Animal Nutrition Association of Canada

Deficiencies in the Canadian Feed Regulatory System and the Need for Performance-Based Regulation

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EXECUTIVE SUMMARY

The current Feeds Regulations in Canada are unique in dictating nutrient levels of diets and more generally in requiring the registration of individual feeds *per se*. Diets meeting specifications detailed in Table 4 of the regulations are exempt from registration, a situation that was of mutual benefit to the feed industry and regulatory agencies when it was introduced in 1983. Since that time, the developments in the feed and animal industries are such that Table 4 is now restrictive and does not accommodate modern concepts of nutrition or feed formulation or allow feed companies to adequately address key societal issues such as food safety and environmental protection. By today's standards, the nutrients listed in Table 4 are by and large of little significance to animals or those purchasing feed. A general review of feed legislation in other countries reveals no enforcement of nutrient levels in animal diets. The most progressive new legislation is seen in the European Union, where as a general trend in simplifying all regulatory processes, there is a move towards self-regulation of feed manufacture that is seen as one part of a regulated and monitored farm-to-fork food program. In the EU and other countries there is a move away from feed registration and this is being replaced by registration of feed mills. Such industry self-directed EU legislation is associated with greater need for transparency of feed manufacture via modified labeling and greater access to all information and the important fact that the industry assumes liability for its actions.

In addition to archaic systems of registration of individual feeds, the Canadian feed industry is being hampered by such a daunting process of feed ingredient/feed additive registration, that our industry is being denied access to competitive feed ingredients. International and even Canadian companies are simply not bothering to register new products in Canada. The new EU performance-based regulatory system also covers the important component of new ingredient/additive registration coupled with regulatory oversight. The Canadian feed industry has a number of future options regarding advocacy efforts for the regulatory process governing feed manufacture. Such choice will be dictated by the balance between altruism vs. the relative complacency and secrecy of the status quo.

Options for future governance are:

- Status quo retaining Table 4, although for the vast majority in the feed industry this is not seen as a viable option.

- Retain only existing Table 4 maximum nutrient constraints.

- Retain modified Table 4 maximum nutrient constraints where there may be issues of safety or animal welfare.

- Propose self-directed governance with federal oversight. Such governance to place emphasis on registration of feed mills (extension/progression of HACCP) rather than feeds, fast track new ingredient registration and provide greater transparency through modern labeling and other IT support material.

1. BACKGROUND

The impact of Table 4 within the 1983 Feeds Regulations has evolved from one of mutual benefit to both feed manufacturers and regulatory agencies to the current situation of imposing restrictions on best practices of feed manufacture. Intimately associated with the impact of Table 4 on feed manufacture is the current concern regarding feed and feed ingredient registration, and especially the process used and timelines deemed necessary for compliance. This review addresses these concerns relative to historical developments in animal feed manufacture, evolution in our knowledge about the nutrient needs of animals, the impact of new ingredients and nutrient sources on animal nutrition, and our cognizance of overriding societal issues such as food safety, environmental footprints and animal welfare. Ultimately, the Canadian feed industry must compete on a global basis to ensure the long term viability of our $20 billion food animal industries, and as such needs positive support reinforcement from all regulatory agencies.

2. THE FEED INDUSTRY 1970-2010

The Feeds Act and Regulations of 1983 were introduced at a time of rapid change within the animal feed and primary food animal industries. Up to this time, feed was produced in modest amounts at very many locations across Canada, and these feeds sold locally to thousands of farmers. Most feed mills produced many different feeds, and for the most part, each mill accommodated demands to produce feed for the complete range of farm animals. Not all feed mill locations had trained nutritionists, and there was reliance on National Research Council (NRC) estimates of nutrient requirements as a starting point for diet formulation. Reformulation occurred infrequently because of limited supply of alternative ingredients together with rudimentary computing hardware and software. Concurrently there was pressure to involve the feed industry in the regulation of food supply to Canadians, and this led to various statutes of federal legislation. Registration of all feeds was quickly deemed un-manageable because of the daunting volume of multi-species feeds produced at all these locations across Canada. A mutually agreed solution within the 1983 Feeds Regulations was to take the unprecedented decision, relative to all other known feed regulatory systems world-wide, to exempt feeds if they met criteria for “quality” in terms of providing a basic supply of selected nutrients. These nutrient bounds came to be known as Table 4. Exemption from registration was allowed if the levels of specified nutrients fell between these proposed minimum and maximum levels. This exemption drastically reduced the administrative burden of registration and the cost of registration and generally met the needs of the feed industry at that time. Over the next 20 years there was consolidation and specialization in the feed industry together with rapid evolution in knowledge concerning requirement of available nutrients for most classes of livestock.

Such expansion of the knowledge base was supported by rapid developments in capacity of formulation systems and their integration with feed manufacture, feed processing, quality control procedures and labeling and data storage.

Concurrently the animal industries were starting to specialize and consolidate. Fewer farms raised more than one animal species and animal numbers became more concentrated on these farms that were themselves often concentrated in certain locales across Canada. This specialization into farming pigs, poultry, dairy cattle, beef cattle, fish and other minor species was associated with greater knowledge concerning animal health and wellbeing, environmental control and the realization that animal production could impact certain aspects of meat, milk and egg quality and composition. These refinements, specialization and sophistication of knowledge within most animal production systems led to the demand for more specialized feeds and nutritional knowledge and greater agility in formulation in terms of fluctuating ingredient prices and ingredient availability. As one example, the sophisticated animal industries increasingly demanded feeds formulated to supply digestible or metabolizable nutrients, rather than simply the total level of nutrients as was previously deemed acceptable. Such demand for increased knowledge and sophistication of feed formulation and the role of individual feeds within life-cycle feed programs was fueled by a golden era of animal nutrition research in Canada and world-wide. Knowledge transfer, about the nutrient requirements of farm animals, directly to corporate animal nutritionists invariably made NRC standards quickly redundant, even within the usual 5-8 year interim period between the standard NRC periods for review. For certain species, such as poultry, the NRC abandoned the costly attempt at providing current information in a timely manner, with the latest and likely the last information released in 1994.

The demand for more exact specification of animal feeds led to rapid advancements in quality control procedures at the feed mill, in terms of gaining greater knowledge about the nutrient content of incoming ingredients as well as guarantees of the nutrient profile for commercial feeds. Coupled with new technology in electronic control over most steps in feed manufacture such development has resulted in unprecedented quality of animal feed manufacture in terms of not only greater precision in meeting an animal's nutrient requirements, but also in consistent supply of the nutrient composition of such feeds on an ongoing basis.

Over the last 15 years, feed production and animal and food production have been greatly impacted by the need to accommodate real or perceived, very broad, societal issues. These issues mainly relate to food safety, food composition, animal welfare and various environmental concerns. As a generalization it seems that animal feed quality assurance today is more concerned with these societal issues than it is about meeting the animal's nutrient requirements. Concern about the nutrient composition of diets is not a major issue within the current focus of various HACCP and feed mill registration systems world-wide.

Certainly these feed mill certification programs can only benefit the animal and food industries, yet we have somewhat lost focus on feed nutrient supply. The unease over antibiotic use in animal feeds has created a new industry in the identification and use of alternate antimicrobials, while the concern over using genetically modified ingredients has caused upheaval in feed manufacture in Europe.

The BSE issue in Europe led to major reorganization of global feed manufacturing processes and legislative initiatives, while the EU dioxin debacle fueled changes towards accountability, traceability and transparency of feed production. As discussed later, it is interesting that it was the EU feed and animal industries that were the focus of these major issues that undermined consumer confidence, and yet today legislation of the European feed industry has moved more towards self-regulation and away from direct government control.

3. TABLE 4

For review, the current version of Table 4, within Schedule 1 of the 1983 Feeds Regulations is shown as Appendix 1. In summary, Table 4 details the minimum and maximum nutrient bounds, between which feeds for most farm animal species are exempt from registration. This data has remained virtually unchanged since its inception in 1983, with the most notable amendment being an increase in the maximum allowance for selenium for monogastric animals, from 0.1 ppm to the current level of 0.3 ppm. As previously mentioned, the intent was to reduce the burden and cost of feed registration, and in 1983 the introduction of Table 4 was considered an amicable solution to these issues for both the feed industries and the regulatory agencies. Table 4 seems to be globally unique in that no other country's regulatory agency has taken this approach, and in fact no such agency dictates or mentions nutrient levels per se in their various feeds and/or food legislation. Table 4 of Schedule I was incorporated as part of the Feeds Regulations introduced in 1983 (SOR/83-593). The original Table 4 established nutrient ranges for chickens, turkeys, swine, beef and dairy cattle and sheep. In 1990, Table 4 was slightly modified (SOR/90-73) and then expanded to also include diets for horses, goats, ducks and geese (SOR/90-92) and then finally modified to include rabbits, mink and salmonid fish (SOR/90-730).

There are a number of challenges now faced by feed manufacturers in complying with Table 4 as they impact modern feed formulation, feeding practices and attempts at addressing today's all-important societal issues.

3.1 Nutrient selection

By today's standards of animal nutrition, the list of nutrients detailed in Table 4 is rather unusual. These nutrients do not coincide with the lists detailed in regulatory labeling of feeds and for most species the nutrients are relegated in importance in terms of challenges in meeting animals' nutrient needs, their cost or the potential of nutritional deficiency or excess occurring. Deficiency or excess would only occur in the unlikely event of gross error at the feed mill, which is a situation that obviously cannot be prevented by regulation. In the early 1980's when the concept of Table 4 was being developed, there was perhaps variation in supply and potency of trace minerals, and levels were certainly easy to assay. Likewise Vitamins A, D and E were fairly easy to assay, while the B vitamin cluster were much more difficult to assay. If there is to be a deficiency of vitamins in monogastric animals, then it is usually related to one or more of the B vitamins since there is virtually no storage in the body compared to vast reserves of most fat soluble vitamins as solely detailed in Table 4.

Cobalt is now not added to diets for monogastric animals, since its need is accommodated via supply of Vitamin $B_{12.}$ Likewise magnesium is a very unusual nutrient to consider for most classes of farm animals. Potassium is not usually considered in monogastric nutrition unless there is an underlying need to balance for electrolytes. Of all the nutrients listed, only calcium, phosphorus and sodium are likely to be "variable" and potentially impact animal performance and animal welfare. The metric ICU for vitamin D reflects a very dated concept.

3.2 Nutrient minimums

Table 4 has become dated mainly because of a number of the nutrient minimum specifications and this mainly relates to trace minerals and phosphorus. Today, it is efficacious to use phytase enzyme that releases endogenous plant phosphorus that is bound as phytic acid, and that is usually indigestible to pigs and poultry. The digested phosphorus in phytic acid is often supplied more cheaply than are inorganic phosphates, and so this reduces the need to supply supplemental phosphorus by 15-30%. The current minimum specifications for phosphorus disregard the potential of using phytase enzymes, since the required minimum guarantees for phosphorus are too high. The consequence of this historical constraint is more expensive diets, more phosphorus into the environment and sometimes an induced imbalance between supply of calcium and phosphorus which can impact animal welfare via compromised skeletal integrity.

There is also a trend to using organic-bound, rather than inorganic salts of some or all trace minerals. This trend started with organic selenium, where it was shown that protein-bound selenium was more efficacious than sodium selenite in terms of tissue levels of selenium accruing from comparable additions of the two sources. Subsequently there has been increased acceptance of organic forms of copper, zinc, iron and manganese as more "available" sources of these minerals. Since there is little known advantage to high tissue accretion of these trace minerals, the general trend is to formulate to levels giving comparable tissue accumulation, and this situation is often achieved by using just 20-50% of regular diet supplements. The outcome is comparable animal performance and wellbeing achieved at 60-80% reduction in environmental accumulation of these metals. The historic minimums in Table 4 often prevent the use of low-level supplementation of organic trace minerals.

The level of nutrients in the water supplied to farm animals is usually insignificant in relation to those same nutrients supplied in the feed. For example, even with the hardest water imaginable, the contribution of calcium is insignificant to the animal's daily need. The only nutrient naturally contained in drinking water that can impact the animal's metabolism is sodium. In certain regions, and most prominently in Western Canada, saline water supply can dramatically impact animal performance unless the sodium and chloride levels in feed are appropriately adjusted. Backed by knowledge of seasonal concentration of sodium in water, it is sometimes essential to reduce the dietary supply below that dictated by the minimum suggested in Table 4, and this is particularly so for poultry. Without reduction in dietary supply of sodium necessary to balance the animal's overall intake of sodium, animal performance and animal wellbeing are compromised.

3.3 Nutrient maximums

The maximum level of nutrients dictated within Table 4, rarely pose issues during feed formulation. The levels are generally set so high that they are never achieved during feed formulation and feed manufacture, and even these high levels are far from being toxic or problematic to animals.

3.4 Nutrient balance

Table 4 makes no attempt to create or control the balance between nutrients listed in the specifications or to accommodate the concept of nutrient density. The rationale behind Table 4 is that feeds falling between these minimum-maximum specifications would be efficacious and safe for animals and that feed manufacturers are not "cheating" their customers. It is rather a naïve view that feeds falling within these guidelines are safe and efficacious and that Table 4 is thus the appropriate regulatory solution. The metabolism of trace minerals is very complex due to interaction between minerals at sites of absorption and during catabolic and anabolic process related to growth/productivity and maintenance. The classic example is the interaction between zinc and manganese (and perhaps copper) and so the supply of either will impact and dictate the need for supply of the corresponding interactive element. Consequently, accommodating the guidelines of Table 4 while supplying the maximum of zinc coupled with the minimum for manganese may well precipitate a "deficiency" of the latter in monogastric animals. The need for calcium and phosphorus is predicated on the supply of a balance between these nutrients, and again animals will be compromised by using the allowable maximum for phosphorus coupled with the minimum for calcium within Table 4, where atypical skeletal metabolism is expected.

The supply of sodium and potassium often needs to be rationalized based on the supply of anions, and especially the supply of chloride. It seems illogical to dictate supply of the former elements with disregard for anion content of the diet. There is also documentation suggesting that the balance between some of the fat soluble vitamins can impact availability of individual vitamins. In poultry for example, high levels of vitamin A can increase the need for vitamin D, and this interaction would occur if the minimum levels of vitamin D as dictated by Table 4 were combined with the corresponding maximum levels of vitamin A.

For any class of animal, and especially for monogastrics, feed intake is greatly influenced by diet energy level. The energy level of diets is not specified or guaranteed within Table 4, yet energy concentration is the major factor influencing feed intake. As energy level varies, to suit particular market, economic or certain animal needs, so the concentration of critical essential nutrients has to be correspondingly adjusted so as to prevent over- or under-consumption. For the nutrients listed in Table 4, the implementation of diet adjustment according to energy level will impact the dietary need for calcium, phosphorus and perhaps sodium. With low-energy diets, the required sodium level likely approaches the minimum specified by Table 4, which coupled with saline water and the fact that animals drink more when offered low energy diets, leads to issues in meeting Table 4 minimums for this nutrient as it impacts animal wellbeing.

3.5 Accommodating feed supplements and ruminant feeds

Table 4 does not accommodate the production of supplements that are usually concentrated "diets" intended to be mixed with other ingredients to produce a complete feed. This situation is almost universal with dairy and beef feeds. For dairy cattle, the manufactured supplement will commonly be mixed with roughages to provide the final ration fed to an animal. Table 4 assesses compliance based on the concentrate sold by the feed manufacturer and this situation poses a major issue in manufacturing ruminant feeds since forages grown on-farm contribute the bulk of an animal's daily ration. Table 4 ignores the nutrient contribution of such roughages. If roughages are high or low in any nutrient specified in Table 4, then compliance is made untenable. For example, in most beef and dairy diets the vast majority of potassium is provided by roughages. The need to meet the Table 4 minimum for potassium is irrelevant and compliance will inevitably mean oversupply of potassium and this situation will compromise the animal's metabolism. A potential solution would be to consider daily intakes of nutrients for ruminants and take into account the "average" composition of roughages in this calculation, so the nutrient levels in the concentrate can be calculated in terms of adequacy in meeting the ruminant's daily requirements. Interestingly this approach is taken for selenium, where Table 4 specifies metrics in terms of levels of daily intake, but only for dry and lactating cows.

Forages are notoriously variable, from year to year and from plant species to species and so balancing for such nutrients as potassium becomes very challenging if the final ration is to conform to Table 4 or if the supplement is to conform to Table 4. It is difficult to regulate the nutrient profile of forages, but presumably they fall into the "GRAS" category (generally recognized as safe).

Accommodating Table 4 is made even more difficult for ruminant diets by the variable metrics expressed as units of nutrients per animal per day or units per kilogram of body weight. In some instances such as for selenium as previously mentioned, there is an illogical end result in that Table 4 dictates more selenium for older animals, when nutritionally and biochemically their relative need is reduced.

3.6 Classifications of animal age

The current age classifications for most species in Table 4 are based on historical NRC classifications. In the case of pigs and poultry as an example, these NRC age classifications have remained virtually unchanged over the last 40 years. Over this time animal characteristics have certainly changed with the main difference being reduced days to achieve a given market weight. For example using designators of "Chickens 0-8 weeks" and "Chickens 8-20 weeks" is a reflection of the historical reliance on slow-growing breeds that were used for both meat and egg production. The term "Chickens 0-8 weeks" now encompasses an age bracket that itself far exceeds the life-cycle of most meat chickens raised in Canada. Today the commercial formulation of diets for broiler chickens is appropriate for age classifications detailed in days rather than weeks, with some diet types used for just 3-4 days, after which time a change in diet

nutrient specification is accommodated. For pigs and poultry there is the potential or need to formulate sex-specific diets, a situation that is not accommodated in Table 4. Certainly most adult males maintained for reproduction, regardless of species, have very different nutrient needs compared to their cohort females. In this regard adult male animals are often fed at close to maintenance, which often means oversupply of macro nutrients as dictated by Table 4, a situation that can compromise the welfare of adult male animals.

3.7 Environmental accountability

As for most NRC specifications, Table 4 was created in an era prior to major concern about environmental responsibility and issues related to the feed industries environmental footprint. As previously mentioned, it is now possible to greatly improve an animal's retention of many nutrients through use of novel feed ingredients and additives. We can reduce the output of copper and zinc into the environment by at least 50% by judicious use of very low levels of minerals complexed with proteins or other organic compounds. The apparent greater availability of these mineral sources allows for reduced supplements coupled with concomitant greater use of minerals inherent in the major feed ingredients. For example, using organic minerals at low levels, the Canadian poultry industry's environmental burden of elemental copper could be reduced by at least 100 tonnes and that of elemental zinc by 1500 tonnes each year. Unfortunately, complying with existing regulation, the diet formulation needed to accommodate this societal benefit would need all diets to undergo registration, since the minimums detailed in Table 4 are too high and so do not accommodate such an initiative.

The other major anomaly of Table 4 is too high a phosphorus requirement relative to the requirement that can be used in conjunction with phytase enzyme. Phytase is now used world-wide as a replacement for inorganic phosphates. This novel enzyme releases phosphorus in phytic acid found in plant material, replacing anywhere from 15% to almost 30% of the mineral conventionally supplied by inorganic phosphorus sources such as calcium phosphates. This direct replacement of enzyme for phosphate mineral reduces manure accumulation of phosphorus by a corresponding amount. Table 4 has not evolved to accommodate the practice of using phytase enzyme, and perpetuates the very dated concept of the need for too high a level of total phosphorus in the diet. Phytase usage is now the norm rather than the exception in feed formulation world-wide, and so regardless of the outcome of deliberations about Table 4, the concern about the minimum requirements of phosphorus being too high must be addressed for environmental protection reasons. One suspects that necessarily registering all "low-phosphorus" diets containing phytase would pose a non-workable burden on the registration system. The new EU Feed Regulations (see Section 4.3) also detail the moral dilemma of the environmental footprint involved in transportation of bulky phosphates vs. that of compact phytase enzymes.

3.8 The need for Table 4 and/or feed registration that dictates nutrient supply

Why does there need to be a formal regulatory process that dictates the responsibilities of professional animal nutritionists? No other feeds legislation or similar regulatory process world-wide appears to dictate (or even mention) dietary nutrients or their concentrations, outside of the cursory needs for labeling. In effect, the federal government is saying that corporate animal nutritionists across Canada cannot be entrusted with the task of deciding on the nutrient needs of farm animals. One answer in support of current government regulatory practice describes the need to protect the consumer, which in this case is the farmer purchasing the feed. Certainly a farmer cannot assess the quality of a feed by simple appearance, yet the sophistication of modern farming methods ensures that "quality" is continually assessed in today's competitive market. Accurate record keeping of animal productivity, and even private analytical testing of feeds by progressive farmers, are the checks on feed composition and value. In reality, animal feed is rarely purchased based on diet composition, and certainly not based on the minor trace elements listed in Table 4. More commonly, animal feed is purchased from feed manufacturers based on prior results of animal productivity, cost per tonne, financing agreements and even considerations of reliability of delivery. Diet nutrient composition is rarely questioned or at most will be confined to the very simplistic information associated with labeling and tag descriptions.

The inference of the regulatory justification for Table 4 is either lack of confidence in the ability of corporate nutritionists to formulate diets and understand animal nutrient requirements, and/or that even if such background knowledge exists, feed manufacturers will attempt to cheat their customers by supplying diets with inappropriate levels of nutrients. These assumptions are unique internationally in regulations concerning animal feed, since regulations now focus almost exclusively on feed quality assurance as it relates to health and wellbeing of end-use consumers of the various animal food products.

4 COMPARATIVE GLOBAL LEGISLATION IMPACTING MANUFACTURE OF FEED FOR FARM ANIMALS

Most countries have legislative and regulatory systems impacting the manufacture and sale of animal feeds. Regulations often become quite complex when both state/provincial and federal agencies are involved, as is the situation in the USA. While regulatory approaches are variable, the common element is focus on feed safety in terms of drug use, potential for contaminants and control over the list of allowable ingredients and their final labeling. In many countries feed mills are registered with the appropriate government agency and so become licensed to produce an array of feeds that may contain medication. Once registered, the feed manufacturer faces no further restrictions in formulating animal feeds according to the nutrient specifications determined to be appropriate. Labeling requirements for complete feeds are sometimes more detailed than currently practiced in Canada, and this is a general move towards accountability, traceability and transparency within the feed and animal industries.

4.1 United States Feed Regulations

The USA arguably has the most complex system in terms of documentation and clarity of general regulations. In part this uncertainty, at least to those not working within their legislative system, is due to the fact that a number of federal agencies are involved and the fact that legislation at the state level operates independently and lacks inter-jurisdictional consistency. The FDA Center for Veterinary Medicine has developed a comprehensive Animal Feed Safety System (AFSS) intended to protect the health of animals and humans. AFSS applies risk assessment to contaminants in ingredients for animal feeds and especially BSE and mendicants. Emphasis is on ingredients as much as it is on manufactured feeds. New rules apply to commercial feed manufacturers as well as on-farm mixers of feed. The latter have previously been exempt from regulation unless feeds contain medications.

The Federal Food, Drug and Cosmetic Act (FDCA) requires that any substance that is added to animal feed must be used in accordance with a food additive regulation unless it is generally recognized as safe for that use (GRAS). Typical feed ingredients such as forages, grains, and most minerals and vitamins are generally recognized under the FDCA as safe sources of nutrients. In petitioning for feed ingredients or additives outside of GRAS status, each of the following subject areas have to be addressed: a) human food safety; b) target animal safety; c) environmental impact; d) utility (intended physical, nutritional or other technical effect); e) manufacturing chemistry; f) labeling (cautions, warnings, shelf life, directions for use); and g) proposed regulation. Outside of cursory needs for labeling, there is no mention of nutrients *per se* in any of these legislative or regulatory documents, and so no process comparable to Table 4.

4.2 English and Australian Feed Regulations

Australia also has Commonwealth (federal) and state legislation governing feed manufacture for farm animals. Most legislation is quite dated and new initiatives relate to compliance with new EU legislation as it impacts trade in animal food products from Australia to EU countries. There is no indication of need to comply with any nutrient specifications for any class of animal. Like most countries in the EU, England has its own feeds regulation, the emphasis of which has changed to reflect issues with BSE in the 1990's. The Feeding Stuffs Regulations No 3281, 2005 are heavily focused on the definition of ingredients, the requirements for labeling, allowable variance for nutrient guarantees and maximum allowable levels of potential toxins. In accordance with the general direction of EU legislation there is emphasis on self-regulation within the confines of more extensive labeling of nutrients than currently occurs in Canada. For complete feeds there is a compulsory requirement to label simply for crude protein, oils/fat, fiber and ash. Somewhat more unique is the compulsory need to define the levels of lysine and methionine for pigs and poultry (optional for other species). Labeling of all other nutrients are optional declarations. Interestingly within these optional declarations is energy level of feeds, with values being calculated using species-specific EU equations based on proximate components. The regulations also define acceptable limits for variance in analytical levels of most nutrients and clearly define maximum allowable inclusion for undesirable substances such as heavy metals and dioxin as well as natural plant toxins and aflatoxin etc. The regulations do not stipulate the nutrient content of any feed.

4.3 European Union Feed Regulations

The EU feed and animal industries have struggled through various issues impacting consumer confidence and food safety. It is therefore somewhat surprising that the most recent rules, "Regulation of the European Parliament and of the Council on the Placing on the Market and Use of Feed", Brussels 13 July 2009, PE-CONS 3611/5/09, AGRILEG 28, CODEC 209 is perhaps the most straightforward document of any such feed-related regulations, to both read and comprehend. In essence the regulations move towards self-governance by the feed manufacturing industries with an underlying need for transparency, accountability and traceability. The consequences of reduced regulatory burden are promoted in order to sustain the economic viability of the €60 billion animal feed industry. On the other hand the move towards self-regulation clearly places the feed industry, and not government, as being fiscally liable for any breaches of food or environmental safety etc. The regulations focus entirely on animal and public health and other than rudimentary requirements for labeling, there is no attempt to deal with mandatory or maximum levels of any nutrients in animal feeds.

Following issues with BSE, dioxin contamination and other concerns regarding consumer confidence about the food chain, the EU moved through a series of legislative changes that culminated with the unwieldy edict of feed manufacturers being required to list all ingredients

included in all animal feeds and also their inclusion level. While such labeling was made somewhat redundant by the need to be only within ± 15% of stated inclusion level, the industry was obviously concerned about confidentiality of their feed product formulations and the negative impact of this regulatory process on research and development and intellectual property, within such an open system. The new EU rules have retained mandatory listing of ingredients, in descending order of inclusion level, but without the need for specifying inclusion levels. Such listing of ingredients, as agreed to by the EU feed industries, supports transparency within feed manufacture. However, if labeling or diet description details certain features or emphasizes certain nutrients, then there is a mandatory need to support such claims during labeling with appropriate information about inclusion levels or nutrient levels. For example describing a diet as "containing flax" triggers the requirement to detail the inclusion level of flax used in the diet.

Under the new EU regulations, complete feeds for all animal species must be labeled with levels of crude protein, crude fat, crude oils and fats, crude ash, calcium, phosphorus and sodium. For pigs and poultry there is the additional mandatory requirement to list levels of methionine and lysine.

In its impact assessment document (COM(2008)124 final) the Commission states that this new feed regulation is part of the EU government's goal for simplification of all judicial processes, and in effect will replace 4 existing Council Directives and 50 amending or implementing acts.

In accepting a current outdated system of governance, the Commission recognizes that developments in both the feed and legislative environments influencing the feed industries reveal the need to modernize and simplify current law in order to:

a. achieve legal clarity
b. facilitate smooth functioning of the EU market
c. simplify technical requirements
d. remove unnecessary administrative burdens
e. increase international competitiveness, and
f. provide customers with informed choices, without being misled, through modern labeling and IT options.

The Commission recognizes that the production of "genuine, wholesome and safe" feed is primarily the responsibility of the feed business by adhering to HACCP principles, with compliance controlled and monitored by the various competent government authorities. This new EU approach is a major step towards self-regulation of the feed industries and they themselves must now support and be partially responsible for governance and monitoring of feed and food safety. Reduced administrative burden is balanced with greater accountability of the content of feed so as to make available more informed choices, via labeling and other IT mechanisms, for their customers. As will be discussed later, one component of this accountability is development of a central registered ingredient database at a cost to the industry of over $1 million.

5. THE NEED FOR CHANGE IN REGULATORY APPROACH TO THE CANADIAN ANIMAL FEED INDUSTRIES

Having the opportunity to travel extensively around the world, it is always disconcerting for this writer to hear that Canada is generally regarded as a country of non-opportunity when it comes to registering and developing new feed products. Our market size rarely warrants the current time, effort and cost involved in getting feed additives and ingredients to the market. To some extent this was merely an inconvenience for our feed industry until about 10 years ago, at which time there was (government) pressure to reduce the use of feed-borne antibiotics and their replacement with alternative products. Modern animal agriculture needs control over animal pathogens, and as much as some politicians and naïve consumers expect their food to be produced by small-scale "back-yard farming" there will never be an alternative to modern large-scale farming in order to feed society. Modern feed manufacture and animal husbandry suddenly has the need to include an array of additives, including enzymes, essential oils, fatty acids, microbial components etc. in order to sustain large flocks and herds of farm animals. It is this single factor that has highlighted the archaic system of feed regulation inherent in Canada and the likelihood of our becoming globally uncompetitive by 2020. Obviously it must be recognized that animal feed is part of the human food chain and so requires oversight, yet in many instances the regulatory control over animal feed production is far greater than that imposed on the human food industry.

There needs to be regulation and control over feed safety and it is interesting that the EU, with its myriad of feed-related consumer health issues over the last 10 years is now moving towards a system of self-regulation in order to address feed safety within the feed-to-fork food system. Feed governance should concentrate on feed safety and not feed nutrient content. No country other than Canada imposes restrictions on the nutrient content of animal feeds, relying instead on the competitive feed companies and knowledgeable feed customers/animal producers to ensure desired animal performance and animal welfare. Such trade needs to be supported by a transparent labeling system, that itself is supported by modern sources of more extensive on-demand information. Federal regulation should involve registration of feed mills, along the lines of HACCP accreditation, and such mills, producing feed composed of ingredients from a prescribed list, including mendicants used as per registration, would need no further direct regulation provided there were appropriate methods in place to monitor compliance with registration conditions. Feed registration would only be necessary for feeds that include non-prescribed ingredients, off-label medication or those manufactured at non-registered sites.

Table 4 should not be part of a modern approach to feed industry regulation. However, its removal seems unlikely without an alternate system acceptable to both the feed industry and government. Considering the discussion to date, there are four scenarios to be considered, ranging from status quo to an altruistic system driven by self-governance and supported by federal oversight.

5.1 Retain Table 4 as-is

The status-quo obviously involves retaining the current system of non-registration if feeds accommodate the nutrient specifications of Table 4, as detailed in Appendix 1. While there may be a certain level of comfort provided to government and even to some feed manufacturers by the existence of Table 4 in its current form, the vast majority of commercial feed manufacturers in Canada do not view the status quo as a viable option for sustaining a vibrant animal feed industry.

5.2 Retain only original nutrient maximums in Table 4

Most current issues with Table 4 relate to compliance with nutrient minimums rather than maximums. One option is therefore removal of these minimum specifications and to retain only the current maximum levels as detailed in Appendix 2.

5.3 Retain a modified list of nutrient maximums in Table 4

A number of nutrient maximums currently listed for several species are meaningless to the animal, the nutritionists and the feed customer. Appendix 3 shows an example of modified Table 4 maximum nutrient levels that are more nutritionally relevant and more species-specific.

5.4 Change to a performance-based system of feed industry registration and governance

If it is accepted that feed regulation and registration should concern itself with feed safety as it impacts animal welfare and food safety, rather than the nutrient composition of feeds, then the main components of a modernized regulatory system should be controlled by the feed industry itself, with an appropriate level of government oversight. In large part the foundation for such a situation currently exists, with many feed mills being HACCP certified. Modernized, performance-based regulation could be an extension of this concept, since HACCP certification requires implementation of recognized standards, and independent verification of compliance. Accepting such responsibility should be to the betterment of all feed companies, their customers and the end consumer. The burden of any such system is direct accountability for the consequences of variable feed quality, a more altruistic attitude than currently exists in the industry and greater transparency and accountability.

Any system of performance-based self-governance would only be acceptable with federal oversight, albeit with a different focus. Features of a new system of governance for animal feed manufacture may include:

a) Registration of feed mills rather than feeds

The federal government should involve itself with registration of feed mills and their operating procedures, rather than attempting to control the composition and registration of the vast majority of commercial diets. Most commercial mills have been through the process of HACCP registration and undergo regular follow-up audits by independent third party experts, and so this additional process could simply be an extension/modification of the current system. Focus of mill registration would be on feed safety, drug residues, feed sequencing, etc. The feed industry in the USA is currently undertaking this process independent of the federal government, although the latter indicates that such self-registration will lead to fast-track of any feed mill registration that they may impose.

If mills are registered to produce feed, then there is no further need for feed registration, assuming that such feeds are composed of pre-authorized ingredients and medications used according to pre-approved dosages and combinations. Feed registration would only be required for those feeds containing “unauthorized” ingredients, off-label medicants, or any feed manufactured at a non-registered feed mill. Feed mill registration could be stratified to accommodate main-stream commercial feed manufacturers through to on-farm manufacturers. Registering all animal feed production facilities (to varying degrees of rigor related to capacity/medicant use/sales vs. on-farm use) would provide CFIA with detailed information that could be useful in situations of trace-back related to food safety issues.

b) Pre-registering feed ingredients and feed additives

Much like the previous EU system of novel feed ingredient registration, the Canadian system is flawed in terms of the time and cost involvement. The EU has accepted this criticism and changed the system to one of more speedy resolution involving industry self-regulation coupled with government regulatory oversight. The impetus for this change was the realization that for most novel ingredients (but not all) the time and cost involved in registration far outweighed the potential for a meaningful negative impact on feed quality, animal welfare and food safety. In many instances in Canada, the process to register ingredients for animal feeds is counterintuitive to the process involved in human food production. As an example, certain omega 3 products are now routinely added to human infant formulas while they are not cleared for use in dairy feeds.

The proposed EU system is to transfer the current 160 pre-authorized ingredients into a new regulatory grouping with subsequent additions (or deletions) decided on by comitology procedure on the basis of information provided by the manufacturer/supplier and industry representatives. If such a system was considered in Canada, the feed

industry would form an advisory committee, likely involving some independent scientific representatives knowledgeable in toxicology etc., to make recommendations on acceptance, or not, for novel ingredients and additives included in the list. Details of acceptable ingredients would be forwarded to the federal government for fast-track decision. The government would not accept requests for addition or deletion without such prior industry committee approval. It is argued that for many innocuous ingredients (e.g. the combination of two already registered nutritive products) this industry-driven process would reduce the burden on the current federal regulatory system in Canada. The feed/animal industry is also likely best positioned to make recommendations on additives claimed to impact animal performance. Obviously such a system of ingredient/additive registration would only work successfully with rigorous and unbiased review during pre-screening by the industry/science committee.

c) Labeling and transparency of feed composition

It is irresponsible for government to take as the foundation for its regulatory approach the position that all or most feed manufacturers would cheat their customers and undermine their livestock by providing inferior diets or products that fail to meet market expectations. Competitiveness within the industry coupled with limited options of animal genetic stocks, and standardization of housing and animal health management systems all lead to fairly predictable animal performance. When associated with sophisticated record keeping, which sometimes can generate real-time data, diet composition/quality is very easy to monitor. These factors once more reinforce the need to question the current system of feed registration and certainly any need for regulation of diet nutrient content. On the other hand there is an obvious trend in government and society towards accountability and transparency. While a truly open-book policy on formulas and diet nutrient levels may be welcomed by government and the vocal minority seeking information, this extreme situation would run counter to unfettered competition and investment. However the feed industry likely has to move some way towards more liberal and meaningful labeling and a system of full accountability in situations of catastrophic events.

Unlike the situation in the feed industry, labeling is considered an integral part of marketing for many consumer products. As a corollary of not registering most commercial feeds, the industry should provide more meaningful information about animal diets, either at point-of-sale or within a central retrievable database. For monogastric farm animals current labeling/tags are virtually meaningless in terms of the nutrients that impact animal performance and those that impact cost of the diet. Most label information has been unchanged for 40 years and reflects ease in laboratory analysis of mostly redundant nutrients or nutrient classifications. For pigs and poultry the most important information about the diet is its energy level. Currently no country requires labeling for energy level, yet some feed companies in Europe now voluntarily provide such information based on species-specific calculations regressed from gross nutrient composition. However, a variance guarantee within the EU of ± 7.5% for this calculated energy value somewhat negates the usefulness of this exercise and this

therefore points to the need for some future adjustments. Diets for pigs and poultry should be labeled with levels of total methionine and lysine.

Simply to accommodate emphasis on transparency of feed manufacture, diets should be labeled with a list of component ingredients, listed in descending order of inclusion level. This approach should be accompanied by a central repository of detailed information about all ingredients, and ANAC may be a candidate for this central role of information gathering and dissemination. As previously detailed, the EU industry is considering such a task, budgeted at just over €250,000 to establish the database (without cost of translation to 22 member languages) and €90,000 per year to service and update the system. Any potential customer requesting information on, for example, distiller's grains would be directed to the designated website for detailed general information.

If there were a change in approach for government control/regulation of feed manufacture as discussed herein, there would likely need to be a mechanism for disclosure of diet composition to government agencies and customers in the event of catastrophic animal health, food safety or environmental situations. Such disclosure would not be at the discretion of the customer, but rather would be based on a legal need directed by government agencies. The new EU legislation accommodates such occurrences, and has apparently been agreed to by all stakeholders with the proviso that any such information release is accompanied by legally binding confidentiality agreements.

d) Information needed within a central repository

As mentioned above, ANAC could serve as the central repository for supporting information about all animal feeds for its members or the industry as a whole or even for end-point consumers of animal food products. To a large extent this web-based information would be used as an underpinning to transparency of the feed manufacturing processes and industries. Undoubtedly any such collated information could be sourced elsewhere, albeit not at one site. Such information, available to feed customers (and perhaps consumers) could cover:

- as previously suggested, if labeling includes an ingredient list, then these ingredients need detailed descriptions regarding very general descriptions of source, any manufacturing process, average nutrient composition, etc;
- the list of "pre-registered" ingredients used in animal feeds;
- average nutrient specifications for animal diets, e.g. calf starter, pig grower, pullet grower, etc. Also typical feeding schedules and periods in which each diet is commonly used;
- typically how diets are analyzed to accommodate label claims;
- how feeds are manufactured?

6. CONCLUSION

Table 4 and the current system of feed registration represent an outdated concept of regulation. The federal government and the feed industry, with the support of livestock producers, should work to reach agreement on a set of regulatory actions that focus on and monitor accredited safety controls instituted by feed mills, rather than concentrating on nutrient composition of feeds and feed ingredients *per se*.

Time will tell if both the federal government and the industry, guided to a significant extent by international best practices, will be able to agree on the type of modernized framework discussed here. Both sides will need to recognize the need for a more performance-based and self-directed regulatory system, incorporating greater emphasis on accountability, traceability and transparency, and providing for the degree of government oversight needed to generate public confidence in a new approach to feed safety.

Appendix 1

Table 4 *(Section 5)*

Range of Nutrient Guarantees for Complete Feeds[1] for Use in the Exemption of Feeds from Registration

FEED INTENDED FOR	LIMITS	COBALT (mg/kg)	COPPER (mg/kg)	IODINE (mg/kg)	IRON ! (mg/kg)	MANGA-NESE ! (mg/kg)	SELEN-IUM (mg/kg)	ZINC ! (mg/kg)	CAL-CIUM (%)	PHOS-PHORUS (%)	MAGNE-SIUM ! (%)	SODIUM (%)	POTAS-SIUM ! (%)	SULFUR (%)	VITAMIN A	VITAMIN C (IU/kg)	VITAMIN DE (IU/kg)
CHICKENS	MIN.	NRS	4	0.4	80	55	NRS	65	0.6 (G) 0.7 (S) 2.75 (B) 3.25 (L)	0.4 (G) 0.5 (S,L,B)	0.06	0.15	0.2	NRS	1,500 IU/kg (O) 4,000 IU/kg (L,B)	NRS	200 ICU/kg (O) 500 ICU/kg (L,B)	10
	MAX.	5	125	10	750	500	0.3 (added)	500	1.2 (O) 6 (L,B) 2.5 (PL)	1.5 (L,B) 1.2 (O)	0.3	0.8	2	NRS	20,000 IU/kg (O) 40,000 IU/kg (L,B)	NRS	5,000 ICU/kg	NRS
TURKEYS	MIN.	NRS	6	0.4	60	55	NRS	75	0.8 (O) 2.25 (B)	0.7	0.05	0.15	0.4	NRS	4,000 IU/kg	NRS	900 ICU/kg	10 (O) 25 (B)
	MAX.	5	125	10	750	500	0.3 (added)	500	2.5 (O) 4 (B)	1.2	0.3	0.8 (O) 0.4 (PS)	2	NRS	40,000 IU/kg	NRS	5,000 ICU/kg	NRS
SWINE	MIN.	NRS	6	0.2	40 (O) 80 (B) 150 (S)	10	NRS	100	0.5 (O) 0.75 (LT,B) 0.8 (PS)	0.5 (O) 0.6 (PS)	0.04	0.1 (O) 0.15 (B) 0.2 (LT)	0.2	NRS	1,300 IU/kg (G) 2,000 IU/kg (O) 4,000 IU/kg (B)	NRS	125 IU/kg (F) 200 IU/kg (O)	10
	MAX.	5	125	10	750	200	0.3 (added)	500	2	2	0.3	0.8	2	NRS	20,000 IU/kg	NRS	1,500 IU/kg	NRS
DAIRY CATTLE	MIN.	0.1	10	0.5 (LT) 0.25 (O)	100 (S) 50 (O)	40	NRS	40	0.4	0.3	0.2 (LT) 0.16 (O) 0.07 (S)	0.1 (O) 0.18 (LT)	0.8	0.1	2,200 IU/kg (O) 3,200 IU/kg (LT,B)	NRS	300 IU/kg	NRS
	MAX.	10	100	10	750	300	0.3 (added)	500	2.5	1.3	1	2.4	3	0.4	200,000 IU/Day	NRS	33,000 IU/Day	NRS
BEEF CATTLE	MIN.	0.1	4	0.1	10	20	NRS	20	0.18	0.18	0.04 (O) 0.18 (LT,B)	0.06	0.6	0.1	2,200 IU/kg (O) 2,800	NRS	275 IU/kg	15

FEED INTENDED FOR	LIMITS	COBALT (mg/kg)	COPPER (mg/kg)	IODINE (mg/kg)	IRON ! (mg/kg)	MANGA-NESE ! (mg/kg)	SELEN-IUM (mg/kg)	ZINC ! (mg/kg)	CAL-CIUM (%)	PHOS-PHORUS (%)	MAGNE-SIUM ! (%)	SODIUM (%)	POTAS-SIUM ! (%)	SULFUR (%)	VITAMIN A	VITAMIN C (IU/kg)	VITAMIN DE (IU/kg)	
															IU/kg (DC) 3,900 IU/kg (LT,B)			
	MAX.	10	50	10	750	200	0.3 (added)	250	2	1	0.5	1.2[2]	3	0.4	100,000 IU/Day	NRS	33,000 IU/Day	NRS
SHEEP	MIN.	0.1	NRS	0.1 (O) 0.8 (LT)	30	20	NRS	35	0.21	0.16	0.04	0.04	0.5	0.1	1,400 IU/kg (O) 3,000 IU/kg (LT)	NRS	150 IU/kg (O) 300 IU/kg (LT,B)	10
	MAX.	10	8 (added)	10	250	200	0.3 (added)	150	2	0.6	0.5	1.2[2]	3	0.4	75,000 IU/Day	NRS	7,500 IU/Day	NRS
HORSES	MIN.	0.1	9	0.1	50	40	NRS	40	0.8 (S) 0.6 (G,B) 0.4 (O)	0.55 (S) 0.45 (G,B) 0.3 (O)	0.1	0.35	0.5	0.15	3,000 IU/kg	NRS	275 IU/kg	15
	MAX.	10	125	2.5	500	400	NRS	500	2	2	0.3	1.2	3	NRS	40,000 IU/kg	NRS	5,000 IU/kg	NRS
GOATS	MIN.	0.1	10	0.2	50	40	NRS	50	0.4	0.3	0.2	0.2	0.8 (LT) 0.5 (O)	0.16	3,000 IU/kg	NRS	500 IU/kg	30
	MAX.	10	40	10	500	200	0.3 (added)	250	2	1	0.5	1.2	NRS	NRS	40,000 IU/kg	NRS	3,000 IU/kg	NRS
DUCKS and GEESE	MIN.	NRS	9	0.4	100	40	NRS	70	0.8 (S) 2.75 (BD) 2.25 (BG) 0.6 (O)	0.65 (S) 0.6 (O)	0.06	0.15	0.4	NRS	4,000 IU/kg	NRS	500 ICU/kg	20 (B) 10 (O)
	MAX.	5	125	10	750	500	0.3 (added)	500	4 (B) 1.5 (O)	1.2	0.3	0.4 (S) 0.8 (O)	2	NRS	40,000 IU/kg	NRS	5,000 ICU/kg	NRS
SALMONID FISH	MIN.	NRS	5	5	50	20	NRS	75	0.5	1	0.1	0.2	0.7	NRS	2,500 IU/kg	100	2,400 IU/kg	30
	MAX.	NRS	75	20	500	150	0.1	300	3	2.5	0.3	1.2	1.3	NRS	25,000 IU/kg	NRS	10,000 IU/kg	NRS
MINK	MIN.	NRS	4.5	0.2	60	40 (O) 44 (B)	NRS	60 (O) 66 (B)	0.3 (O) 0.4 (G,B) 0.6 (LT)	0.3 (O) 0.4 (G,B) 0.6 (LT)	0.04	0.2	0.2 (O) 0.3 (G,B)	NRS	6,000 IU/kg	NRS	500 IU/kg	25
	MAX.	NRS	100	20	700	NRS	NRS	500	3	2.5	NRS	0.8	NRS	NRS	60,000 IU/kg	NRS	25,000 IU/kg	NRS
RABBITS	MIN.	0.1	10	0.2	50 (O) 100 (LT)	10	NRS	50 (O) 70 (LT,B)	0.5 (O) 1 (LT)	0.3 (O) 0.6 (LT,B)	0.25	0.2	0.6	NRS	3,000 IU/kg	NRS	400 IU/kg	40

FEED INTENDED FOR	LIMITS	COBALT (mg/kg)	COPPER (mg/kg)	IODINE (mg/kg)	IRON (mg/kg)	MANGANESE (mg/kg)	SELENIUM (mg/kg)	ZINC (mg/kg)	CALCIUM (%)	PHOSPHORUS (%)	MAGNESIUM (%)	SODIUM (%)	POTASSIUM (%)	SULFUR (%)	VITAMIN A	VITAMIN C (IU/kg)	VITAMIN DE (IU/kg)
	MAX.	5	125	10	500	200	0.1 (added)	500	2	1	0.6	0.5	2	NRS	50,000 IU/kg	NRS	4,000 IU/kg	NRS

NOTES

[1]

For dairy cattle, complete feed refers to the grain ration.

[2]

The maximum for sodium does not apply to feed intended for beef cattle and sheep that is designed to be used to limit or regulate feed intake. A statement to the effect that adequate water must be provided shall be part of the directions for use.

ABBREVIATIONS

B:
Breeding
BD:
Breeding ducks
BG:
Breeding geese
DC:
Dry pregnant cows
F:
Swine 60-100 kg body weight
G:
Chickens 8-20 weeks of age

Turkeys 8 weeks to market
Swine 20-60 kg body weight
Weaned horses up to 12 months of age
Mink 4-12 weeks of age

L:
Layer chickens
LT:
Lactating
NRS:
No requirement specified
O:
Others
PL:
Prelayer chickens 17-20 weeks of age
PS:
Turkeys 0-4 weeks of age
Swine 1-10 kg body weight
S:
Chickens 0-8 weeks of age
Calf, foal, duck and geese starter
Weanling swine up to 20 kg body weight

SOR/88-473, s. 5; SOR/90-73, ss. 13 to 20; SOR/90-92, s. 2; SOR/90-730, s. 3; SOR/93-232, s. 2.

Appendix 2.

Table 4. Nutrient Maximums for Complete Feeds[1] for Use in the Exemption of Feeds from Registration

(No change from current Table 4, Schedule1)

														Vitamin (IU/kg, unless specified/d)			
Feed Intended For	**Cobalt (mg//kg)**	**Copper (mg/kg)**	**Iodine (mg/kg)**	**Iron (mg/kg)**	**Manganese (mg/kg)**	**Selenium (mg/kg) (added)**	**Zinc (mg/kg)**	**Calcium (%)**	**Phosphorus (%)**	**Magnesium (%)**	**Sodium (%)**	**Potass sium (%)**	**Sulfur (%)**	**A**	**C**	**D**	**E**
Chickens	5	125	10	750	500	0.3	500	1.2 (0) 6 (L,B) 2.5 (PL)	1.5 (L,B) 1.2 (0)	0.3	0.8	2	NRS	20,000 (()) 40,000 (L,B)	NRS	5,000	NRS
Turkeys	5	125	10	750	500	0.3	500	2.5 (0) 4 (B)	1.2	0.3	0.8 (0) 0.4 (PS)	2	NRS	40,000	NRS	5,000	NRS
Swine	5	125	10	750	200	0.3	500	2	2	0.3	0.8	2	NRS	20,000	NRS	1.500	NRS
Dairy	10	100	10	750	300	0.3	500	2.5	1.3	1	2.4	3	0.4	200,000 (IU/day)	NRS	33,000 IU/day	NRS
Beef	10	50	10	750	200	0.3	250	2	1	0.5	1.2[2]	3	0.4	100,000 (IU/day)	NRS	33,000 IU/day	NRS
Sheep	10	8	10	250	200	0.3	150	2	0.6	0.5	1.2[2]	3	0.4	75,000 (IU/day)	NRS	7,500 (IU/day)	NRS
Horse	10	125	2.5	500	400	NRS	500	2	2	0.3	1.2	3	NRS	40,000	NRS	5,000	NRS
Feed Intended	**Cobalt (mg//kg**	**Copper (mg/kg)**	**Iodine (mg/kg**	**Iron (mg/kg**	**Manganese**	**Selenium**	**Zinc (mg/kg**	**Calcium**	**Phosphoru**	**Magnesiu**	**Sodium (%)**	**Potass**	**Sulfur (%)**	**A**	**C**	**D (IU/kg)**	**E**

for	)		)	)	(mg/kg)	(mg/kg)	)	(%)	s (%)	m (%)		sium (%)		(IU/kg)			
Goats	10	40	10	500	200	0.3	250	2	1	0.5	1.2	NRS	NRS	40,000)	NRS	3,000	NRS
Waterfowl	5	125	10	750	500	0.3	500	4 (B) 1.5 (0)	1.2	.03	0.4 (S) 0.8 (0)	2	NRS	40,000	NRS	5,000	NRS
Salmonid Fish	NRS	75	20	500	150	0.1	300	3	2.5	0.3	1.2	1.3	NRS	25,000	NRS	10,000	NRS
Mink	NRS	100	20	700	NRS	NRS	500	3	2.5	NRS	0.8	NRS	NRS	60,000	NRS	25,000	NRS
Rabbits	5	125	10	500	200	0.1	500	2	1	0.6	0.5	2	NRS	50,000	NRS	4,000	NRS

NOTES

[1] For dairy cattle, complete feed refers to the grain ration.

[2] The maximum for sodium does not apply to feed intended for beef cattle and sheep that is designed to be used to limit or regulate feed intake. A statement to the effect that adequate water must be provided shall be part of the directions for use.

ABBREVIATIONS

B: Breeding
DB: Breeding ducks
BG: Breeding geese
DC: Dry pregnant cows
F: Swine 60-100 kg body weight
G: Chickens 8-20 weeks of age
L: Layer chickens
LT: Lactating
NRS: No requirement specified
0: Others
PL: Prelay chickens 17-20 weeks of age

Turkeys 8 weeks to market
Swine 20-60 kg body weight
Weaned horses up to 12 months of age
Mink 4-12 months of age
Swine 1-10 kg body weight
S: Chickens 0-8 weeks of age
Calf, foal, duck and geese starter
Weaning swine up to 20 kg body weight

Appendix 3.

Table 4. Nutrient Maximums for Complete Feeds[1] for Use in the Exemption of Feeds from Registration

(proposed example modifications)

														Vitamin (IU/kg, unless specified/d)			
Feed Intended For	Cobalt (mg//kg)	Copper (mg/kg)	Iodine (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)	Selenium (mg/kg) (added)	Zinc (mg/kg)	Calcium (%)	Phosphorus (%)	Magnesium (%)	Sodium (%)	Potassium (%)	Sulfur (%)	A	C	D	E
Chickens	NRS	125	10	750	500	0.3	500	1.2 (0) 6 (L,B) 2.5 (PL)	1.5 (L,B) 1.2 (0)	NRS	0.8	2	NRS	20,000)	NRS	10,000	NRS
Turkeys	NRS	125	10	750	500	0.3	500	2.5 (0) 4 (B)	1.2	NRS	0.8	2	NRS	20,000	NRS	10,000	NRS
Swine	NRS	125	10	750	200	0.3	500	2	2	NRS	0.8	2	NRS	20,000	NRS	1.500	NRS
Dairy	10	100	10	750	300	0.3	500	2.5	1.3	1	2.4	3	0.4	200,000 (IU/day)	NRS	33,000 IU/day	NRS
Beef	10	50	10	750	200	0.3	250	2	1	0.5	1.2[2]	3	0.4	100,000 (IU/day)	NRS	33,000 IU/day	NRS
Sheep	10	8	10	250	200	0.3	150	2	0.6	0.5	1.2[2]	3	0.4	75,000 (IU/day)	NRS	7,500 (IU/day)	NRS
Horse	10	125	2.5	500	400	NRS	500	2	2	0.3	1.2	3	NRS	40,000	NRS	5,000	NRS

Feed Intended for	Cobalt (mg//kg)	Copper (mg/kg)	Iodine (mg/kg)	Iron (mg/kg)	Manganese (mg/kg)	Selenium (mg/kg)	Zinc (mg/kg)	Calcium (%)	Phosphorus (%)	Magnesium (%)	Sodium (%)	Potass sium (%)	Sulfur (%)	A (IU/kg)	C	D (IU/kg)	E
Goats	10	40	10	500	200	0.3	250	2	1	0.5	1.2	NRS	NRS	40,000)	NRS	3,000	NRS
Waterfowl	NRS	125	10	750	500	0.3	500	4 (B) 1.5 (0)	1.2	NRS	0.4 (S) 0.8 (0)	2	NRS	20,000	NRS	5,000	NRS
Salmonid Fish	NRS	75	20	500	150	0.1	300	3	2.5	0.3	1.2	1.3	NRS	25,000	NRS	10,000	NRS
Mink	NRS	100	20	700	NRS	NRS	500	3	2.5	NRS	0.8	NRS	NRS	60,000	NRS	25,000	NRS
Rabbits	5	125	10	500	200	0.1	500	2	1	0.6	0.5	2	NRS	50,000	NRS	4,000	NRS

NOTES

[1] For dairy cattle, complete feed refers to the grain ration.

[2] The maximum for sodium does not apply to feed intended for beef cattle and sheep that is designed to be used to limit or regulate feed intake. A statement to the effect that adequate water must be provided shall be part of the directions for use.

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Swine 20-60 kg body weight
Weaned horses up to 12 months of age
Mink 4-12 months of age
Swine 1-10 kg body weight
S: Chickens 0-8 weeks of age
Calf, foal, duck and geese starter
Weaning swine up to 20 kg body weight

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