i. It is clearly labeled for its intended use as animal food, such as “dog food” or “cat treats”.
ii. No statements of quality or grade appear in the ingredient statement [PF5(d)(3)].
iii. The largest or most prominent use of the term “human grade” on each panel of the label and any labeling (brochures, point of sale materials, websites, etc.) must be juxtaposed with the statement of intended use (e.g., human grade dog food or human grade cat treats), in the same style, color print, and type size as the term “human grade”.
iv. A claim of “human grade ingredients” is only acceptable if the product as a whole meets the requirements of the “human grade” pet food term; and
v. The label is in compliance with all applicable labeling rules, including any voluntary labeling allowed under participation in the Agriculture Marketing Service Process Verified Program.

Board Recommends Acceptance.

b. Ingredient Definitions Committee:

i. Board recommends acceptance of the Human Grade feed term, added to Chapter 6 under "Feed Terms and Definitions" which start on page 347 of the 2022 electronic OP

Board Recommends Acceptance.

ii. Publish a new tentative definition relating to organisms in 36.11 Dried Fermentation Product to allow the use of Lactobacillus diolivorans as a silage inoculant. Leave the existing definition in place.

Board Recommends Acceptance.

iii. Make the following changes in ODI: (tentative changes do not go into ODI) **

ODI Action	Name	Reference	Comments
New Name	Dried Lactobacillus diolivorans Fermentation Product	36.11	Business meeting xx/xx/xxxx

Board Recommends Acceptance.

**ODI updating—in order to add transparency of the impact of committee decisions on the Online Database of Ingredients (ODI) label validation tool, the committee recommendations will include a table of the anticipated changes to ODI to reflect changes to common or usual names and/or references in the OP. It is anticipated this table will also appear in the front of the OP with the dates of adoption by the Association Membership. OP section editors are responsible for the accuracy of the ODI updates.

iv. Remove Pennyroyal American and Pennyroyal European from table 87.30 (OP page 473). And list them in section 99 as withdrawn Ingredients.

Board Recommends Acceptance.

v. Make the following changes in ODI: (tentative changes do not go into ODI) **

ODI Action	Name	Reference	Comments
remove reference	**ferric choline citrate**	90.26	IDC meeting 2/24/22
Remove ingredient	Pennyroyal, American		Business meeting xx/xx/xx

Remove ingredient	Pennyroyal, European		Business meeting xx/xx/xx

Board Recommends Acceptance.

**ODI updating—in order to add transparency of the impact of committee decisions on the Online Database of Ingredients (ODI) label validation tool, the committee recommendations will include a table of the anticipated changes to ODI to reflect changes to common or usual names and/or references in the OP. It is anticipated this table will also appear in the front of the OP with the dates of adoption by the Association Membership. OP section editors are responsible for the accuracy of the ODI updates.

vi. Remove footnote on 2022 OP April revision page 385 "~~The molasses collective term is not recognized by the FDA (21 CFR 501.110).~~"

Board Recommends Acceptance.

vii. Publish a new Official Definition 33.29 Black Soldier Fly Larvae Oil. Page 407 Delete T33.29

Board Recommends Acceptance.

viii. Publish replacement of Official Definition with T60.117(C) Dried Black Soldier Fly Larvae. Page 445 – delete existing official.

Board Recommends Acceptance.

ix. Publish replacement of Official Definition with T73.309 Urea formaldehyde Condensation Polymer. Page 470 –delete existing official on page 468

Board Recommends Acceptance.

x. Make the following changes in ODI: (tentative ingredients do not go into ODI) **

ODI Action	Name	Reference	Comments
Add ingredient and reference	Black Soldier Fly Larvae Oil	33.29	Business meeting xx/xx/xx
Remove ingredient	Calcium lignin sulfonate		Business meeting xx/xx/xx
Add ingredient and reference	Hydrophobic Silica	Table 101.1	Business meeting xx/xx/xx
Add ingredient and reference	Polyethylene glycol (400) dioleate	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Polysorbate 60	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Phytase	Table 101.1	Business meeting xx/xx/xx
Add ingredient	L-Methionine 85%	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Canthaxanthin	Table 101.1	Business meeting xx/xx/xx
Add ingredient	L-Glutamine	Table 101.1	Business meeting xx/xx/xx

ODI Action	Name	Reference	Comments
Add ingredient	Saccharomyces cerevisiae expressing xylose isomerase from Piromyces sp. E2	Table 101.1	Business meeting xx/xx/xx
Add ingredient	L-methionine 90%	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Dried Methylobacterium extorquens biomass	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Clinoptilolite of sedimentary origin	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Krill Meal	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Beta-Gluconase	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Dried L-threonine fermentation product	Table 101.1	Business meeting xx/xx/xx
Add ingredient	Marine microalgae oil	Table 101.1	Business meeting xx/xx/xx

Board Recommends Acceptance.

**ODI updating—in order to add transparency of the impact of committee decisions on the Online Database of Ingredients (ODI) label validation tool, the committee recommendations will include a table of the anticipated changes to ODI to reflect changes to common or usual names and/or references in the OP. It is anticipated this table will also appear in the front of the OP with the dates of adoption by the Association Membership. OP section editors are responsible for the accuracy of the ODI updates.

c. Feed & Feed Ingredient Manufacturing Committee

i. Update the Official Guidelines for Contaminant Levels Permitted in Mineral Feed Ingredients in Chapter Five of the AAFCO OP, AAFCO Model Guidance Documents, following the Analytical Variations (AV) on Page 301 of the 2021 AAFCO Official Publication.

Review Appendix 1

Board Recommends Acceptance.

d. Strategic Affairs Committee:

i. Insert Resolutions Policy. It will be inserted into the OP, Chapter 5, beginning on page 241 of 2022 revised OP.

Strategic Affairs Minutes 20220309
TEXT REVIEWED AND EDITED BY FASS: March 9, 2022 version
AAFCO POLICY ON RESOLUTIONS (adopted xx/xx/xxxx)

I. PURPOSE

Each year prior to the AAFCO Association Business Meeting, resolutions are submitted to the AAFCO Board of Directors by members or committees for consideration. Through this process,

members and committees may raise concerns and suggested action relating to legislative, regulatory, and technical issues as they apply to commercial animal feed and food safety issues.

II. SCOPE

To establish protocols for the receipt and consideration by members of proposed resolutions submitted through the AAFCO Board of Directors that involves procedures, format, and frames.

III. PROCEDURES

1. In January of each year, the President shall call for resolutions at the Midyear Association Business Meeting. The Executive Director may follow up with members through additional communications and seek the submission of resolutions by members and committee chairs.

2. Proposed resolutions will be accepted only if they come from an AAFCO member representative or committee recommendation. If needed for explanatory purposes, a resolution should be accompanied by a statement (not to exceed one page) summarizing the purpose and the justification for the proposed resolution. Guidance and resolution samples will be provided to members to assist with drafting.

3. The Executive Director shall receive and accept all resolutions that meet established guidance on clarity and form and may modify language if deemed advisable, as long as the intent is not changed and the change is in consultation with the resolution sponsor. The Executive Director may consolidate resolutions that are similar in content and intent and so indicate when presenting the revised resolution to the Board.

4. The Executive Director, by tradition, shall also prepare and present at the time and place of AAFCO Annual Meeting additional resolutions that are of a memorial or recognition nature or in good etiquette and are appropriate for the Association.

5. All proposed resolutions reviewed and accepted for clarity and form by the Executive Director shall be submitted to the Board of Directors no later than 60 days prior to the Annual Meeting for approval by the Board of Directors. The Board may invite the sponsor of the resolution to attend a Board of Directors meeting to provide context for the resolution and answer questions. Resolutions that are not passed by the Board of Directors for approval shall not be provided to members for consideration at the Annual Association Business Meeting.

6. The President or President-Elect will be responsible for coordinating the inclusion of the Board-approved proposed resolutions, which are to be presented for membership approval, into the meeting materials for the Annual Association Business Meeting.

7. All resolutions reviewed and approved by the Board of Directors shall be presented to the membership during the Annual Association Business Meeting by the President-Elect, with the Board of Directors' recommendations of approval.

8. Floor action on resolutions shall be by two-thirds majority vote of the members present or by proxy at the Annual Association Business Meeting, which constitutes a quorum.

9. The AAFCO Board of Directors shall initiate all action required by the approved resolutions and will attempt to achieve the resolution's intent during the ensuing year. Board members may delegate actions to the Executive Director or Committee Chairs for implementation.

10. The Executive Director shall coordinate the posting of resolutions on AAFCO's website and forward copies to appropriate parties at the direction of the Board of Directors. Response to a resolution may be posted on AAFCO's website at the discretion of the Board of Directors.

IV. PROCESS SUMMARY

Benchmark	Estimated Dates	Action	Responsible Party	Notes
Midyear Association Business Meeting	January 15	Call for resolutions to members	President	Resolutions due 60 days prior to the Annual Meeting
60 days prior to the Annual Meeting	June 1	Collect, organize, review, and consolidate, if needed, resolutions for consideration by the Board	Executive Director	Executive Director assembles resolution(s) for BOD consideration
June Board meeting	June 20	Board members review and approve resolutions for membership consideration	BOD members	Resolutions not approved by the Board will not be recommended for membership consideration
Annual Association Business Meeting	August 1	Membership vote	President-Elect	During Association Business Meeting
Board Meeting at end of Annual Meeting	August 5	Board members provide direction on where to post resolution or any other action needed	BOD members	Provides direction on next steps for publishing and enacting resolution to Executive Director
30 days after the Annual Meeting	September 5	Post resolutions (other actions as needed)	Executive Director	Post approved resolutions on website

Board Recommends Acceptance.

4. Nomination Committee

The Nominating Committee recommends the following slate for Board of Directors beginning January 1, 2023.

President: Austin Therrell, SC
President-Elect: Hollis Glenn, CO
Secretary-Treasurer: Ashlee-Rose Ferguson, WA
Director: Eric Brady, TN
Director: Joshua Arbaugh, WV
Director: Laura Scott, CAN
Director: Darrell Johnson, KY
Director: Dan King, MN
Immediate Past President: George Ferguson, NC

Board Recommends Acceptance.

This concludes committee and board recommendations needing membership approval.

5. Credential Report: FASS

Number of voting members represented
Number of states in attendance
Number of countries
Number of FDA representatives
Number of life members
Total meeting attendance

Official Guidelines for Contaminant Levels Permitted in Mineral Feed Ingredients

Section Editor – Jennifer Kormos, Canada

The Mineral Investigation Committee considered the matter of contaminants in mineral feed ingredients for several years before adopting an approach to the problem as reported in the 1978 *Official Publication*. The original approach was combined with toxicity data in the 1980 National Academy of Sciences, National Research Council (NRC) *Mineral Tolerance of Domestic Animals*[1] to produce the guidelines appearing in the *Official Publication* through 2021. Updates to the AAFCO Official Guidelines in 2022 were derived from multiple sources including the 2005 NRC *Mineral Tolerance of Animals*.[2] The 2005 *Mineral Tolerance of Animals* indicates that the expert subcommittee did not consider tissue residues of mineral contaminants with regard to human food safety when setting the various maximum tolerable levels (MTL or tolerance) for minerals. Given the lack of consideration for human food safety by the NRC expert subcommittee, the AAFCO Mineral Guidelines Work Group that updated these Official Guidelines took the approach that if a tolerance for a given mineral was reduced by the 2005 NRC expert subcommittee from the tolerance stated in the 1980 *Mineral Tolerance of Domestic Animals*, the Work Group accepted the reduced amount in the 2005 *Mineral Tolerance of Animals*. If, however, the 2005 NRC expert subcommittee increased a tolerance for a given mineral, the Work Group retained the lesser tolerance from the 1980 *Mineral Tolerance of Domestic Animals*.

The mineral section of the 2022 AAFCO Official Publication contains 141 mineral ingredient definitions for sources of 15 elements to consider in drafting guidelines to limit contaminants. Variables considered and used in guideline development included:

(1) Differing nutrient requirements between species and within species, e.g., young vs. mature, lactating vs. non-lactating, and layers vs. broilers.

(2) Whether the toxicity of a contaminant varies between and within species.

(3) The concentration of a nutrient varies between several ingredient sources. For example, magnesium oxide (MgO) contains 6 times the magnesium (Mg) to an equivalent weight of magnesium sulfate heptahydrate ($MgSO_4$-$7H_2O$), and thus, could contain 6 times the contaminant level compared to magnesium sulfate for an equivalent contaminate burden in a finished product since only one-sixth as much magnesium oxide would be needed to meet a given amount of magnesium.

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[1] National Academy of Sciences, National Research Council. *Mineral Tolerance of Domestic Animals* (1980). National Academy Press, Washington, D.C. 20001.

[2] National Academy of Sciences, National Research Council. *Mineral Tolerance of Animals Second Revised Edition, 2005*. National Academy Press, Washington, D.C. 20001.

(4) The range between a nutrient requirement and toxicity for a given element varies greatly. Manganese, for example, is required at about 50 ppm but levels as high as 1,000 to 2,000 ppm can be tolerated.

(5) Knowledge of nutrient requirements and toxicities is incomplete and/or imprecise in many cases.

If the variables are acknowledged, it becomes apparent that precise contaminant limits, fixed at the very brink of toxicity, are impractical. Rather, we must work in much more general and conservative terms, using scientific data to limit, but not exclude some subjective decisions based upon common sense. Safety factors, for example, would be included in the latter category.

With the above factors in mind, the following approach was used in developing the overall recommendations for handling contaminants in mineral feed ingredients proposed in this report.

(1) Determine the all-species average requirement for each of the 15 elements included in the AAFCO mineral definitions if a requirement has been established.[3] These values (Table 1) were adapted from the NRC nutrient requirement recommendations for the species listed in Table 1.

(2) Determine the all-source average content for each element.

(3) Calculate, from the data in (1) and (2) above, the dilution factor needed to meet NRC recommended amounts for each element (Table 2). Example: If the average calcium content from all AAFCO sources is 32% and the NRC recommendation is 1.55%, the dilution factor is 21. In other words, the calcium source will be diluted by a factor of 21 on a complete feed basis.[4]

(4) Come up with a safety factor, which is 2.5 in this report.

(5) Group contaminants according to toxicity following the general guidelines proposed in the 2021 report of the Work Group to this Committee. Five groups, labeled 1 through 5, ordered from least to greatest tolerance, were recommended by the Work Group based on the MTL in Complete Feed (Table 3).

(6) Set limits <u>within each group</u> as follows:

a. Level for contaminants below which no declaration or labeling for the contaminants is required or deemed appropriate.

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[3] Chromium is believed to be essential, but no minimum requirement has been established for any species, thus, chromium does not appear in Table 1.

[4] A Complete Feed is a multi-ingredient product fed to an animal. Examples include, but are not necessarily limited to, total mixed rations, sweet feeds, pelleted feeds or grain mixes. It also can be the summation of the total amount of feedstuffs fed separately at various locations or times within a 24-hour period.

b. A range of contaminants' levels permitted in feed ingredients if, but only if, the product is labeled as to the contaminants' levels. "Labeling" here and elsewhere is considered in the broader sense, e.g., "Typical Analysis Specification Sheet" or similar information supplied by the manufacturer to customers.

c. Contaminants' levels above which the product's use as a feed ingredient is prohibited. This guidance does not apply to the primary nutritional element(s) of defined mineral ingredients. Definition 57.119 sodium selenite contains selenium at 460,000 ppm, but selenium from sodium selenite is a primary nutritional element.

(7) Select a dilution factor (see item (3) above) to be used in setting the maximum contaminant level permitted in a feed ingredient without labeling the amount present. A dilution factor of 21 is recommended and was used in arriving at the values in Table 3. This is the lowest value in Table 2 (for calcium) and thus provides the greatest margin of safety.

(8) Calculate the maximum level permitted in ingredients, without labeling, for each of the 5 groups, using the following equation:

$$MLP = (CFL \times DF)/SF,$$

where

MLP is Maximum Level Permitted without labeling (on "Typical Composition Specification Sheets" for example)

CFL is NAS recommended maximum Continuous Feeding Level for the most toxic element in the group

DF is Dilution Factor

SF is Safety Factor

Example:

In Group 1 (Table 3) of inorganic mercury, cadmium, and selenium, inorganic mercury has the least daily tolerance in complete feed at 0.2 ppm. Therefore, if DF = 21 and SF = 2.5, MLP = (0.2 ppm x 21) / 2.5 = 1.7 ppm. Thus, ingredients containing 1.7 (~2) ppm or less of Group 1 contaminants will not raise the level in the total ration above the MTL for any of the contaminants in Group 1.

The MLP values for the other 4 groups were determined similarly.

(9) Determine range of contaminant levels permitted, by group, if levels are stated in the labeling. This is a judgment decision.

(10) Determine contaminant levels, by group, above which an ingredient would be excluded from use in a feed. This is also a judgment decision.

The procedure recommended above provides a systematic approach to establishing contaminant limits in feed ingredients based upon toxicity data in the NRC publications for mineral tolerances of animals and other publicly available information. The equation used to set the limits is designed to handle worst case situations, since it is based upon the most toxic element in each group and assumes the lowest dilution of the ingredient (dilution factor of 21). Thus, an additional margin of safety is provided automatically for all but the most toxic contaminants in each group and the greatest nutrient requirements. This margin of safety comes not just from focusing on the MTL for the most

toxic element in the group, but also because the values in the last three columns of Table 3 represent the total amount, that is the sum of the content, of all elements within the Group. That these values represent the sum of the Group, and not just the amount of an individual element within the group, has been a source of confusion by users of the former versions of Table 3. However, a reading of the 1978 minutes of the former AAFCO Mineral Investigation Committee reveals that this is in fact the approach and intent of the group that originally established these guidelines. Table 3 has been reorganized to try and clarify this aspect of the guidelines.

Finally, fluorine is not included in Table 3 because fluorine is closely associated with phosphate ingredients and has been handled successfully for many years by requiring the phosphorus:fluorine ratio to be not less than 100:1. It is recommended this policy continue unchanged.

Table 1. Approximate Mineral Requirements (Total Diet Basis - greatest concentration)[a]

Mineral	Swine	Dairy	Beef	Poultry	Aquaculture	Sheep	Goats	All-species Average
Calcium (%)	0.85	0.8	0.71	5	2	0.67	0.79	1.55
Phosphorus (%)	0.7	0.44	0.34	0.6	2	0.45	0.45	0.71
Potassium (%)	0.3	1.35	0.7	1	1.2	0.59	0.78	0.85
Magnesium (%)	0.06	0.4	0.2	0.5	0.35	0.16	0.15	0.26
Sodium (%)	0.4	0.34	0.1	0.23	0.15	0.08	0.12	0.20
Chloride (%)	0.5	1.2	-	0.35	-	0.18	0.29	0.50
Sulfur (%)	-	0.4	0.15	-	-	0.18	0.26	0.25
Cobalt (ppm)	-	0.11	0.1	-	-	0.2	0.12	0.13
Copper (ppm)	10	18	10	16	53	6	26	19.86
Iron (ppm)	100	26	50	80	199	83	71	87.00
Iodine (ppm)	0.14	0.88	0.5	1.7	1.1	0.83	0.81	0.85
Manganese (ppm)	25	24	40	120	13	34	29	40.71
Selenium (ppm)	0.3[b]	0.3[b]	0.3[b]	0.3[b]	0.7[c]	0.3[b]	0.3[b]	0.30
Zinc (ppm)	100	73	30	100	200	55	71	89.86

[a] Updated & adopted from National Academy of Sciences, Engineering, and Mathematics, National Research Council (NAS/NRC) recommendations as of 2015.

[b] FDA approved concentration.

[c] Aquaculture species are not included in the selenium food additive regulation.

Table 2. Approximate Dilution Factors and Typical Contaminate Levels of AAFCO Defined Mineral Feed Ingredients

	Recommended Level NAS/NRC[a]	Approx. dil. To meet rec. level[b]	Typical Contamination Levels (ppm)[c]					
			Arsenic	Lead	Mercury	Cadmium	Nickel	Antimony
Calcium	1.55%	2.1×10^1	2.5	5--30	0.05	5--10	--	--
Phosphorus	0.71%	3.5×10^1	2--5	5--30	0.05	5--10	--	--
Potassium	0.85%	5.2×10^1	1	1	1	--	--	--
Magnesium	0.26%	1.1×10^2	1--10	1--20	0.1--5	1	--	--
Sodium	0.20%	1.6×10^2	--	--	0	--	--	--
Chloride	0.50%	8.9×10^1						
Sulfur	0.25%	1.8×10^2	1	1	1	--	--	--
Cobalt	0.13 ppm	2.8×10^6	2--20	1--20	1--20	2--200	800	--
Copper	19.86 ppm	2.5×10^4	3--100	9--600	1	2--100	100	0--20
Iron	87 ppm	2.3×10^3	1--50	1--90	1	--	--	--
Iodine	0.85 ppm	8.5×10^5	2	3	2	1	--	--
Manganese	40.71 ppm	5.1×10^3	1--10	1--90	--	1--20	--	70--200
Selenium	0.3 ppm	1.3×10^6	--	--	1	1--5	1--5	--
Zinc	89.86 ppm	6.0×10^3	10--800	100—2,000	1	80--500	--	10

[a] Values from Table 1, including goats and aquaculture. NAS/NRC stands for National Academy of Sciences, Engineering, and Mathematics, National Research Council.

[b] Dilution factor calculated using mineral ingredient values from the NAS/NRC Nutrient Requirements of Dairy Cattle, Nutrient Requirements of Small Ruminants, and information available to the work group.

[c] Unchanged as Adapted from "NFIA Mineral Ingredient Handbook," National Feed ingredient Association, 1979 edition, and from "AFIA Feed Ingredient Guide," American Feed Industry Association Inc.

Table 3. Official Guidelines Suggested for Contaminants in Individual Mineral Feed Ingredients.

Contaminant Group[a]	Maximum Tolerable Level in Complete Feed (ppm)	Total Level of Group Permitted Without Labeling (ppm)[b,c]	Labeling Required Between Indicated Range (ppm)[b]	Use Prohibited at Levels Above (ppm)[b]
Group 1[d]	**0 – <5**			
Mercury (inorganic)	0.2	**2**	**2-500**	**500**
Cadmium	0.5			
Selenium	2			
Group 2	**5 – <15**			
Arsenic	5[e]			
Iodine	5[f]			
Molybdenum	5[g]	**42**	**42-1000**	**1000**
Cobalt	10			
Lead	10			
Vanadium	10			
Group 3	**15 – <50**			
Copper	15[h]			
Barium	20	**126**	**126-1500**	**1500**
Tungsten	20			
Lithium	25			
Group 4	**50 – <150**			
Nickel	50[i]			
Antimony	70[j]	**420**	**420-2000**	**2000**
Chromium	100[k]			
Tin	100			
Group 5	**150 or >**			
Boron	150			
Aluminum	200			
Bromine	200			
Zinc	250[l]	**1260**	**>1260**	**No Limit**
Bismuth	400			
Manganese	400[m]			
Iron	500			

[a] Ordered from most to least toxic within Group.

[b] Values in column represent the total (i.e., the sum) of the content of all elements in the Group.

[c] Calculated as (NRC MTL for most toxic element in the Group * dilution factor of 21) / safety factor of 2.5.

[d] Fluorine is not included in Table 2 because fluorine is closely associated with phosphate ingredients and has been handled successfully for many years by requiring the phosphorus:fluorine ratio to be not less than 100:1

[e] Arsenic 5 for fish, 30 for all other species.
[f] Iodine 5 for horses, 50 for cattle and sheep.
[g] Molybdenum 5 for horse, cattle and sheep.
[h] Copper MTL's are species dependent. MTL's are: 15 for sheep, 40 for cattle, 100 for fish and ducks, 250 for other poultry species, horses and swine.
[I] Nickel MTL for horse, rodent and fish, unchanged from previous.
[j] Antimony MTL for rodents only, unchanged from previous.
[k] Values for chromium III ($Cr^{+}3$). Chromium VI (Cr+6) is carcinogenic and typically not incorporated or found in mineral ingredients.
[l] Zinc 250 for fish, 500 for horse, cattle, poultry, rodents.
[m] Manganese 400 for horse, 1000 for swine.