SECTION 4. PLANNING THE 2003 FSIS DOMESTIC MONITORING PLAN: VETERINARY DRUGS

PHASE I - GENERATING AND RANKING LIST OF CANDIDATE COMPOUNDS

LIST OF CANDIDATE COMPOUNDS

The candidate veterinary drugs of concern selected by members of the Surveillance Advisory Team (SAT) are presented below. Since FSIS wishes to prioritize which *analyses* should be conducted, compounds that are, or are likely to be, detected by the same analytical methodology have been grouped together. Compounds banned from extralabel use under the Animal Medicinal Drug Use Clarification Act (AMDUCA), as well as phenylbutazone, have been **bolded**.

--*Antibiotics:*[1]

- Those antibiotics quantitated by the FSIS Bioassay multiresidue method (MRM) and associated follow-up methodologies[2] [tetracycline, oxytetracycline, chlortetracycline, beta-lactams (penicillins and cephalosporins; not differentiated within this category), gentamicin, spectinomycin/streptomycin (not differentiated), erythromycin, tilmicosin, tylosin, neomycin, flavomycin, bacitracin, hygromycin, novobiocin, lincomycin*, pirlimycin*, clindamycin*, spiramycin*, oleandomycin*] *identification by mass spectrometry; not quantitated
- Amikacin (aminoglycoside)
- Apramycin (aminoglycoside)
- Kanamycin (aminoglycoside)
- Spectinomycin (aminoglycoside)
- Streptomycin (aminoglycoside)
- Ampicillin (beta-lactam)
- Amoxicillin (beta-lactam)
- Cloxacillin (beta-lactam)

[1] It can be seen that many of the compounds detected by the FSIS Bioassay (see footnote 2) are also listed separately. This was done because, even though these compounds could be detected by the Bioassay, FSIS also wished to consider the merits of implementing individual chemical methodologies (generally High Performance Liquid Chromatography [HPLC]) for their analysis. Compounds were considered for individual chemical analysis in cases where their established tolerances were based on the chemical methodologies, and thus analysis by such a methodology would be necessary to determine when a finding represented a violation.

[2] FSIS quantitates most antibiotics using a 7-plate Bioassay that measures microbial inhibition. The pattern of inhibition (i.e., the combination of plates showing inhibition) is used to identify the antibiotic. There are some antibiotics, however, that share the same pattern of inhibition. In these cases, it is necessary to undertake follow-up testing (High Performance Liquid Chromatography [HPLC] or mass spectrometry) to identify the compound, where such follow-up methodologies are available. The compounds that share patterns of inhibition, and which are individually identified through follow-up testing, are:

tetracycline/oxytetracycline/chlortetracycline - compounds individually identified by follow-up with HPLC method for tetracyclines

tilmicosin/tylosin - differentiated by mass spectrometry

- Hetacillin (beta-lactam)
- Ticarcillin (beta-lactam)
- Ceftiofur (cefalosporin)
- Cefazolin (synthetic cefalosporin)
- **Chloramphenicol**
- Florfenicol (chloramphenicol derivative)
- Thiamphenicol (chloramphenicol derivative)
- **Fluoroquinolones in FSIS MRM (ciprofloxacin, desethyleneciprofloxacin, danofloxacin, difloxacin, enrofloxacin, marbofloxacin, orbifloxacin, and sarafloxacin)**
- **Avoparcin (glycopeptide)**
- **Vancomycin (glycopeptide)**
- Clindamycin (lincosamide)
- Lincomycin (lincosamide)
- Pirlimycin (lincosamide)
- Oleandomycin (macrolide)
- Spiramycin (macrolide)
- Tilmicosin (macrolide)
- Tylosin (macrolide)
- Colistin (polypeptide antibiotic)
- Virginiamycin

--*Other Veterinary Drugs:*
- Amprolium (coccidiostat)
- Arsenicals (detected as elemental arsenic)
- Avermectins in FSIS MRM (doramectin, ivermectin, and moxidectin) (antiparasitics)
- Eprinomectin (avermectin)
- Benzimidazoles in FSIS MRM (thiabendazole and its 5-hydroxythiabendazole metabolite, albendazole 2-animosulfone metabolite, benomyl in the active hydrolyzed form carbendazim, oxfendazole, mebendazole, cambendazole, and fenbendazole) (anthelmintics)
- Berenil (antiprotozoal)
- Carbadox (antimicrobial)
- **Clenbuterol and other unapproved beta agonists (growth promotants)**[3]
- Ractopamine (beta agonist)
- Clorsulon (anthelmintic)
- Dexamethasone (glucocorticoid)
- Methyl prednisone (glucocorticoid)
- Prednisone (glucocorticoid)
- Halofuginone (antiprotozoal, coccidiostat)
- Hormones, naturally-occurring (17-β estradiol, progesterone, testosterone)
- **DES (hormone, synthetic)**
- MGA (hormone, synthetic)
- Trenbolone (hormone, synthetic)
- Zeranol (hormone, synthetic)
- Lasalocid (coccidiostat)

[3]The screening test used by FSIS has been officially validated for clenbuterol only, but has also demonstrated the ability to detect other beta agonists, including fenoterol and cimaterol. The follow-up confirmatory method detects eight unapproved beta agonists (clenbuterol, cimaterol, fenoterol, mabuterol, salbutamol, brombuterol, and terbutaline).

- Levamisole (anthelmintic)
- Morantel and pyrantel (anthelmintic)
- Nicarbazin (coccidiostat)
- **Nitrofurans (incl. furazolidone, nitrofurazone) (antimicrobial)**
- **Nitromidazoles in FSIS MRM (dimetridazole, ipronidazole) (antiprotozoals)**
- **Ronidazole (nitroimidazole) (antimicrobial)**
- Etodolac (nonsteroidal anti-inflammatory drug [NSAID])
- Flunixin (NSAID)
- **Phenylbutazone (NSAID)**
- Dipyrone (NSAID)
- Sulfonamides in FSIS MRM (incl. sulfapyridine, sulfadiazine, sulfathiazole, sulfamerazine, sulfamethazine, sulfachlorpyridazine, sulfadoxine, sulfamethoxypyridazine, sulfaquinoxaline, sulfadimethoxine, sulfisoxazole, sulfacetamide, sulfamethoxazole, sulfamethizole, sulfanilamide, sulfaguanidine, sulfabromomethazine, sulfasalazine, sulfaethoxypyridazine, sulfaphenazole, and sulfatroxazole) (antimicrobials, some are coccidiostats)
- Sulfanitran (antibacterial, coccidiostat)
- Thyreostats (incl. thiouracil)
- Veterinary tranquilizers in FSIS MRM (azaperone and its metabolite azaperol, xylazine, haloperidol, acetopromazine, propionylpromazine, and chlorpromazine)

RANKING OF CANDIDATE COMPOUNDS

DRUGS BANNED FROM EXTRALABEL USE UNDER AMDUCA

FDA has advised FSIS that it is particularly important to include phenylbutazone, and drugs banned from extralabel use under AMDUCA, since they are of high public health concern, in the FSIS NRP. Therefore, these drugs are not evaluated for inclusion using the ranking formula presented below. Instead, all drugs in this category are automatically assigned a high sampling priority, and are included in the NRP if methodologies and resources are available. All these drugs are listed in Table 4.2b, Drugs Banned from Extarlabel use under AMDUCA.

COMPOUND SCORING

Using a simple 4-point scale (4 = high; 3 = moderate; 2 = low; 1 = none), the SAT scored each of the above veterinary drugs or drug classes in each of the following categories:

X FSIS Historical Testing Information on Violations
X Regulatory Concern
X Lack of FSIS Testing Information on Violations
X Withdrawal Time
X Impact on New and Existing Human Disease
X Relative Number of Animals Treated
X Acute or Chronic Toxicity Concerns

Definitions of each of these categories, and the criteria used for scoring, appear at the end of this section in the "*Scoring Key for Veterinary Drugs, 2003 Domestic Residue Program.*"

The results of the compound scoring process are presented in Table 4.1, *Scoring Table for Veterinary Drugs*.

COMPOUND RANKING

Background

As stated above, FSIS chose to employ techniques and principles from the field of risk assessment to obtain a ranking of the relative public health concern represented by each of the above candidate compounds or compound classes.

If FSIS were in possession of detailed historical data on the distribution of levels of each of the candidate compounds or compound classes in meat, poultry, and egg products, then that information could be combined with consumption data to estimate exposure. By combining these exposure data with toxicity information, risk estimates for each compound or compound class could be generated:

Risk = Exposure x Toxicity (4.1)
= Consumption x Residue Levels x Toxicity
= Consumption x "Risk Per Unit of Consumption"

Given the limited resources available for this priority-setting effort, FSIS did not attempt to associate different degrees of risk with different amounts or percentages by which the tolerance or action level was exceeded. FSIS instead determined that the best available method for the measurement of relative toxicity is associated with the tolerance or action level. *Specifically, the frequency of violation of the tolerance or action level was used as an indicator of the risk per unit of consumption of a product.*

The first criterion evaluated in Table 4.1, "FSIS Historical Testing Information on Violations," is based on the percent of tested carcasses found to have residues in excess of the tolerance or action level, from FSIS random sampling programs of animals entering the food supply. Specifically, compounds were scored by two methods: (a) the maximum violation rate seen in any production class (averaged over 1992 - 2001); and (b) the maximum, for any class, of the violation rate (again, averaged over 1992 - 2001), but weighted by the size of the production class. The final score for each drug was assigned based on the highest of these two scores.[4] Therefore, it can be seen from Equation (4.1) that the violation rate scores assigned in Table 4.1 represent a rough overall estimate of *relative* risk per unit of consumption.[5] However, for the many candidate compounds or compound classes of concern that have never been included in the FSIS NRP, data on violation rates is not available. It was therefore necessary to generate an estimate of the overall violation rate for each these untested compounds and compound classes.

Estimating the Violation Rate

"Regulatory Concern," "Withdrawal Time," and "Relative Number of Animals Treated" were chosen as scoring categories because it was expected that each of these would be positively correlated with the violation rate. Therefore, they might serve as predictors of violations in those compounds or compound

[4] For a more detailed explanation, refer the *Scoring Key for Veterinary Drugs*.

[5] While some consideration was given to the size of the production class in scoring "FSIS Historical Testing Information on Violations," no systematic weighting was applied to the scores in this category based upon consumption. Hence, the scores assigned to this category represent relative risk *per unit of consumption*, rather than relative risk. To obtain values for relative risk, the scores in this category must be multiplied by the consumption data for each individual production class. This calculation is implemented subsequently, in Phase IV, using Equation (4.6); the results are presented in Table 4.5.

classes for which no reliable historical testing information was available. As indicated in the *Scoring Key for Veterinary Drugs*, the "Regulatory Concern" category was designed to predict the "likelihood of occurrence of violations, based on regulatory intelligence information about possible misuse." "Withdrawal Time" is expected to correlate with "FSIS Historical Testing Information on Violations" because a longer withdrawal time is less likely to be properly observed. When the withdrawal time is not observed prior to slaughter, the carcass may contain violative levels of residues, since the time necessary for sufficient metabolism and/or elimination of the drug would not have passed. "Relative Number of Animals Treated" is expected to correlate with "FSIS Historical Testing Information on Violations" simply because heavy compound use increases the likelihood of violations.

Recall that violation rate data are available for selected compounds and compound classes. Using the scores assigned to these compounds and compound classes, it was possible to evaluate how well the above criteria were correlated. In an effort to impute values for the missing data, a linear regression model was applied. The dependent variable in this model was the category "FSIS Historical Testing Information on Violations," while the only significant independent variable was the product of the scores for "Regulatory Concern" and "Relative Number of Animals Treated."

Table 4.1 lists 14 compounds or compound classes for which current, reliable data were available to score the category "FSIS Historical Testing Information on Violations," and 49 compounds or compound classes for which they were not. Of the 14 compounds for which there were violation rate scores, 3 (nitroimidazoles, fluoroquinolones, and phenylbutazone) were eliminated from the regression calculation because, as explained in the definition of "Regulatory Concern" at the end of this section, their scores in this category automatically default to a "4" because they are banned from extralabel use under AMDUCA, or banned entirely. In other words, their Regulatory Concern scores are not based on misuse, and are therefore not predictive of the violation rate. A least squares linear regression model, using the value of the independent variable from the remaining 11 scored compounds or compound classes, was then used to predict scores in the category "FSIS Historical Testing Information on Violations" for the 49 compounds for which this information is not available. The following equation was derived:

$$Vp = 0.14(R*N) + 1.15 \qquad (4.2)$$

where Vp= Predicted score for "FSIS Historical Testing Information on Violations"
R = score for "Regulatory Concern"
N = score for "Relative Number of Animals Treated"
R*N = product of R and N.

This model is the result of using a stepwise regression with several possible independent variables. The independent variables available for the stepwise regression were:

1. A score for Regulatory Concern (R)
2. A score for Withdrawal Time (W)
3. A score for Relative Number of Animals Treated (N)
4. R^2
5. W^2
6. N^2
7. The product of R and W
8. The product of R and N
9. The product of W and N.

No terms involving the withdrawal time were included in the final equation since none were found to be significant factors in the regression model.

The model represented by Equation (4.2) was significant, with an overall model p-value of 0.01, and an R^2 value of 0.53, accounting for 53 percent of the variability in the data.

Where current, reliable historical testing data were available for a compound or compound class, FSIS used the score assigned in Table 4.1. Where current, reliable historical data were not available, FSIS used the predicted score generated by Equation (4.2).

Rating the Veterinary Drugs According to Relative Public Health Concern

As indicated above, the score for "FSIS Historical Testing Information on Violations," combines information on residue levels and toxicity, and thus represents a rough overall estimate of the relative risk per unit of consumption for each drug or drug class. Although this score, once multiplied by relative consumption data for each production class, would conform most closely to a purely risk-based ranking, FSIS believes that additional attributes should also be considered in the ranking. Thus, the ranking according to relative public health concern incorporates, as modifiers, the remaining scoring categories presented in Table 4.1:

Relative Public Health Concern = *Predicted* or *Actual* score for (4.3)
"FSIS Historical Testing Information on Violations" (Estimate of Relative Hazard)
x *modifier for* "Acute or Chronic Toxicity Concerns"
x *modifier for* "Impact on New and Existing Human Disease"
x *modifier for* "Lack of FSIS Testing Information on Violations"

The finding of a violation means that a compound was found at a level where the likelihood of a toxic effect exceeds the Food and Drug Administration's (FDA's) standards. However, this does not address the *severity* of the effect associated with the toxic endpoint. To capture this concern FSIS has added a modifier for "Acute or Chronic Toxicity Concerns." Thus, compounds whose toxic effect can be severe (such as chloramphenicol, exposure to which has been associated with aplastic anemia) are given a maximum score in this category.

A modifier has also been added for "Impact on New and Existing Human Disease." This represents the extent to which the use or misuse of this compound will contribute to new and existing human disease. For example, there is a possibility that the creation of antibiotic-resistant human pathogens may result from the use of antibiotics in animals. This represents a potential public health concern that is not captured by the violation rate.

Finally, the modifier for "Lack of FSIS Testing Information on Violations" has been incorporated because sparse or dated data, or a lack of data altogether, increase the relative public health need to obtain information on residue violations for a compound or compound class. In other words, consider two hypothetical compounds, A and B. Suppose FSIS has sampled extensively for compound A, and that A's violation rate earns it a score of "3" in that category. Further suppose that FSIS has never sampled for compound B but that, based on its scores in the “Regulatory Concern,” “Withdrawal Time,” and “Number of animals treated” categories, B has a *predicted* violation rate score of "3." Also assume that A and B have been assigned identical scores in all other categories. FSIS believes there is greater need to sample for B than for A, because FSIS has extensive information on A, but none on B.

The use of modifiers presents an element of arbitrariness, as there are no fundamentally "correct" assumptions for the appropriate weight that should be given to each. The approach of FSIS was to consider several alternative sets of weighting factors, and assess the robustness of the final ranking. In Table 4.1, the drugs are rated for relative public health concern by combining the scoring categories

presented in Equation (4.3), above, using the weighting formula shown in the last column. In this formula, the score for "FSIS Historical Testing Information on Violations" has been multiplied by a weighted average of the modifiers for "Acute or Chronic Toxicity Concerns" and "Impact on New and Existing Human Disease." These last two categories were combined because they both represent the negative potential public health effects associated with the use of a compound or compound class. The product of the above categories was then multiplied by a modifier for "Lack of FSIS Testing Information on Violations." Note that various formulas were considered, differing principally in the relative weights given to "Acute or Chronic Toxicity Concerns" versus "Impact on New and Existing Human Disease," and in the magnitude of the modifier for "Lack of FSIS Testing Information on Violations." FSIS chose the selected formula, based on a consensus about the relative importance of each modifier, and of how much each modifier should be allowed to alter the underlying risk-based score, "V," in Equation (4.4), below. The value of the selected mathematical formula is that it formalizes the basis of FSIS's judgement. This enables others to observe and understand the adjustments that were made, and it ensures consistency in how these adjustments were applied across a wide range of compounds. Equation (4.4) summarizes the way final adjustments were made.

Relative public health concern rating, veterinary drugs (4.4)
$= V*((D+3*T)/4) *\{1+[(L-1)*0.05]\}$

Where: V = *Predicted* or *Actual* score for "FSIS Historical Testing Information on Violations "
D = score for "Impact on New and Existing Human Disease"
T = score for "Acute or Chronic Toxicity Concerns"
L = score for "Lack of FSIS Testing Information on Violations

In this formula, the category of "Acute or Chronic Toxicity Concerns" was given three times the weight of "Impact on New and Existing Human Disease," because the former represents known direct health effects, while the latter represents possible indirect health effects. Further, in this formula, the final ratings of compounds or compound classes receiving scores of 4, 3, 2, and 1 in "Lack of FSIS Testing Information on Violations" would be increased by 15%, 10%, 5%, and 0% respectively. In other words, the rating of a compound or compound class that had never been tested by FSIS (in the production classes and matrices of concern) would be increased by 15%, while the rating of one that had been recently tested by FSIS (again, in the production classes and matrices of concern) would remain unchanged.

The formulas used here for the veterinary drugs, and in Chapter 6 for the pesticides, have been normalized to give the same maximum value. Because the formula for the pesticides uses different terms (i.e., scoring categories) from that for the veterinary drugs, their scores are not precisely comparable. However, as a result of the normalization the scores for the pesticides and veterinary drugs are comparable in magnitude, thus enabling at least a rough comparison to be made across these two very different categories of compounds.

In Table 4.2a, *Rank and Status for Veterinary Drugs*, the drugs are ranked by their rating scores, as generated using the above weighting formula. The scores presented in Table 4.2 enable FSIS to bring consistency, grounded in formal risk-based considerations, to its efforts to differentiate among a very diverse range of drugs and drug classes in a situation that is marked by minimal data on relative exposures**.** These rankings do not account for differences in exposure due to differences in overall consumption.[6] Data on relative consumption are applied subsequently, in Phase IV, when relative exposure values for each compound/production class (C/PC) pair are estimated.

[6] See footnote 5.

PHASE II - SELECTING DRUGS FOR INCLUSION IN THE 2003 NRP

Following the completion of the ranking of the veterinary drugs, FSIS (1) used these rankings to select those compounds and compound classes that should be included in the 2003 NRP, based purely on their relative public health concern and (2) determined which of these compounds and compound classes actually could be included in the 2003 NRP, based on the availability of laboratory resources.

The consensus of FSIS and FDA was that those compounds and compound classes ranked 24th or higher (out of a total of 52) represented a potential public health concern sufficient to justify their inclusion in the 2003 NRP. In addition, FDA expressed an interest in having FSIS perform limited testing on one compound that did not fall within this group of 24 (veterinary tranquilizers, ranked 49th, in market hogs).

Once the high-priority compounds and compound classes had been identified, it was necessary for FSIS to apply practical considerations to determine the compounds for which the Agency would sample. The principal practical consideration was the availability of laboratory resources, especially the availability of appropriate analytical methods within the FSIS laboratories. Based on these considerations, FSIS plans to include the following veterinary drugs in the 2003 Monitoring Plan:

--*Antibiotics:*

- Those antibiotics quantitated by the FSIS Bioassay MRM and associated follow-up methodologies[7] [tetracycline, oxytetracycline, chlortetracycline, beta-lactams (penicillins and cephalosporins; not differentiated within this category), gentamicin, spectinomycin/streptomycin (not differentiated), erythromycin, tilmicosin, tylosin, neomycin, flavomycin, bacitracin, hygromycin, novobiocin, lincomycin*, pirlimycin*, clindamycin*, spiramycin*, oleandomycin*] *identification by mass spectrometry; not quantitated
- Chloramphenicol
- Fluoroquinolones in FSIS MRM (ciprofloxacin, desethyleneciprofloxacin, danofloxacin, difloxacin, enrofloxacin, marbofloxacin, orbifloxacin, and sarafloxacin)

--*Other Veterinary Drugs:*

- Arsenicals (detected as elemental arsenic)
- Avermectins in FSIS MRM (incl. doramectin, ivermectin, moxidectin) (antiparasitics)
- Carbadox (antimicrobial)
- Clenbuterol and other unapproved beta agonists (growth promotants)[8]
- Ractopamine (beta agonist)
- Flunixin (NSAID)
- MGA (hormone, synthetic)
- Phenylbutazone (NSAID)
- Sulfonamides in FSIS MRM (incl. sulfapyridine, sulfadiazine, sulfathiazole, sulfamerazine, sulfamethazine, sulfachloropyridazine, sulfadoxine, sulfamethoxypyridazine, sulfaquinoxaline, sulfadimethoxine, sulfisoxazole, sulfacetamide, sulfamethoxazole, sulfamethizole, sulfanilamide, sulfaguanidine, sulfabromomethazine, sulfasalazine, sulfaethoxypyridazine, sulfaphenazole, and sulfatroxazole) (antimicrobials, some are coccidiostats)

[7]See footnote 2.

[8]See footnote 3.

Thus, in the 2003 NRP, FSIS plans to employ 12 methodologies that analyze for veterinary drugs. Six of the 12 are single-compound methodologies, and six are MRM's (phenylbutazone is detected by the FSIS MRM for chlorinated hydrocarbon and chlorinated organophosphate compounds). Together, these methodologies encompass approximately 60 different compounds.

Table 4.2 lists all of the original candidate veterinary drugs in rank order. This table specifies whether each compound or compound class will be sampled under the 2003 Monitoring Plan. For each highly ranked compound or compound class that was not included in the 2003 Monitoring Plan, a brief explanation of the reason for its exclusion is provided. This table will be used to identify future method development needs for veterinary drugs for the FSIS NRP.

PHASE III - IDENTIFYING THE COMPOUND/PRODUCTION CLASS (C/PC) PAIRS

The SAT participants (principally those from FDA) identified the production classes of concern for each of the drugs and drug classes to be included in the 2003 NRP. These determinations were based upon professional judgment of the likelihood of finding violations within each production class (information examined included use approvals, extent of use, evidence of misuse and, if available, past violation history), combined with the proportion of total domestic meat consumption each production class represented. The results are presented in Table 4.3, *Production Classes to be Considered for Each Veterinary Drug/Drug Class*. C/PC pairs included in the 2003 NRP are designated by a "●." Those C/PC pairs that are of regulatory concern, but that could not be included in the 2003 NRP because of laboratory resource constraints, are marked with a "○." Since all production classes will be sampled by the chlorinated hydrocarbon/chlorinated organophosphate (CHC/COP) method (see Section 6), and since this method also detects phenylbutazone, the latter will, by default, likewise be sampled in all production classes. However, phenylbutazone is not of regulatory concern in all production classes. Those production classes in which phenylbutazone will be sampled, but where it is not of regulatory concern, are designated by a "❍" (i.e., these production classes will be sampled for phenylbutazone, but only because it is automatically detected through the CHC/COP methodology).

NOMENCLATURE

Production classes are defined as follows:

- Bulls are mature, sexually intact male cattle.
- Beef cows are sexually mature female cattle of beef type, ordinarily having given birth to one or more calves.
- Dairy cows are sexually mature female cattle of dairy type, ordinarily having given birth to one or more calves.
- Heifers are young, female cattle that have not yet given birth to a calf.
- Steers are male cattle castrated before sexual maturity.
- Bob veal are calves up to three weeks of age or 150 pounds
- Formula-fed veal are confinement-raised calves fed on a liquid milk replacer diet and weighing more than 150 pounds.
- Non-formula-fed veal are calves fed a diet that includes solid feeds such as grass and grains requiring a functional rumen and weighing between 150 and 400 pounds.
- Heavy calves are non-formula-fed calves weighing greater than 400 pounds with the physical characteristics of a calf.

FSIS has sufficient analytical capability to consider sampling all production classes of concern for the following compound classes: antibiotics (by Bioassay); arsenicals; avermectins; sulfonamides; and phenylbutazone (via the CHC/COP methodology). To establish a relative sampling priority for each C/PC pair, the ranking score for each compound class (as calculated in Table 4.1) was multiplied by the estimated relative percent of domestic consumption for each production class (as calculated in Table 4.4 and as presented in Table 4.3). This is shown in Equation (4.6):

$$(\text{Relative sampling priority})_{C/PC} = (\text{Ranking score})_{C} \times (\text{Rel. \% domestic consumption})_{PC} \quad (4.6)$$

Equation (4.6) is analogous to the equation used to estimate risk (Equation (4.1)), in which risk per unit of consumption is multiplied by consumption. While the results of Equation (4.6) do not constitute an estimate of risk, they provide a numerical representation of the relative public health concern represented by each C/PC pair, and thus can be used to prioritize FSIS analytical sampling resources according to the latter. Note that the risk ranking provided by Equation (4.6) is based upon average consumption across the entire U.S. population, rather than upon maximally exposed individuals.

In Table 4.5, *Veterinary Drug Compound/Production Class Pairs, Sorted by Sampling Priority Score, "Full Resource" Sampling*, the calculation shown in Equation (4.6) has been carried out for the antibiotics, arsenicals, avermectins, and sulfonamides, for each production class in which the specified drug might appear (as indicated in Table 4.6). The C/PC pairs were sorted by their sampling priority scores, and roughly divided into quartiles. Initially, C/PC pairs in the first through fourth quartiles were assigned sampling numbers of 460, 300, 230, and 90, respectively. The cutoff scores for Relative Public Health Concern corresponding to each sampling level were as follows: >29.00 = 460 samples; 2.51 – 29.00 = 300 samples; 0.14 - 2.50 = 230 samples; < 0.14 = 90 samples. These priority scores were combined with historical violation rate information for each individual C/PC pair, and information on laboratory sampling capacity to select, for each pairing, from among four different sampling options: very high regulatory concern (460 analyses/year); high regulatory concern (300 analyses/year); moderate regulatory concern (230 samples/year); low regulatory concern (90 samples/year).[9] Thus the larger sample sizes, which provide the greater chance of detecting violations, are directed towards those C/PC pairs that have been identified as representing higher levels of relative public health concern. Statistically, if v is the true violation rate in the population and n is the number of samples, the probability, P, of finding at least one violation among the n samples (assuming random sampling) is: $P = 1-(1-v)^n$. Therefore, if the true violation rate is 1%, the probabilities of detecting at least one violation with sampling levels of 460, 300, 230, and 90 are 99%, 95%, 90%, and 60%, respectively. The higher sampling levels are useful when FSIS wishes to monitor slaughter classes with somewhat lower violation rates (which is typically done for larger slaughter classes, since these represent a larger potential consumer exposure). For example, if the true violation rate is 0.5%, increasing the sampling level from 300 to 460 increases the chance of detecting a violation from 78% to 90%. By contrast, the lower sampling levels enable FSIS to ensure, without expending excessive resources, that gross residue violation problems do not exist in minor slaughter classes. For example, while 90 samples offers only a 60% probability of violation detection at a violation rate of 1%, at a violation rate of 3% the detection probability increases to 94%.

Because the numbers of squab produced and consumed are very limited, and because quantitative data on squab production were not available, squab were not included in the above determination, and were instead assigned, for each analysis performed, a sampling frequency of 45 animals. This number was judged to be appropriate relative to the estimated annual U.S. production of squab.

[9]For reasons explained below, arsenicals in young chickens were scheduled to be sampled at a still higher level of 1200/analyses per year.

- Market hogs are swine usually marketed near six months of age and 200 to 300 pounds live weight.
- Boars are mature swine showing male sexual characteristics.
- Stags are male swine castrated after they have reached sexual maturity.
- Sows are mature female swine.
- Sheep are mature sheep with no distinction by gender.
- Lambs are young sheep for which there is proof that the ovine was less than 14 months of age, or that exhibit a break joint (epiphysis) of the distal metacarpal bone of either foreleg.
- Goats are of either sex and any age.
- Horses are of either sex and any age.
- Bison are of either sex and any age.
- Young chickens are broilers/fryers that are usually less than 10 weeks of age, roasting chickens that are young chickens of either sex usually less than 12 weeks of age, and capons, which are surgically neutered male chickens usually less than 4 months of age.
- Mature chickens are adult female chickens usually more than 10 months of age.
- Young turkeys are fryer turkeys that are either male or female and usually less than 12 weeks of age, and roaster turkeys that are either male or female usually less than 6 months of age.
- Mature turkeys are of either sex and usually more than 15 months of age.
- Ducks are of either sex and any age.
- Geese are of either sex and any age.
- Other fowl include ratites (typically ostriches, emus, and rheas), guineas, squabs (young, fledgling pigeons), adult pigeons, pheasants, grouse, partridges, quail, etc.
- Rabbits are any of several lagomorph mammals.
- Egg products are dried, frozen, or liquid eggs.

PHASE IV - ALLOCATION OF SAMPLING RESOURCES

"FULL-RESOURCE" SAMPLING

Table 4.3 also lists the estimated consumption of each production class as a percentage of the total consumption of all the production classes in the table. To obtain these estimates, production data on animals (and egg products) presented for slaughter (or processing) in federally inspected establishments, during calendar year 2001, were employed as a surrogate for consumption. The production data for calves was collected, collated and reported by FSIS, using the Automated Data Reporting System. The production data for all other production classes, including egg products, was collected by FSIS, and collated and reported by the National Agricultural Statistical Service. As shown in Equation (4.5), the estimated relative percent of consumption represented by each production class was obtained by dividing the estimated total annual U.S. domestic production (pounds dressed weight) for that class by the total poundage for all production classes that are listed in Table 4.3:

$$(\text{Est. rel. \% domestic consumption})_{PC} = \frac{(\text{Annual production, pounds dressed wt.})_{PC}}{\text{Total annual production, all production classes}} \qquad (4.5)$$

All calculations and results are presented in Table 4.4, *Estimated Relative Consumption, Domestically Produced Meat, Poultry, and Egg Products*.

Note that individual data were not available for ratites and squab, which fall under the “other fowl” category. Ratites comprise the preponderance of this category. Thus, for simplicity, the value for the other fowl category was used to represent the value for ratites in Tables 4.3 and 4.4.

ADJUSTING RELATIVE SAMPLING NUMBERS

Adjusting for historical data on violation rates of individual C/PC pairs

As described above, FSIS used "FSIS Historical Testing Information on Violations" as a critical factor in ranking the various drugs and drug classes according to their relative public health concern. Because this information is available for each production class individually, it can also be used to further refine the relative priority of sampling each C/PC pair. Table 4.6, *Adjusted Number of Analyses for Each Veterinary Drug Compound/Production Class Pair, "Full Resource" Sampling*, lists the number of analyses assigned to each C/PC pair in Table 4.5. It also lists, for the period 1/1/92 - 12/31/01, the total number of samples analyzed by FSIS under its Monitoring Plan (i.e., random sampling only) for each C/PC pair, and the percent of samples found to be violative (i.e., present at a level in excess of the action level or regulatory tolerance; or, for those compounds that are prohibited, present at any detectable level). Using this data, the following rules were applied to adjust the sampling numbers:

1. Less than 300 samples from the C/PC pair tested over the 10-year period: +1 level (i.e., increase by one sampling level, e.g., from 230 samples to 300 samples).
2. At least 300 samples tested over the 10-year period, violation rate $\geq$ 0.50%, but < 0.70%: +1 level.
3. At least 300 samples tested over the 10-year period, violation rate $\geq$ 0.70%: +2 levels.
4. At least 300 samples tested over the 10-year period, violation rate = 0.00%: -1 level.
5. The maximum number of samples to be scheduled for testing is 460.

The three exceptions to this are:

1. Geese, bisons, ratites and rabbits are not scheduled for more than 90 samples per analysis. Because very few geese, bisons, ratites and rabbits are produced, and because virtually all of them are slaughtered by a very limited number of establishments, collecting a larger number of samples would present an unfair burden to these establishments.
2. Horses are not scheduled for more than 230 samples per analysis. Because very few horses are slaughtered and virtually all horses are slaughtered by a very limited number of establishments, collecting a larger number of sample would present an unfair burden to these establishments.
3. As explained above, squab are automatically assigned 45 samples for each analysis performed.

All of the above adjustments were applied, and the sampling numbers obtained following these adjustments are listed in Table 4.6 under the heading "INITIAL ADJ. #" (initial adjusted number of samples).

Adjusting for laboratory capacity

Following this, it was necessary to make a final set of adjustments to match the total sampling numbers for each compound class with the analytical capabilities of the FSIS laboratories.

For antibiotics, FSIS laboratory capacity was less than the proposed number of samples. To accommodate this discrepancy, a ceiling of 300 samples was established for all production classes. This enabled FSIS to avoid eliminating any production classes of concern from antibiotic sampling, while maintaining an adequate level of data quality for the most important production classes.

For avermectins, FSIS laboratory capacity was slightly less than the proposed number of samples. To accommodate this discrepancy, the one production class that qualified for a sampling level of 460 was reduced to 300.

For sulfonamides, FSIS laboratory capacity was less than the proposed number of samples. To accommodate this discrepancy, all 460-sample production classes were reduced to 300 samples, all 300-sample production classes were reduced to 230 samples, and selected 230-sample production classes were reduced to 90 samples. This enabled FSIS to avoid eliminating any production classes of concern from sulfonamide sampling, while maintaining an adequate level of data quality for the most important production classes.

For the arsenicals, a decision was made to increase the number of analyses in young chickens from 460 to 1200, to obtain a more accurate characterization of arsenical violations in this production class. The basis for this decision was that: (a) the violation rate for arsenicals in young chickens between 1992 - 2001 has averaged 0.33%, which is relatively high; and (b) young chickens are the largest production class (constituting an estimated 36%, by weight, of total domestic consumption of meat, poultry and egg products), and violations in young chickens thus represent a relatively larger public exposure than violations in smaller production classes.

The sample numbers obtained following all needed adjustments for laboratory capacity are listed in the last column of Table 4.6, under the heading "FINAL ADJ. #" (final adjusted number of samples).

"LIMITED RESOURCE" SAMPLING

The 2003 NRP includes a number of compounds for which FSIS has only recently begun to sample. In monitoring for these compounds, FSIS was most concerned with obtaining information on their occurrence in particular production classes where it was suspected they might be of concern. To enable FSIS to sample this entire range of compounds, it was necessary to limit the number of samples taken per compound. In apportioning this "limited resource" sampling among the production classes of concern, it was particularly important to ensure that a sufficient number of samples was taken from each production class analyzed. If too few samples were taken from a production class, and no violations were detected, it would be difficult to interpret such a result (the interpretation could not be informed by data from earlier sampling, because no such sampling exists). With a small number of samples, the lack of a detected violation might mean that the true violation rate was very low, or it might mean that the true violation rate was high but that too few samples were taken to detect a violation. Thus, where possible, a minimum of 300 analyses was to be carried out in each production class sampled. This yields a 95% chance of detecting a violation, if the true violation rate were 1%. However, because of laboratory resource limitations, it was not always possible to sample at this level.

Selection of production classes for the limited resource compounds was made as follows:

Chloramphenicol is of concern in dairy cows, formula-fed veal, non-formula-fed veal, bob veal, and ratites. The analytical capacity for chloramphenicol in 2003 is 900 samples, and the FSIS method for chloramphenicol does not work in ratites. FSIS will thus conduct 300 analyses for chloramphenicol in each of these three bovine production classes.

DES is of concern in formula-fed veal, steers, and heifers. Zeranol is of concern in formula-fed veal, heavy calves, and non-formula-fed veal. The analytical capacity for DES/zeranol in 2003 is 300 samples, and the top priority production class for both compounds is formula-fed veal. FSIS will thus conduct 300 analyses for DES/zeranol in formula-fed veal.

Flunixin is of concern in dairy cows and horses. The analytical capacity for domestic scheduled sampling of flunixin in 2003 is 460 samples, and the top priority production class is dairy cows. Thus, FSIS will conduct 300 analyses for flunixin in dairy cows, and 160 analyses for flunixin in horses.

MGA is of concern in heifers, steers, formula-fed veal, and non-formula-fed veal. The analytical capacity for MGA in 2003 is 300 samples, and the top priority production class is heifers. FSIS will thus conduct 300 analyses for MGA in heifers.

Ractopamine is of concern in heifers, steers, market hogs, roaster pigs, and young turkeys. The analytical capacity for domestic sampling of ractopamine in 2003 is 530 samples, and the two top priority production classes are market hogs and steers. FSIS will conduct 300 analyses for ractopamine in market hogs, and 230 in steers.

The above information is presented in tabular format at the end of Section 9 in Table 9.1, *Detailed Sampling Plan, 2003 FSIS NRP, Domestic Monitoring Plan and Exploratory Projects*, Table 9.2, *Summary, 2003 FSIS NRP, Domestic Monitoring Plan and Exploratory Projects*, and in Table 9.6, *Combined Summary, 2003 FSIS NRP, Domestic Monitoring Plan and Exploratory Projects and Import Monitoring Plan*.

NOTE ON SEASONALITY

Some of the residues sampled under the Monitoring Plan may be analyzed for a period of three to four months, rather than over an entire year. This is done because, to cover such a wide range of residues, it maybe necessary for FSIS to maximize laboratory efficiency. It is more efficient to dedicate instrumentation and analysts to a small number of compounds, finish those analyses, and then change to a new set of analyses, rather than attempting to maintain analytical capacity for all of the above analytes simultaneously.

SCORING KEY FOR VETERINARY DRUGS
2003 FSIS DOMESTIC RESIDUE PROGRAM

FSIS Historical Testing Information on Violations (1/1/92 - 12/31/01)

Violation rate scores were calculated by two different methods, A and B, using violation rate data from FSIS random sampling of animals entering the food supply:

Method A: Maximum Violation Rate. Identify the production class exhibiting the highest average violation rate (the number of violations over the period from 1992 - 2001, divided by the total number of samples analyzed). Score as follows:

4 = > 0.70%
3 = 0.31% - 0.70 %
2 = 0.15% - 0.30%
1 = < 0.15%
NT = Not tested by FSIS
NA = Tested by FSIS, but violation information does not apply

Note that the above violation rate criteria are different from those used in planning the 1998 – 2002 NRP's. For previous NRP's the criteria were as follows: 4 = > 1.0%; 3 = 0.50% - 1.0 %; 2 = 0.15% - 0.49%; and 1 = < 0.15%. These new cutoffs permit FSIS to better distinguish between "high-violation" and "low-violation" slaughter classes.

Method B: Violation Rate Weighted by Size of Production Class. For each production class analyzed, multiply the average violation rate (defined above) by the relative consumption value for that class (weighted annual U.S. production for that class, divided by total production for all classes for which FSIS has regulatory responsibility). Add together the values for all production classes. Score as follows:

4 = > 0.15%
3 = 0.076% - 0.15%
2 = 0.01% - 0.075%
1 = < 0.01%
NT = Not tested by FSIS
NA = Tested by FSIS, but violation information does not apply

Final score is determined by assigning, to each drug or drug class, the greater of the scores from Method A and Method B.

It can be seen that Method A identifies those drugs that are of regulatory concern because they exhibit high violation rates, independent of the relative consumption value of the production class in which the violations have occurred. Method B identifies those drugs that may not have the highest violation rates, but would nevertheless be of concern because they exhibit moderate violation rates in a relatively large proportion of the U.S. meat supply. By employing Methods A and B together, and assigning a final score based on the highest score received from each, both of the above concerns are captured.

Regulatory Concern

This consists of professional judgments made about the likelihood of occurrence of violations, based on regulatory intelligence information about possible misuse. Due to the public health significance of drug residue violations, information concerning a compound must meet only one of the requirements listed under each number below to receive that numerical ranking.

4 = Well-documented intelligence information gathered from a variety of reliable sources indicates possible widespread misuse of the compound, and/or this compound not approved for use in food animals in th U.S.

3 = Intelligence information gathered through a variety of sources indicates only occasional misuse of this compound. The dosage form/packaging of this compound has potential for misuse.

2 = Intelligence information rarely indicates misuse of this compound.

1 = Intelligence information has never indicated misuse of this compound.

Lack of FSIS Testing Information on Violations

This represents the extent to which FSIS analytical testing information on a residue is limited, absent or obsolete.

4 = FSIS has not included this compound in its sampling program within the past 10 years (1/1/92 - 12/31/01); or FSIS has included this compound within its program only between 6 and 10 years ago (1/1/92 - 12/31/96), but the sampling does not meet the criteria specified for a "3;" or FSIS has included this compound in its sampling program, but the information is not at all useful in predicting future violation rates, because of subsequent significant changes in the conditions of use of the compound (e.g., the reduction in withdrawal time for carbadox), or because regulatory intelligence information indicates that the situation has changed significantly since the last time the compound was sampled; or because the compound is of concern in several production classes of interest, but testing has been carried out in only one.

3 = FSIS has tested within the past 5 years (1/1/97 - 12/31/01), but in fewer than 75% of the production classes of interest; or even if 75% of production classes were tested, there was no production class from which at least 300 samples have been analyzed; or the only testing was between 6 and 10 years ago, where FSIS has analyzed at least 75% of production classes of interest for at least 2 of these 5 years, with a total of at least 500 samples per production class during this 5-year period and, in the case of a multiresidue method (MRM), the method used covers all compounds of interest with the compound class; or, the compound would normally have qualified for a "1" or "2," but the method used was not sufficiently sensitive to permit accurate determination of the true violation rate.

2 = FSIS has included this compound in its sampling program within the past 5 years in at least 75%, but less than 100% of the production classes of interest, with at least 300 samples in at least one production class; or 100% of the production classes of interest have been sampled, but the amount and duration of sampling has been insufficient to qualify for a "1."

1 = FSIS has included this compound in its sampling program within the past 5 years, and has analyzed 100% of the production classes of interest for at least 2 of these 5 years, with a total of at least 500 samples per production class during this 5-year period, and in the case of an MRM,

the method used covers all compounds of interest with the compound class. Or if FSIS has included this compound in its sampling program for at least 4 of the past 5 years, and at least 6,000 samples have been analyzed during this period.

Withdrawal Time

Producers using approved animal drugs are required to follow approved "conditions of use." For each drug, in each production class in which it is approved, the conditions of use specify the dosing regimen and the withdrawal time. The withdrawal time is the number of days that must pass between completion of the dosing regimen and the time of slaughter. This allows sufficient time for the concentration of drug in the animal to decrease below the tolerance. For approved drugs, the following scores were used. For unapproved drugs, scores in this category were assigned based on estimates of their half-lives.

4 = Withdrawal time greater than 14 days

3 = Withdrawal time between 8 and 14 days

2 = Withdrawal time between 1 and 7 days

1 = Zero-day withdrawal time

Impact on New and Existing Human Disease

This represents the extent to which the use or misuse of this compound may contribute to new and existing human disease, principally from the potential to change patterns of antibiotic resistance in human pathogens.

4= Scientific information gathered from a variety of reliable sources indicate that possible widespread use of this compound might significantly modify drug resistance patterns of human pathogenic organisms.

3 = Limited scientific information is available to suggest or document public health risk but compound has the potential to affect microflora.

2 = No scientific information available to suggest or document public health risk.

1 = Current scientific information available suggests no public health risk.

Relative Number of Animals Treated

These scores are based on economic data on doses sold, as well as surveys of treatment practices in animal populations that are representative of national feedlot, dairy, poultry, and swine production.

4 = Products containing this drug fall within the top third of those administered to animals treated within a particular category and dosage form of active ingredient.

3 = Products containing this drug fall within the middle third of those administered to animals treated within a particular category and dosage form of active ingredient.

2 = Products containing this drug fall within the bottom third of those administered to animals treated within a particular category and dosage form of active ingredient (but have more usage than products given a score of "1," as defined below).

1 = Products containing this drug are estimated to have extremely limited usage.

Note: Where data were unavailable, scores were estimated, based on comparison to related drugs with known usage levels. Numbers estimated in this way are contained within parentheses.

Acute or Chronic Toxicity Concerns

This represents a combination of the toxicity of the compound and the severity associated with the compound's toxic endpoint.

4 = Compound is a carcinogen, or potentially life threatening, or has significant acute effects including the anaphylactic response to an allergen.

3 = Systemic No Observed Effect Levels (NOEL's) seen at intermediate to low doses in laboratory test animals. Antimicrobial effects with a high potential to alter intestinal microflora.

2 = Systemic NOEL's seen at high oral doses in laboratory test animals. Antimicrobial effects with a moderate potential to alter intestinal microflora.

1 = Compound generally shows no toxicity in laboratory test animals even at doses much higher than present in edible tissues at zero-day withdrawal.

Table 4.1
Scoring Table for Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND/COMPOUND CLASS	Historical Testing Info. on Violations (FSIS) (V)	Regula-tory Concern (CVM) (R)	With-drawal Time (CVM) (W)	Relative Number of Animals Treated (CVM) (N)	Predicted V = (0.19437* R*N) + 0.84625	Predicted V, Except When Actual V is Available	Impact New & Existing Human Disease (CDC) (D)	Acute or Chronic Toxicity Con-cerns (CVM) (T)	Lack of Testing Info. on Viola-tions (FSIS) (L)	Relative Public Health Concern Score = V*[(D+3*T)/4] *{1+[(L-1)*0.05]}
Those antibiotics quantitated by the FSIS Bioassay MRM	4	4	4	4	3.422	4	3	4	1	15.0
Amikacin (aminoglycoside)	NT	3	4	2	2.002	2.002	3	2	4	5.2
Apramycin (aminoglycoside)	NT	4	4	2	2.286	2.286	3	2	4	5.9
Kanamycin (aminoglycoside)	NT	3	4	2	2.002	2.002	3	2	4	5.2
Spectinomycin (aminoglycoside)	NA-D, M	4	4	3	2.854	2.854	3	2	4	7.4
Streptomycin (aminoglycoside)	NA-D	4	4	3	2.854	2.854	3	2	4	7.4
Amoxicillin (beta-lactam)	NT	3	2	2	2.002	2.002	3	4	4	8.6
Ampicillin (beta-lactam)	NT	3	2	2	2.002	2.002	3	4	4	8.6
Cloxacillin (beta-lactam)	NT	3	2	2	2.002	2.002	3	4	4	8.6
Hetacillin (beta-lactam)	NT	2	2	2	1.718	1.718	3	4	4	7.4
Ticarcillin (beta-lactam)	NT	2	2	2	1.718	1.718	3	4	4	7.4
Ceftiofur (cefalosporin)	NT	3	2	3	2.428	2.428	4	2	4	7.0
Cefazolin (synthetic cefalosporin)	NT	3	2	2	2.002	2.002	3	2	4	5.2
Florfenicol (chloramphen. deriv.)	NT	3	4	4	2.854	2.854	3	3	4	9.8
Thiamphenicol (chloramphen. deriv.)	NT	3	2	1	1.576	1.576	3	3	4	5.4
Fluoroquinolones	1	4	3	3	2.854	1	4	2	3	**7.8**
Clindamycin (lincosamide)	NA-Q	2	2	2	1.718	1.718	3	3	4	5.9
Lincomycin (lincosamide)	NA-Q	2	2	2	1.718	1.718	3	3	4	5.9
Pirlimycin (lincosamide)	NA-Q	3	4	3	2.428	2.428	4	2	4	7.0
Oleandomycin (macrolide)	NA-Q	2	2	2	1.718	1.718	3	3	4	5.9
Spiramycin (macrolide)	NA-Q	2	3	2	1.718	1.718	3	2	4	4.4
Tilmicosin (macrolide)	1	4	4	3	2.854	1	3	3	3	3.3
Tylosin (macrolide)	NA-D	3	3	2	2.002	2.002	3	2	1	4.5
Colistin (polypeptide antibiotic)	NT	1	1	2	1.434	1.434	1	3	4	4.1

Table 4.1 - *Continued*
Scoring Table for Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND/COMPOUND CLASS	Historical Testing Info. on Violations (FSIS) (V)	Regula-tory Concern (CVM) (R)	With-drawal Time (CVM) (W)	Relative Number of Animals Treated (CVM) (N)	Predicted V = (0.19437* R*N) + 0.84625	Predicted V, Except When Actual V is Available	Impact New & Existing Human Disease (CDC) (D)	Acute or Chronic Toxicity Con-cerns (CVM) (T)	Lack of Testing Info. on Viola-tions (FSIS) (L)	Relative Public Health Concern Score = V*[(D+3*T)/4] *{1+[(L-1)*0.05]}
Virginiamycin	NT	1	1	3	1.576	1.576	3	1	4	2.7
Amprolium (coccidiostat)	NT	4	2	2	2.286	2.286	3	2	4	5.9
Arsenicals (detected as As)	3	4	2	4	3.422	3	3	2	1	6.8
Avermectins in FSIS MRM (incl. doramectin, ivermectin, moxidectin) (antiparasitics)	3	3	4	4	2.854	3	2	3	1	8.3
Eprinomectin (avermectin)	NT	2	2	3	2.002	2.002	2	2	4	4.6
Benzimidazoles (anthelmintic)	1	1	3	2	1.434	1	1	2	4	2.0
Berenil (antiprotozoal, Histomonas)	NA-G, Mx	4	4	1	1.718	1.718	2	3	4	5.4
Carbadox (antimicrobial)	3 [NA-O]	4	4	3	2.854	3	3	4	2	11.8
Ractopamine (beta agonist)	NA-O [NT]	4	2	3	2.854	2.854	2	3	3	8.6
Clorsulon (anthelmintic, Trematodes)	NT	2	3	2	1.718	1.718	2	2	4	4.0
Dexamethasone (glucocorticoid)	NA-O	4	2	2	2.286	2.286	1	3	3	6.3
Methyl prednisone (glucocorticoid)	NT	4	2	2	2.286	2.286	1	3	4	6.6
Prednisone (glucocorticoid)	NT	2	2	1	1.434	1.434	1	3	4	4.1
Halofuginone (antiprotozoal, coccidiostat)	2	1	2	2	1.434	2	2	2	2	4.2
Hormones, naturally-occurring	NT	2	1	4	2.286	2.286	2	2	4	5.3
MGA (hormone, synthetic)	NA-O	3	1	4	2.854	2.854	3	3	3	9.4
Trenbolone (hormone, synthetic)	NT	4	1	3	2.854	2.854	3	3	4	9.8
Zeranol (hormone, synthetic)	NT	3	1	3	2.428	2.428	3	3	4	8.4
Lasalocid (coccidiostat)	NT	2	1	3	2.002	2.002	3	2	4	5.2
Levamisole (anthelmintic, Nematodes)	3 [2]	3	3	2	2.002	3	1	1	3	3.3
Morantel and pyrantel (anthelmintic)	1	1	1	2	1.434	1	2	1	3	1.4
Nicarbazin (coccidiostat)	NA-O [1]	2	2	1	1.434	1.434	2	1	4	2.1
Etodolac (NSAID)	NT	3	2	1	1.576	1.576	1	3	4	4.5

Table 4.1 - *Continued*
Scoring Table for Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND/COMPOUND CLASS	Historical Testing Info. on Violations (FSIS) (V)	Regula-tory Concern (CVM) (R)	With-drawal Time (CVM) (W)	Relative Number of Animals Treated (CVM) (N)	Predicted V = (0.19437* R*N) + 0.84625	Predicted V, Except When Actual V is Available	Impact New & Existing Human Disease (CDC) (D)	Acute or Chronic Toxicity Con-cerns (CVM) (T)	Lack of Testing Info. on Viola-tions (FSIS) (L)	Relative Public Health Concern Score = V*[(D+3*T)/4] *{1+[(L-1)*0.05]}
Dipyrone (NSAID)	NT	4	3	1	1.718	1.576	1	4	4	5.9
Sulfonamides (antimicrobials, some are coccidiostats)	4	4	3	4	3.422	4	3	3	1	12.0
Sulfanitran (antibacterial, coccidiostat)	NT	4	3	4	3.422	3.422	3	3	4	11.8
Thyreostats (incl. thiouracil)	NT	4	3	1	1.718	1.718	2	4	4	6.9
Veterinary tranquilizers	NT	4	2	2	2.286	2.286	1	1	4	2.6

Key:
MRM = multiresidue method
NT = not tested by FSIS (1/1/92 - 12/31/01)
NA = compound has been tested by FSIS (1/1/92 - 12/31/01), but the information is not applicable
NA-C = compound is of concern in several prouction classes, but testing has been carried out in only one
NA-D = detected and quantitated, but not uniquely identified, i.e., method cannot distinguish between this compound and one or more other compounds
NA-G = testing carried out in limited geographical area only, and thus does not necessarily represent overall national violation rate, e.g., sampling for berenil in Puerto Rico
NA-M = problem with analytical methodology
NA-Mx = new information indicates that testing was not carried out in the correct matrix, e.g., berenil testing carried out in plasma rather than serum)
NA-N = new information since previous testing, suggesting that the results of this testing may not be representative of the current situation
NA-Q = detected but not quantitated by method
NA-O = data is preliminary, because useable data on this compound (i.e., data not subject to any of the various problems listed immediately above) has been collected for only one year
FSIS = scores in this column supplied by FSIS
CVM = scores in this column supplied by CVM
CDC = scores in this column supplied by CDC
Numbers in parentheses are estimates.
[Where scores have been changed from the 2002 NRP, those from year 2002 are shown in square brackets.]

Table 4.2a
Rank and Status of Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

Rank	DRUG	SCORE	STATUS IN 2003 NRP
1	**Antibiotics in FSIS Bioassay MRM** (tetracycline, oxytetracycline, chlortetracycline, beta-lactams [penicillins and cephalosporins; not differentiated within this category], streptomycin/spectinomycin [not differentiated], gentamicin, erythromycin, tilmicosin, tylosin, neomycin, flavomycin, bacitracin, hygromycin, novobiocin, lincomycin*, pirlimycin*, clindamycin*, spiramycin*, oleandomycin*) *identification by follow-up with mass spectrometry; not quantitated	**15.0**	Monitoring Plan, MRM. Domestic: all production classes except egg products. Imported: all fresh product classes.
2	**Sulfonamides in FSIS MRM** (sulfapyridine, sulfadiazine, sulfathiazole, sulfamerazine, sulfamethazine, sulfachloropyridazine, sulfadoxine, sulfamethoxypyridazine, sulfaquinoxaline, sulfadimethoxine, sulfisoxazole, sulfacetamide, sulfamethoxazole, sulfamethizole, sulfanilamide, sulfaguanidine, sulfabromomethazine, sulfasalazine, sulfaethoxypyridazine, sulfaphenazole, and sulfatroxazole) (antimicrobials, some are coccidiostats)	**12.0**	Monitoring Plan, MRM. Domestic: all production classes except sheep and rabbits. Imported: all production classes.
3	Sulfanitran (antibacterial, coccidiostat)	**11.8**	NIP; no method - need to add to sulfonamide MRM, or find new method.
4	Carbadox (antimicrobial)	**11.8**	Monitoring Plan. Domestic: 460 roaster pigs. Imported: 93 fresh pork.
5	Florfenicol (chloramphenicol derivative)	**9.8**	NIP; no method. FDA is developing an MRM for chloramphenicol, florfenicol, and thiamphenicol.
6	Trenbolone (hormone, synthetic)	**9.8**	NIP; no method. Need to attempt extension of FSIS DES/zeranol method to trenbolone.
7	MGA (hormone, synthetic)	**9.4**	Monitoring Plan. Domestic: 300 heifers. Should also be analyzable by extension of FSIS DES/zeranol method, or by adoption of Swiss MRM.
8	Ractopamine (beta agonist)	**8.6**	Monitoring Plan. Domestic: 300 market hogs and 230 steers. Imported: 93 fresh pork.
9	Amoxicillin (beta-lactam)	**8.6**	NIP; no method - need MRM for beta-lactams.
10	Ampicillin (beta-lactam)	**8.6**	NIP; no method - need MRM for beta-lactams.
11	Cloxacillin (beta-lactam)	**8.6**	NIP; no method - need MRM for beta-lactams.
12	Zeranol (hormone, synthetic)	**8.4**	Monitoring Plan. Domestic: 360 Formula-Fed veal
13	**Avermectins in FSIS MRM** (doramectin, ivermectin, and moxidectin) (antiparasitic)	**8.3**	Monitoring Plan, MRM. Domestic: ratites and all non-avian production classes. Imported: all non-avian fresh product classes.
14	Flunixin (NSAID)	**8.3**	Monitoring Plan. Domestic: 300 dairy cows and 160 Horses.
15	Spectinomycin (aminoglycoside)	**7.4**	NIP; method not operational – ultimately need MRM for aminoglycosides.
16	Streptomycin (aminoglycoside)	**7.4**	NIP; no method - need MRM for aminoglycosides; will need bridging data to use chemical method on streptomycin.
17	Hetacillin (beta-lactam)	**7.4**	NIP; no method - need MRM for beta-lactams.
18	Ticarcillin (beta-lactam)	**7.4**	NIP; no method - need MRM for beta-lactams.
19	Ceftiofur (cefalosporin)	**7.0**	NIP; no method - need MRM for beta-lactams.
20	Pirlimycin (lincosamide)	**7.0**	NIP; method needs improvement.

Table 4.2a - *Continued*
Rank and Status for Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

Rank	DRUG	SCORE	STATUS IN 2003 NRP
21	Thyreostats (incl. thiouracil)	**6.9**	NIP; laboratory resources not available.
22	Arsenicals (detected as As)	**6.8**	Monitoring Plan. Domestic: beef cows, goats, all porcine production classes, and all avian production classes (including egg products) except ratites and squab. Imported: All avian production classes. Fresh goat and pork. Processed pork and beef/pork.
23	Methyl prednisone (glucocorticoid)	**6.6**	NIP; no method, but should be analyzable by extension of FSIS DES/zeranol method.
24	Dexamethasone (glucocorticoid)	**6.3**	NIP; laboratory resources not available.
BASED ON CONSULTATION WITH FDA, CDC, AND OTHER AGENCIES, COMPOUNDS BELOW THIS POINT WERE NOT CONSIDERED TO REPRESENT A BROAD POTENTIAL PUBLIC HEALTH RISK. HOWEVER, SOME OF THESE MAY BE SAMPLED ON A SPECIFIC, AS-NEEDED BASIS. NONE OF THE COMPOUNDS ON THE FOLLOWING PAGE WAS SELECTED FOR INCLUSION IN THE 2003 FSIS NATIONAL RESIDUE PROGRAM (NRP).			
25	Amprolium (coccidiostat)	**5.9**	NIP; low priority.
26	Apramycin (aminoglycoside)	**5.9**	NIP; no method,. low priority
27	Clindamycin (lincosamide)	**5.9**	NIP; no method, low priority
28	Lincomycin (lincosamide)	**5.9**	NIP; no method, low priority.
29	Oleandomycin (macrolide)	**5.9**	NIP; no method, low priority.
30	Dipyrone (NSAID)	**5.9**	NIP; no method. Priority may increase in future, and ARS is developing an MRM for veterinary tranquilizers and NSAID's.
31	Berenil (antiprotozoal)	**5.4**	NIP; scored as low priority, but priority may increase because of recent FDA concerns about misuse in dairy cattle. FSIS method available, but for plasma only. Need to review NADA method for liver.
32	Thiamphenicol (chloramphenicol derivative)	**5.4**	NIP; no method. FDA is developing an MRM for chloramphenicol, florfenicol, and thiamphenicol.
33	**Hormones, naturally-occurring** (17-estradiol, testosterone, and progesterone)	**5.3**	NIP; no method, low priority, but should be analyzable by extension of FSIS DES/zeranol method.
34	Amikacin (aminoglycoside)	**5.2**	NIP; no method - need MRM for aminoglycosides.
35	Cefazolin (synthetic cefalosporin)	**5.2**	NIP; no method - need MRM for beta-lactams.
36	Kanamycin (aminoglycoside)	**5.2**	NIP; no method - need MRM for aminoglycosides.
37	Lasalocid (coccidiostat)	**5.2**	NIP; Official FSIS Method available, low priority.
38	Eprinomectin (avermectin)	**4.6**	NIP; no method, low priority.
39	Tylosin (macrolide)	**4.5**	NIP; no method, low priority.
40	Etodolac (NSAID)	**4.5**	NIP; no method, low priority.
41	Spiramycin (macrolide)	**4.4**	NIP; low priority.
42	Halofuginone (antiprotozoal, coccidiostat)	**4.2**	NIP; Official FSIS Method available, low priority.
43	Colistin (polypeptide antibiotic)	**4.1**	NIP; no method, low priority.
44	Prednisone (glucocorticoid)	**4.1**	NIP; no method, low priority, but should be analyzable by extension of FSIS DES/zeranol method, or by adoption of Swiss MRM.
45	Clorsulon (anthelmintic)	**4.0**	NIP; Official FSIS Method available, low priority.
46	Tilmicosin (macrolide)	**3.3**	NIP; laboratory resources not available.
47	Levamisole (anthelmintic)	**3.3**	NIP; Official FSIS Method available, low priority.
48	Virginiamycin	**2.7**	NIP; no method, low priority.

Table 4.2a - *Continued*
Rank and Status for Veterinary Drugs
2003 FSIS NRP, Domestic Monitoring Plan

Rank	DRUG	SCORE	STATUS IN 2003 NRP
49	**Veterinary tranquilizers** (azaperone and its metabolite azaperol, xylazine, haloperidol, acetopromazine, propionylpromazine, and chlorpromazine)	**2.6**	NIP; screening method available. Low score, but FDA indicates interest in applying this method to dairy cows, market hogs, and ratites. ARS is developing an MRM for veterinary tranquilizers and NSAID's.
50	Nicarbazin (coccidiostat)	**2.1**	NIP; no method, low priority.
51	**Benzimidazoles in FSIS MRM** (thiabendazole and its 5-hydroxythiabendazole metabolite, albendazole 2-animosulfone metabolite, benomyl in the active hydrolyzed form carbendazim, oxfendazole, mebendazole, cambendazole, and fenbendazole) (anthelmintics)	**2.0**	NIP; Official FSIS Method available, low priority.
52	Morantel and pyrantel (anthelmintic)	**1.4**	NIP; Official FSIS Method available, low priority.

**The clenbuterol methodology employs a screen that has been officially validated for clenbuterol only, but has also demonstrated the ability to detect other beta agonists (including fenoterol and cimaterol). This is followed by a confirmatory method that detects eight unapproved beta agonists (clenbuterol, cimaterol, fenoterol, mabuterol, salbutamol, brombuterol, and terbutaline).

Key:
CHC/COP = Chlorinated hydrocarbon/chlorinated organophosphate.
MRM = Multiresidue method.
NIP = Not included in 2002 FSIS National Residue Program (NRP).
NSAID = Non-steroidal anti-inflammatory drug.
FDA-NCTR = Food and Drug Administration, National Center for Toxicological Research, Jefferson, AR.
In the second column, where multiple compounds have been grouped together for analysis or potential analysis by a single MRM, the title of that group has been bolded (e.g., "Antibiotics in FSIS Bioassay MRM").

Table 4.2b
Drugs banned from Extralabel use under AMDUCA*
2003 FSIS NRP, Domestic Monitoring Plan

1	Chloramphenicol	--	Monitoring Plan. Domestic: 300 each, dairy cows, formula-fed veal, and non-formula-fed veal. Imported: 90 fresh veal. FDA is developing an MRM for chloramphenicol, florfenicol, and thiamphenicol.
2	**Nitrofurans** (incl. furazolidone and nitrofurazone) (antimicrobial)	--	NIP; no viable method available.
3	**Fluoroquinolones in FSIS MRM** (ciprofloxacin, desethyleneciprofloxacin, danofloxacin, difloxacin, enrofloxacin, marbofloxacin, orbifloxacin, sarafloxacin)	--	Monitoring Plan, MRM. Imported: 8 fresh chicken, turkey, and other fowl.
4	**Clenbuterol and other unapproved beta agonists** (growth promotants)**	--	Monitoring Plan. Domestic: 300 each, market hogs and steers; 230 formula-fed veal. By eyeball screen followed by confirmatory method performed by FDA-NCTR. Need to test eyeball screen to officially extend to other beta agonists, and install NCTR confirmatory MRM for beta agonists.
5	Ronidazole (nitroimidazole) (antimicrobial)	--	NIP; may be able to add to MRM for nitroimidazoles.
6	**Nitromidazoles in FSIS MRM** (dimetridazole and ipronidazole) (antiprotozoal)	--	NIP; laboratory resources not available.
7	Avoparcin (glycopeptide)	--	NIP; no method.
8	Vancomycin (glycopeptide)	--	NIP; no method,
9	DES (hormone, synthetic)	--	Monitoring Plan. Domestic: 360 Formula-Fed veal
10	Phenylbutazone (NSAID)	--	Monitoring Plan, as part of the CHC/COP MRM. Domestic: all production classes except roaster pigs. Imported: all product classes except processed veal, processed mutton/lamb, and processed other fowl. An ELISA method in kidney is being implemented in the FSIS MWL.

*Drugs banned from extralabel use under AMDUCA were not evaluated, using the ranking formula, for inclusion in Table 4.2a. Instead, these drugs were automatically assigned a high sampling priority and will be included in the NRP if methodologies and resources are available.

Table 4.3
Production Classes to be Considered for Each Veterinary Drug/Drug Class
2003 FSIS NRP, Domestic Monitoring Plan

Est. Rel. % Dom. Cons.	DRUG->	Anti-biotics	Sulfon-amides	MGA	Racto-pamine	Zer-anol	Aver-mecs.	Flu-nixin	Arsen-icals	Chlor-fenicol.	Pheny-lbute.	DES	Clen-buterol
	DRUG SCORE->	15.0	12.0	9.4	8.6	8.4	8.3	8.3	6.8	--	--	--	--
0.033	Horses	●	●				●	●			●		
0.650	Bulls	●	●				●				●		
1.939	Beef cows	●	●				●		●		●		
1.923	Dairy cows	●	●				●	●		●	●		
9.811	Heifers	●	●	●	○		●				●	○	
16.026	Steers	●	●	○	●		●				●	○	●
0.036	Bob veal	●	●				●			○	⊙		
0.237	Formula-fed veal	●	●	○		●	●			●	⊙	●	●
0.011	Non-formula-fed veal	●	●	○		○	●			●	⊙		
0.022	Heavy calves	●	●			○	●				●		
0.014	Bison	●	●				●				⊙		
0.010	Sheep	●					●				⊙		
0.244	Lambs	●	●				●				⊙		
0.033	Goats	●	●				●		●		⊙		
21.129	Market hogs	●	●		●		●		●		⊙		●
0.013	Roaster pigs	●	●		○		●		●		●		
0.084	Boars/Stags	●	●				●		●		●		
1.117	Sows	●	●				●		●		●		
36.726	Young chickens	●	●						●		⊙		
0.606	Mature chickens	●	●						●		⊙		
6.476	Young turkeys	●	●		○				●		⊙		
0.057	Mature turkeys	●	●						●		⊙		
0.146	Ducks	●	●						●		⊙		
0.002	Geese	●	●						●		⊙		
>>0.01	Squab	●	●								⊙		
0.010	Ratites	●	●				●			○	⊙		
0.002	Rabbits	●					○				⊙		
2.724	Egg products	○	●						●		⊙		

Key:

Est. Rel. % Dom. Cons. = Estimated relative percent of domestic consumption, calendar year 2001. This was derived by estimating the total annual U.S. domestic production (pounds dressed weight) for each production class, and dividing by the total poundage for all production classes on this list (see Table 4.4). See explanation in text, Section 4, for values used for ratites and squab.

● = Scheduled for sampling under the 2003 FSIS NRP.

○ = Of potential regulatory concern, but could not be sampled under the 2003 FSIS NRP because of laboratory resource constraints or methodological limitations.

⊙ = Not of regulatory concern, but sampled anyway because comes through during CHC/COP method.

Table 4.4
Estimated Relative Consumption, Domestically Produced Meat, Poultry, and Egg Products
2003 FSIS NRP, Domestic Monitoring Plan

PRODUCTION CLASS	NUMBER HEAD SLAUGHTERED	LBS./ ANIMAL, DRESSED WT.	TOTAL LBS., DRESSED WT.	EST. RELATIVE CONSUMPTION
Bulls	620,000	893	553,660,000	0.650%
Beef cows	3,092,000	[534]	1,651,128,000	1.939%
Dairy cows	2,582,000	[634]	1,636,988,000	1.923%
Heifers	11,379,000	734	8,352,186,000	9.811%
Steers	17,097,000	798	13,643,406,000	16.026%
Bob veal	404,546	[75]	30,340,950	0.036%
Formula-fed veal	823,775	[245]	201,824,875	0.237%
Non-formula-fed veal	25,787	[350]	9,025,450	0.011%
Heavy calves	46,630	[400]	18,652,000	0.022%
SUBTOTAL, CATTLE	**36,070,738**		**26,097,211,275**	**30.654%**
Market hogs	93,201,000	193	17,987,793,000	21.129%
Roaster pigs	[160,000]	70	11,200,000	0.013%
Boars/Stags	318,000	226	71,868,000	0.084%
Sows	3,009,000	316	950,844,000	1.117%
SUBTOTAL, SWINE	**96,688,000**		**19,021,705,000**	**22.343%**
Sheep	144,000	62	8,928,000	0.010%
Lambs	2,921,000	71	207,391,000	0.244%
SUBTOTAL, OVINE	**3,065,000**		**216,319,000**	**0.254%**
Goats	560,310	50	28,015,500	0.033%
Horses	56,332	500	28,166,000	0.033%
Bison	19,483	610	11,884,630	0.014%
TOTAL, ALL LIVESTOCK	**135,823,738**		**45,335,235,275**	**53.252%**
Young chickens			31,265,809,000	36.726%
Mature chickens			515,796,000	0.606%
Young turkeys			5,512,988,000	6.476%
Mature turkeys			48,712,000	0.057%
Ducks			124,141,000	0.146%
Geese			1,972,001	0.002%
Other fowl (includes ratites)			8,215,000	0.010%
SUBTOTAL, POULTRY	**0**		**37,477,633,001**	**44.022%**
Rabbits			1,353,923	0.002%
Egg products			2,319,322,000	2.724%
GRAND TOTAL, ALL PRODUCTION CLASSES			**85,133,544,199**	**100.000%**

Notes on Table --- Sources of data: The numbers in this table were derived from National Agricultural Statistical Service (NASS) data on animals (and egg products) presented for slaughter (or processing) in federally inspected establishments, for calendar year 2001 (CY '01), with the exception of the numbers for calves, which were obtained from the FSIS Automated Data Reporting System. **Livestock:** For livestock, NASS does not provide figures for total pounds dressed weight. Therefore, CY '01 NASS figures for number of head slaughtered were multiplied by CY '01 NASS values for average pounds dressed weight per animal (where indicated by square brackets, the latter was unavailable and estimates were used instead), to calculate total pounds dressed weight. **Poultry, rabbits, and egg products:** For these production classes, figures for total pounds dressed weight, CY '01, were available from NASS, and it was therefore not necessary to calculate them from the number of head slaughtered. **Purpose:** The purpose of this table is to estimate, for each individual production class for which FSIS has regulatory responsibility, the amount of domestically-produced product consumed relative to the total for all of these production classes (this will in turn be used to estimate relative exposures to chemical residues). This was estimated by assuming that the relative amount of each production class consumed would be approximately proportional to the total poundage (based on dressed weight) of each production class presented for slaughter or processing in federally inspected establishments. Dressed weight, which represents the weight of the carcass after hide, hoof, hair, and viscera have been removed, was used instead of live weight, because the former was thought to be more closely representative of total pounds consumed. *Note: this table estimates the amount of domestically produced product that is consumed, regardless of who consumes it (i.e., no distinction is made between domestically produced product consumed domestically, vs. that which is exported).*

Table 4.5
Veterinary Drug Compound/Production Class Pairs,
Sorted by Sampling Priority Score, "Full-Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

RANK	COMPOUND CLASS	COMPOUND PRIORITY RATING (P)	PRODUCTION CLASS	EST. RELATIVE % DOMESTIC CONSUMPTION (D)	C/PC PAIR PRIORITY SCORE (P x D)	UNADJ. # SAMPLES
1	Antibiotics	15.00	Young chickens	36.726	550.884	460
2	Sulfonamides	12.00	Young chickens	36.726	440.707	460
3	Antibiotics	15.00	Market hogs	21.129	316.934	460
4	Sulfonamides	12.00	Market hogs	21.129	253.547	460
5	Arsenicals	6.75	Young chickens	36.726	247.898	460
6	Antibiotics	15.00	Steers	16.026	240.388	460
7	Sulfonamides	12.00	Steers	16.026	192.311	460
8	Avermectins	8.25	Market hogs	21.129	174.314	460
9	Antibiotics	15.00	Heifers	9.811	147.160	460
10	Arsenicals	6.75	Market hogs	21.129	142.620	460
11	Avermectins	8.25	Steers	16.026	132.214	460
12	Sulfonamides	12.00	Heifers	9.811	117.728	460
13	Antibiotics	15.00	Young turkeys	6.476	97.135	460
14	Avermectins	8.25	Heifers	9.811	80.938	460
15	Sulfonamides	12.00	Young turkeys	6.476	77.708	460
16	Arsenicals	6.75	Young turkeys	6.476	43.711	460
17	Sulfonamides	12.00	Egg products	2.724	32.692	460
18	Antibiotics	15.00	Beef cows	1.939	29.092	460
19	Antibiotics	15.00	Dairy cows	1.923	28.843	300
20	Sulfonamides	12.00	Beef cows	1.939	23.273	300
21	Sulfonamides	12.00	Dairy cows	1.923	23.074	300
22	Arsenicals	6.75	Egg products	2.724	18.389	300
23	Antibiotics	15.00	Sows	1.117	16.753	300
24	Avermectins	8.25	Beef cows	1.939	16.001	300
25	Avermectins	8.25	Dairy cows	1.923	15.863	300
26	Sulfonamides	12.00	Sows	1.117	13.403	300
27	Arsenicals	6.75	Beef cows	1.939	13.091	300
28	Antibiotics	15.00	Bulls	0.650	9.755	300
29	Avermectins	8.25	Sows	1.117	9.214	300
30	Antibiotics	15.00	Mature chickens	0.606	9.088	300
31	Sulfonamides	12.00	Bulls	0.650	7.804	300
32	Arsenicals	6.75	Sows	1.117	7.539	300
33	Sulfonamides	12.00	Mature chickens	0.606	7.270	300
34	Avermectins	8.25	Bulls	0.650	5.365	300
35	Arsenicals	6.75	Mature chickens	0.606	4.090	300
36	Antibiotics	15.00	Lambs	0.244	3.654	300
37	Antibiotics	15.00	Formula-fed veal	0.237	3.556	300
38	Sulfonamides	12.00	Lambs	0.244	2.923	300
39	Sulfonamides	12.00	Formula-fed veal	0.237	2.845	300
40	Antibiotics	15.00	Ducks	0.146	2.187	230

Table 4.5 - *Continued*
Veterinary Drug Compound/Production Class Pairs,
Sorted by Sampling Priority Score, "Full-Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

RANK	COMPOUND CLASS	COMPOUND PRIORITY RATING (P)	PRODUCTION CLASS	EST. RELATIVE % DOMESTIC CONSUMPTION (D)	C/PC PAIR PRIORITY SCORE (P x D)	UNADJ. # SAMPLES
41	Avermectins	8.25	Lambs	0.244	2.010	230
42	Avermectins	8.25	Formula-fed veal	0.237	1.956	230
43	Sulfonamides	12.00	Ducks	0.146	1.750	230
44	Antibiotics	15.00	Boars/Stags	0.084	1.266	230
45	Sulfonamides	12.00	Boars/Stags	0.084	1.013	230
46	Arsenicals	6.75	Ducks	0.146	0.984	230
47	Antibiotics	15.00	Mature turkeys	0.057	0.858	230
48	Avermectins	8.25	Boars/Stags	0.084	0.696	230
49	Sulfonamides	12.00	Mature turkeys	0.057	0.687	230
50	Arsenicals	6.75	Boars/Stags	0.084	0.570	230
51	Antibiotics	15.00	Bob veal	0.036	0.535	230
52	Antibiotics	15.00	Horses	0.033	0.496	230
53	Antibiotics	15.00	Goats	0.033	0.494	230
54	Sulfonamides	12.00	Bob veal	0.036	0.428	230
55	Sulfonamides	12.00	Horses	0.033	0.397	230
56	Sulfonamides	12.00	Goats	0.033	0.395	230
57	Arsenicals	6.75	Mature turkeys	0.057	0.386	230
58	Antibiotics	15.00	Heavy calves	0.022	0.329	230
59	Avermectins	8.25	Bob veal	0.036	0.294	230
60	Avermectins	8.25	Horses	0.033	0.273	230
61	Avermectins	8.25	Goats	0.033	0.271	230
62	Sulfonamides	12.00	Heavy calves	0.022	0.263	230
63	Arsenicals	6.75	Goats	0.033	0.222	230
64	Antibiotics	15.00	Bison	0.014	0.209	230
65	Antibiotics	15.00	Roaster pigs	0.013	0.197	230
66	Avermectins	8.25	Heavy calves	0.022	0.181	230
67	Sulfonamides	12.00	Bison	0.014	0.168	230
68	Antibiotics	15.00	Non-formula-fed veal	0.011	0.159	230
69	Sulfonamides	12.00	Roaster pigs	0.013	0.158	230
70	Antibiotics	15.00	Sheep	0.010	0.157	230
71	Antibiotics	15.00	Ratites	0.010	0.145	230
72	Sulfonamides	12.00	Non-formula-fed veal	0.011	0.127	90
73	Sulfonamides	12.00	Ratites	0.010	0.116	90
74	Avermectins	8.25	Bison	0.014	0.115	90
75	Avermectins	8.25	Roaster pigs	0.013	0.109	90
76	Arsenicals	6.75	Roaster pigs	0.013	0.089	90
77	Avermectins	8.25	Non-formula-fed veal	0.011	0.087	90
78	Avermectins	8.25	Sheep	0.010	0.087	90

Table 4.5 - *Continued*
Veterinary Drug Compound/Production Class Pairs,
Sorted by Sampling Priority Score, "Full-Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

RANK	COMPOUND CLASS	COMPOUND PRIORITY RATING (P)	PRODUCTION CLASS	EST. RELATIVE % DOMESTIC CONSUMPTION (D)	C/PC PAIR PRIORITY SCORE (P x D)	UNADJ. # SAMPLES
79	Avermectins	8.25	Ratites	0.010	0.080	90
80	Antibiotics	15.00	Geese	0.002	0.035	90
81	Sulfonamides	12.00	Geese	0.002	0.028	90
82	Antibiotics	15.00	Rabbits	0.002	0.024	90
83	Arsenicals	6.75	Geese	0.002	0.016	90
84	Avermectins	8.25	Rabbits	0.002	0.013	90

Table 4.6
Adjusted Number of Analyses for Each Veterinary Drug Compound/Production Class Pair, "Full Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND CLASS	PRODUCTION CLASS	PRIORITY SCORE	# SAMP.	%VIOL.	UNADJ. #	ADJUST-MENT	INITIAL ADJ.#	ADJUST-MENT	FINAL ADJ.#
Antibiotics	Young chickens	550.884	4288	0.02	460		460	MAX 300	300
Antibiotics	Market hogs	316.934	4449	0.47	460		460	MAX 300	300
Antibiotics	Steers	240.388	3629	0.03	460		460	MAX 300	300
Antibiotics	Heifers	147.160	3301	0.06	460		460	MAX 300	300
Antibiotics	Young turkeys	97.135	4333	0.18	460		460	MAX 300	300
Antibiotics	Beef cows	29.092	4167	0.12	460		460	MAX 300	300
Antibiotics	Dairy cows	28.843	4582	0.48	300		300		300
Antibiotics	Sows	16.753	4186	0.45	300		300		300
Antibiotics	Bulls	9.755	2524	0.00	300	-1	230		230
Antibiotics	Mature chickens	9.088	3237	0.03	300		300		300
Antibiotics	Lambs	3.654	3857	0.21	300		300		300
Antibiotics	Formula-fed veal	3.556	5209	0.44	300		300		300
Antibiotics	Ducks	2.187	3557	0.11	230		230		230
Antibiotics	Boars/Stags	1.266	2947	0.24	230		230		230
Antibiotics	Mature turkeys	0.858	1855	0.11	230		230		230
Antibiotics	Bob veal	0.535	4243	1.27	230	+2	460	MAX 300	300
Antibiotics	Horses	0.496	2505	6.91	230	NO ADJ	230		230
Antibiotics	Goats	0.494	2802	0.07	230		230		230
Antibiotics	Heavy calves	0.329	3071	0.39	230		230		230
Antibiotics	Bison	0.209	39	0.00	230	+1	300	MAX 90	90
Antibiotics	Roaster pigs	0.197	374	1.60	230	+2	460	MAX 300	300
Antibiotics	Non-formula-fed veal	0.159	2749	0.55	230	+1	300		300
Antibiotics	Sheep	0.157	2491	0.04	230		230		230
Antibiotics	Ratites	0.145	91	0.00	230	+1	300	MAX 90	90
Antibiotics	Geese	0.035	139	0.00	90	NO ADJ	90		90
Antibiotics	Rabbits	0.024	1322	3.18	90	NO ADJ	90		90
Antibiotics	Squab		27	0.00	45	NO ADJ	45		45
TOTAL # SAMPLES					**7545**		**8145**		**6445**

Table 4.6 - *Continued*
Adjusted Number of Analyses for Each Veterinary Drug Compound/Production Class Pair, "Full Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND CLASS	PRODUCTION CLASS	PRIORITY SCORE	# SAMP.	%VIOL.	UNADJ. #	ADJUST-MENT	INITIAL ADJ.#	ADJUST-MENT	FINAL ADJ.#
Avermectins	Market hogs	174.314	2841	0.00	460	-1	300		300
Avermectins	Steers	132.214	3795	0.03	460		460	MAX 300	300
Avermectins	Heifers	80.938	2755	0.00	460	-1	300		300
Avermectins	Beef cows	16.001	3205	0.22	300		300		300
Avermectins	Dairy cows	15.863	2886	0.10	300		300		300
Avermectins	Sows	9.214	2284	0.00	300	-1	230		230
Avermectins	Bulls	5.365	2227	0.27	300		300		300
Avermectins	Lambs	2.010	2596	0.08	230		230		230
Avermectins	Formula-fed veal	1.956	2759	0.00	230	-1	90		90
Avermectins	Boars/Stags	0.696	1440	0.00	230	-1	90		90
Avermectins	Bob veal	0.294	371	0.00	230	-1	90		90
Avermectins	Horses	0.273	1560	0.64	230	NO ADJ	230		230
Avermectins	Goats	0.271	2948	0.61	230	+1	300		300
Avermectins	Heavy calves	0.181	2595	0.27	230		230		230
Avermectins	Bison	0.115	33	0.00	90	+1	230	MAX 90	90
Avermectins	Roaster pigs	0.109	240	0.00	90	+1	230		230
Avermectins	Non-formula-fed veal	0.087	1855	0.32	90		90		90
Avermectins	Sheep	0.087	1711	0.18	90		90		90
Avermectins	Ratites	0.080	82	0.00	90	+1	230	MAX 90	90
Avermectins	Rabbits	0.013	469	0.00	90	-1	0		0
TOTAL # SAMPLES					**4730**		**4320**		**3880**

Table 4.6 - *Continued*
Adjusted Number of Analyses for Each Veterinary Drug Compound/Production Class Pair, "Full Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND CLASS	PRODUCTION CLASS	PRIORITY SCORE	# SAMP.	%VIOL.	UNADJ. #	ADJUST-MENT	INITIAL ADJ.#	ADJUST-MENT	FINAL ADJ.#
Sulfonamides	Young chickens	440.707	3924	0.10	460		460	-1	300
Sulfonamides	Market hogs	253.547	7604	0.72	460	+2	460	-1	300
Sulfonamides	Steers	192.311	3149	0.16	460		460	-1	300
Sulfonamides	Heifers	117.728	2908	0.03	460		460	-1	300
Sulfonamides	Young turkeys	77.708	3949	0.20	460		460	-1	300
Sulfonamides	Egg products	32.692	425	0.00	460	-1	300	-1	230
Sulfonamides	Beef cows	23.273	3799	0.16	300		300	-1	230
Sulfonamides	Dairy cows	23.074	3232	0.28	300		300	-1	230
Sulfonamides	Sows	13.403	4527	0.64	300	+1	460	-1	300
Sulfonamides	Bulls	7.804	2677	0.11	300		300	-1	300
Sulfonamides	Mature chickens	7.270	3009	0.00	300	-1	230	-1	90
Sulfonamides	Lambs	2.923	2907	0.14	300		300	-1	230
Sulfonamides	Formula-fed veal	2.845	3951	0.23	300		300	-1	230
Sulfonamides	Ducks	1.750	2795	0.04	230		230	-1	90
Sulfonamides	Boars/Stags	1.013	3204	0.69	230	+1	300	-1	230
Sulfonamides	Mature turkeys	0.687	1981	0.40	230		230		230
Sulfonamides	Bob veal	0.428	4216	0.78	230	+2	300	-1	230
Sulfonamides	Horses	0.397	1553	0.32	230		230		230
Sulfonamides	Goats	0.395	2554	0.23	230		230		230
Sulfonamides	Heavy calves	0.263	2870	0.17	230		230		230
Sulfonamides	Bison	0.168	33	0.00	230	+1	300	MAX 90	90
Sulfonamides	Roaster pigs	0.158	303	0.99	230	+2	460	-1	300
Sulfonamides	Non-formula-fed veal	0.127	2739	0.69	90	+1	230		230
Sulfonamides	Ratites	0.116	79	0.00	90	+1	230	MAX 90	90
Sulfonamides	Geese	0.028	147	0.68	90	NO ADJ	90	-1	90
Sulfonamides	Squab		30	0.00	45	NO ADJ	45	-1	45
TOTAL # SAMPLES					**7245**		**7895**		**5655**

Table 4.6 - *Continued*
Adjusted Number of Analyses for Each Veterinary Drug Compound/Production Class Pair, "Full Resource" Sampling
2003 FSIS NRP, Domestic Monitoring Plan

COMPOUND CLASS	PRODUCTION CLASS	PRIORITY SCORE	# SAMP.	%VIOL.	UNADJ. #	ADJUST-MENT	INITIAL ADJ.#	ADJUST-MENT	FINAL ADJ.#
Arsenicals	Young chickens	247.898	4547	0.33	460		460	+740	1200
Arsenicals	Market hogs	142.620	2505	0.00	460	-1	300		300
Arsenicals	Young turkeys	43.711	2557	0.23	460		460		460
Arsenicals	Egg products	18.389	425	0.00	300	-1	230		230
Arsenicals	Beef cows	13.091	778	0.13	300		300		300
Arsenicals	Sows	7.539	1382	0.00	300	-1	230		230
Arsenicals	Mature chickens	4.090	1379	0.00	300	-1	230		230
Arsenicals	Ducks	0.984	587	0.68	230	+1	300		300
Arsenicals	Boars/Stags	0.570	867	0.00	230	-1	90		90
Arsenicals	Mature turkeys	0.386	571	0.00	230	-1	90		90
Arsenicals	Goats	0.222	1228	0.33	230		230		230
Arsenicals	Roaster pigs	0.089	281	0.00	90	+1	230		230
Arsenicals	Geese	0.016	0	NT	90	NO ADJ	90		90
TOTAL # SAMPLES					**3680**		**3240**		**3980**

Key:
#SAMP. = Total number of samples analyzed by the FSIS Monitoring Plan (i.e., random sampling only), 1/1/92 - 12/31/01.
%VIOL. = Percent violative, i.e., the percent of samples with residue concentrations exceeding the tolerance or action level (or, for a drug whose use was not permitted in the production class in which it was detected, the percent of samples with any detectable residue).
UNADJ.# = Unadjusted number of samples, obtained from last column of Table 4.7.
INITIAL ADJ.# = Number of samples proposed following adjustment for historical violation rate information or lack of testing information.
FINAL ADJ.# = Finalized sample numbers, obtained following any adjustments needed to match sample volume to laboratory capacity.
NT = Not Tested.
+1 level, +2 levels, -1 level = There are four different sampling levels: 90, 230, 300 and 460. Sampling levels were increased or decreased (e.g., changed from 300 samples to 230 samples) based on the rules described in Section 4.
NO ADJ = As explained in Section 4, the number of samples taken from geese and squab are limited to 90 and 45 per compound class per year, respectively.