NRSP_TEMP007: A National Agricultural Program for Minor Use Animal Drugs

Duration:	October 2015 to September 30, 2020
Administrative Advisor(s):	[Philip Elzer S] [Frank D. Galey W] [Margaret E. Smith (main) NE] [George Smith NC]
NIFA Reps:	

Statement of Issues and Justification

Prerequisite Criteria

How is the NRSP consistent with the mission?
Over the last two previous decades, the lack of approved drugs for minor species had placed US producers at a competitive disadvantage. Globalization of food markets allows countries with more products available for such uses to produce more animals and to export food products to the US. This has proved especially hard for the sheep, farmed fish and shrimp, and honey industries.

More recently, government agencies around the world and the public have become concerned about the continued use of antibiotics in food producing animals. Internationally, scientists have provided strong evidence that antibiotic use in food-producing animals can have a negative impact on public health through the following sequence of events: (1) Use of antibiotics in food-producing animals allows antibiotic-resistant bacteria to thrive while susceptible bacteria are suppressed or die; (2) Resistant bacteria can be transmitted from food-producing animals to humans through the food supply; (3) Resistant bacteria can cause infections in humans; and (4) Infections caused by resistant bacteria can result in adverse human health consequences. Because of the link between antibiotic use in food-producing animals and the occurrence of antibiotic-resistant infections in humans, the Food and Drug Administration/Center for Veterinary Medicine (FDA/CVM) and Centers for Disease Control (CDC) encourage continuing efforts to minimize inappropriate use of antibiotics in humans and animals.

NRSP-7 is an efficient and important program that supports research specifically to gain FDA/CVM approval of new animal drugs for use in minor animal species of agricultural importance. These minor species include sheep, goats, farmed deer, all cultured fish and crustaceans, game birds such as pheasants, partridges, and quail, emus, and honey bees. Data supplied by the Program provided for the publication of 52 New Animal Drug Applications and modification of 73 label claims to include minor species, an overall average of 1.6 New Animal Drug Applications per year and 2.3 new label claims per year. Included in these Public Master Files were one for rabbits, nine for game birds, 16 for fish, lobster and shrimp, 15 for meat and dairy goats, eight for bison and reindeer, one for foxes and two for honey bees. For the 5-year period of this review, NSRP-7 was responsible for three Public Master Files; they included Progesterone Solid Matrix for sheep (NADA 141-302), Lincomix for the control of American foulbrood in honey bees (NADA 111-636) and Chloramine-T for the control of mortality in freshwater-reared salmonids due to bacterial gill diseases (NADA 141-423).

Additionally, NRSP-7 has published 211 articles in peer-reviewed journals, averaging 6.6 per year over the term of the program. For the last five years, however, publications have increased to nearly 10 per year. Thus, although FDA/CVM drug approvals have waned due to increasing costs, the Program has increased its efforts to supply critical data needs to minor species producers. The data generated by the Program is also shared with the Food Animal Residue Avoidance Database (FARAD program to further increase visibility.

While an average of slightly more than one drug approval per year does not begin to address the needs of all these species, it is a remarkable performance for such a small and minimally funded program. The Animal Health Institute, which represents veterinary pharmaceutical companies, states that bringing a major new animal drug to market with FDA/CVM approval generally takes 7 to 10 years and costs up to $100 million (http://www.ahi.org/about-animl-medicines/industry-statistics/). While a minor species use is generally supplemental to a major species approval, it takes nearly as long to complete the requirements and generally still costs several million dollars. NRSP-7 has leveraged partnerships with academia and with producer groups to stretch their budget, but that has become more and more difficult as costs have risen and funding has been reduced.

Even with the estimated increased cost per drug approval in recent years, the NRSP-7 program continues to demonstrate remarkable efficiency and cost effectiveness. Compared to an average investment of the pharmaceutical industry estimated at $10 to $25 million in 2015 for adding a label claim to an existing veterinary drug, information generated for additional label claims by the NRPS-7 program costs only approximately 15 to 35% of pharmaceutical industry costs (http://www.ahi.org/about-animal-medicines/industry-statistics/).

The NRSP-7 is the only national program designed and organized to address the issues of the prudent use of antibiotics, anthelmintics and production drugs in minor species of food- and fiber-producing animals. For 27 years, the Program was funded through a USDA special research grant administered by NIFAin cooperation with the NRSP-7 Technical Committee. Currently, however, NRSP-7 has been dependent on “off-the-top” Regional Research funds allocated to the Minor Use Program. Support for NRSP-7 also comes from pharmaceutical companies, producers and universities in the form of “in kind” contributions for Regional Coordinators. The program also receives significant “in-kind support from several other sources including the institutions conducting the research (state agriculture experiment stations, colleges of veterinary medicine, federal laboratories), animal producer groups through contributions of animals for research, and pharmaceutical companies. For example, /CVM cash and in-kind support was $1.8 million or 1.9-times Hatch funding received during the previous 5-year period of 2009 to 2014. For this same period, support by Stakeholders (producers and pharmaceutical companies) was $5.7 million or 6-times Hatch funding. All outside support totaled $9.7 million or 9.2-times the Hatch funding received by the MUADP over these five years.

Over the next five years, the Program will pursue additional funding support from the Minor Use Minor Species Program of the FDA/CVM and developers of organic or natural alternatives to antimicrobial and pesticide use in food animals. With its recent inclusion in the 2014 Farm Bill, the Program has greater leverage with Congress and NIFA to resume financial support of its mandated research objectives. Stakeholders will also be engaged to further Congressional

interest in tighter control of antimicrobial use in food animals through NRSP-7 research. These efforts, we believe, will assist the Program to be federally funded at a once again at more adequate amounts.

How does this NRSP pertain as a national issue?
In February of 2014 Congress and the President recognized the national role of NRSP-7 in H. R. 2642 the AGRICULTURAL ACT OF 2014, known as the 2014 Farm Bill. SEC. 7404. COMPTETITIVE, SPECIAL, AND FACILITIES RESERCH GRANT ACT includes among its (b) PRIORITY AREAS (1)(C) "(x) the identification of animal drug needs and the generation and dissemination of data for safe and effective therapeutic application of animal drugs for minor uses and minor uses of such drugs in major species." Further, Congressional support for NRSP-7 was provided by the Managers on the part of the House and the Senate in the JOINT EXPLANATORY STATEMENT OF THE COMMITTEE OF CONFERENCE. Page 166 of this document establishes the NRSP-7 Program with the wording, "This section … establishes National Research Support Project-7 for research on drugs for use in minor animal species. (Section 7307)." On page 167 the JOINT STAGEMENT notes that, "The Managers encourage the Director of NIFA to continue to support National Research Support Project-7 and to work cooperatively with the Center for Veterinary Medicine of the Food and Drug Administration to facilitate the development and approval of drugs for minor species and minor uses for major species. (Section 7406)."

Additionally, globalization of food markets has allowed countries with greater animal drug availability an advantage when competing with our sheep, goat, rabbits, deer, farmed shrimp and fish, and honey industries. One-third of the lamb and 82% of venison consumed in the US comes from Australia and New Zealand. Nearly 90% of the commercially farmed shrimp are imported. Additionally, two-thirds of the honey consumed in the US is imported and half of that honey comes from China. In order to complete with these countries, American producers are forced to use therapeutics not approved in minor species.

Government agencies around the world and the public have become concerned about the continued use of antibiotics in food producing animals. Scientists in the U.S. and Europe have provided strong evidence that antibiotic use in food-producing animals can have a negative impact on public health. Antibiotics must be used judiciously in humans and animals because both uses contribute to the emergence, persistence, and spread of resistant bacteria. Resistant bacteria in food-producing animals are of particular concern. Food animals serve as a reservoir of resistant pathogens and resistance mechanisms that can directly or indirectly result in antibiotic resistant infections in humans. Some bacteria have become resistant to more than one type of antibiotic, which makes it more difficult to treat the infections they cause. Preserving the effectiveness of antibiotic drugs is vital to protecting human and animal health.

The economic impact of minor animal species agriculture in the United States is great, but at risk. The United States gross annual farm gate income from production of specialty animal species has been estimated by producer groups at over $4.8 billion. Further, these farm gate revenues produce an economic stimulus to the US Gross Domestic Product estimated at another $37 billion. Table 1 provides a breakdown of theses national figures by state. Lack of approved drugs for these producers is seriously threatening the growth and long-term viability of these

collective industries and the security of our food supply. While the cumulative contribution of minor species to agricultural income is great, the return to pharmaceutical companies for research on therapeutics for this category, by species is small and generally unprofitable.

Because of this substantial investment in time and resources, pharmaceutical companies must be assured that the drug will have a reasonable potential for profit. Therefore most drug approvals are sought only for those animal species that are produced in sufficient numbers to support large volume sales, specifically cattle, swine, chickens and turkeys. There is little economic incentive for pharmaceutical firms to generate data necessary to seek FDA/CVM approval of drugs in minor species; hence, very few drugs are available for management of diseases in these minor species. Inequities in drug availability represent serious management and economic problems for producers for minor species. Today, more than half of all commercially led pharmaceutical R&D in the veterinary medical field is focused on developing products for companion animals, and the emphasis on this sector is likely to increase in coming years, as companion animals live longer, and more diseases of old age are diagnosed and treated2.

The FDA/CVM has been aware that veterinarians and livestock producers were using unapproved drugs for minor species without the safeguards that approved drugs carry. Additionally, little peer-reviewed literature existed to provide veterinarians with sufficient information for rationale extra-label use. Such unapproved drug use could not only cause detrimental effects to the animals being treated, but could also lead to the persistence of drug residues in animal products intended for human consumption. Efforts were and continue to be necessary to provide US animal producers with safe and effective means to compete in a global market, while assuring US consumers a safe and wholesome food supply.

The FDA has taken the position to promote the judicious use of antibiotics that are important in treating humans. This strategy recommends that such antibiotics should be used in food-producing animals only under veterinary oversight and only to address animal health needs, not to promote growth. The American Veterinary Medical Association has, in concert, developed a position statement on the judicious therapeutic use of antimicrobials, essentially limiting any use to under the direct supervision of a veterinarian.

Background - In 1976, the FDA/CVM initiated an extensive study of the minor use of animal drugs through the efforts of a minor use/minor species drug committee. This committee, comprised representatives of the FDA's then Bureau of Veterinary Medicine and Bureau of Foods, the U.S. Department of Agriculture (USDA), the pharmaceutical industry, and animal producer groups. They identified the scope of the problem as a lack of approved drugs for (1) diseases of minor species and (2) the principal minor diseases of major species. The committee identified the principal diseases for which drugs were not available in the minor species. In summary, private sponsors had supported approvals for the use of minor use drugs as follows: none for rabbits, one for ducks and pheasants (none for other game birds), two for food fish, four for goats and 21 for sheep. Minor and specialty use needs have continued to accumulate, leaving the producers of these species without the drugs necessary for disease prevention and control. A definite need has been established for approval of minor use veterinary drugs and the scope of the problem was defined. This need was also affirmed by various grower organizations.

Additionally, the committee recognized that the livestock industry in the United States relies heavily on the judicious use of drugs for the treatment of diseases in food animals. Without these drugs, animal suffering and mortality would greatly increase, as would the cost of producing animal-derived food products. However, before a drug can be marketed for use in a food animal species, it must be shown to be safe to the human consumer of the animal-derived food, and safe and efficacious in the target animal.

The process of generating the safety and efficacy data necessary for FDA/CVM approval of a drug is costly and time-consuming. In 1999, it was estimated that the cost to a pharmaceutical company for research necessary to obtain FDA/CVM approval for a new drug exceeded $20 million, and required 8 to 10 years of concentrated research effort 1. More recently, issues relating to (1) escalating costs in the development of analytical methods, (2) concerns over antimicrobial resistance in human medicine, and (3) increased environmental testing have increased veterinary drug approval costs dramatically2. Drug approvals are generally species and disease specific and additional label claims also come with considerable added expense. Pharmaceutical company estimates place the cost of simply adding a label claim to an FDA/CVM approved drug at $10 to $25 million3, 4.

In 1982, the IR-4 Animal Drug Program was established as part of the overall IR-4 Minor Use Pesticide Management Program. Since that time the animal portion has been established as a national means of securing approved drugs and as a conduit between the animal industries and the FDA/CVM.

In December 1990, the USDA/CSRS requested a peer review of the IR-4 program, including both the pesticide portion and the minor use animal component. A reorganization of the minor use animal drug section was one of the recommendations of the Review Team. This Change was carried out with the development of a separate Minor Use Animal Drug Technical Committee that reported to the IR-4 Administrative Advisors.

In 1992, IR-4 Administrative Advisors recommended that with the change from interregional Projects (IRs) to National Research Support Projects (NRSPs), as well as the experience gained under the reorganized IR-4 Project, that the two programs (pesticide and animal) be separated into two projects. In 1993, NRSP-7 was thus created as the Minor Use Animal Drug Program.

Congress has considered bills to promote drug availability for minor species and for minor uses in major species. The Animal Medicinal Drug Uses Clarification Act of 1994 [AMDUCA] and the Animal Drug Approval Act [ADAA] have expanded “extra label” uses for minor species. The limitations imposed by AMDUCA on extra-label drug use in feeds, however, proved to be a major problem to aquaculture and game bird industries and a guidance document has outlined conditions where limited extra-label use of approved formulations will be permitted under conditions of a valid veterinarian-client-patient relationship. The Minor Use Animal Drug Program is the only organized State/Federal effort to address the inadequate number of FDA/CVM approved drugs available for minor-use species and has been responsible for nearly all of the progress made in the approval of minor-use/minor-species drugs. It also hopes to become the most experienced program to address the excessive use of antibiotics as feed additives.

Most recently, in February of 2014 Congress and the President recognized the national role NRSP-7 in H. R. 2642 the AGRICULTURAL ACT OF 2014, known as the 2014 Farm Bill. SEC. 7404. COMPTETITIVE, SPECIAL, AND FACILITIES RESEARCH GRANT ACT includes among its (b) PRIORITY AREAS (1)(C) "(x) the identification of animal drug needs and the generation and dissemination of data for safe and effective therapeutic application of animal drugs for minor uses and minor uses of such drugs in major species." Further Congressional support for NRSP-7 was provided by the Managers on the part of the House and the Senate in the JOINT EXPLANATORY STATEMENT OF THE COMMITTEE OF CONFERENCE. Page 166 of this document establishes the NRSP-7 Program with the wording, "This section … establishes National Research Support Project-7 for research on drugs for use in minor animal species. (Section 7307)." On page 167 the JOINT STAGEMENT notes that, "The Managers encourage the Director of NIFA to continue to support National Research Support Project-7 and to work cooperatively with the Center for Veterinary Medicine of the Food and Drug Administration to facilitate the development and approval of drugs for minor species and minor uses for major species. (Section 7406)."

Rationale

Priority Established by ESCOP/ESS
The seven ESCOP National Priorities include: (1) Develop new and more competitive crop products and new uses for diverse crops and novel plant species; (2) Develop new products and new uses for animals; (3) Reduce the risks of local and global climatic change on food, fiber, and fuel production; (4) Provide the information and knowledge needed to further improve environmental stewardship; (5) Improve the economic return to agricultural producers; (6) Strengthen our communities and families and (7) Ensure improved food safety and health through agricultural and food systems.

NRSP-7 research addresses three of the seven ESCOP Roadmap Challenges, including Challenge 2, Challenge 5, and Challenge 7. The primary contribution of NRSP-7 is to Ensure improved food safety and health through agricultural and food systems (Challenge 7). Concern over drug residues in our food supply has grown exponentially over the last 10 years. Food producers and veterinarians are under pressure to limit the use of antimicrobials in food animals and employ more prudent oversight over even therapeutic uses. Prior to the initiation of the Program in 1982, private sponsors had supported approvals for the use of minor use drugs as follows: none for rabbits, one for ducks and pheasants (none for other game birds), two for food fish, four for goats and 21 for sheep. A majority of these approvals represented outdated drugs with insufficient data on the post-treatment residue levels as well as efficacy. In 32 years, data supplied by the Program provided for the publication of 52 New Animal Drug Applications and modification of 73 label claims to include minor species, an overall average of 1.6 New Animal Drug Applications per year or 2.3 new label claims per year. Included in these Public Master Files were one for rabbits, nine for game birds, 16 for fish, lobster and shrimp, 15 for meat and dairy goats, eight for bison and reindeer, one for foxes and two for honey bees.

In addition to adding minor species to label claims, the Program works to ensure food safety through the publication of data on the pharmacokinetics, safety and effectiveness of modern drugs in minor species. Extra-label use of drugs by veterinarians, requires knowledge of the

pharmacokinetics, tissue distribution, and sensitivity of the animal to support the decision to treat with an unapproved therapeutic. Regional coordinators in the Program have published 211 peer-reviewed articles supporting veterinarians in their decision to use drugs in an extra-label use manner. This information is also supplied to the FARAD program for online access to veterinarians (http://www.farad.org).

Thus, the linkage to human health includes improving the quality and safety of food, addressing issues of zoonotic diseases that threaten both animal and human health, and assuring safe and efficacious animal health products that do not adversely affect human health.

Additionally, with respect to (ESCOP Roadmap Challenge 5), Improve competitiveness and profitability/economic return to the producer in agriculture, NRSP-7 serves as a critical support component of minor species production systems in the US. Economic survival of these minor species producers depends upon their ability to treat diseases with approved drugs and the knowledge that such treatment will not harm the species or incur illegal drug residues. Production units or farms for minor species typically operate on thin margins. Economic success or even survival depends on optimal health of the crop. Limiting disease with approved therapeutics allows producers to treat animals with confidence and assurance that the dose selected will perform as intended and will not result in illegal contamination.

The study of ivermectin medicated feed blocks for cattle fever ticks by NRSP-7 is another example in which the program supports improved competitiveness in agriculture. Treatment of cattle with ivermectin-treated molasses blocks within the 852-square mile quarantine zone that runs along the Mexico-Texas border was identified as a minor use in a major species. Thus, the experience of the Program with the analysis of ivermectin and the drug approval process has enabled NRSP-7 to establish pivotal efficacy and safety data and await only the cooperation of the manufacturers to put the newly documented products to use in the quarantine zone. Since most other treatment options have failed, without these new ivermectin/molasses blocks in use, the entire U.S. cattle industry is at risk if cattle tick fever returns to the United State (www.angusbeefbulletin.com/extra/2008/dec08/images/.../texas_tick.pdf).

Work by NRSP-7 led to FDA/CVM approval for progesterone implants for estrus synchronization in sheep. This has enabled sheep farmers to begin producing lambs throughout the year. This in turn allows the producer to supply animals to the market at times other than peak “natural” breeding periods, improving US sheep farming competitiveness in the US and foreign markets.

NRSP-7 also assists to Develop new products and new uses for animals (Challenge 2). Without NRSP-7, the introduction of many new animal species would not be possible since they are generally high value specialty animals with few, if any, approved therapeutics. The work on the development of the ivermectin/molasses blocks described in the context of Challenge 5 is also consistent with Challenge 2 and is discussed in more detail above.

Relevance to stakeholders

Animal producers are the primary stakeholders in the NRSP-7 program, but pharmaceutical companies may be considered significant stakeholders as well. Other groups with interest in

minor animal drug use include veterinarians and regulators. The active participation of animal producers and pharmaceutical companies is essential for the success of the program. However, to one degree or another, NRSP-7 involves all stakeholders. NRSP-7 producer stakeholders are represented by the following 58 organizations in 10 categories: American Association of Wildlife Veterinarians, American Association of Zoo Veterinarians, American Farm Bureau, American Feed Industry Association, American Pet Product Manufacturers Association, Inc., American Rabbit Breeders Association, American Sheep Industry Association, American Veterinary Medical Association, Animal Health Institute, Animal Drug Alliance, Arkansas Bait and Ornamental Fish Growers Association, Catfish Farmers of America, Center for Veterinary Medicine, Florida Tropical Fish Farms Association, Inc., Food Animal Concerns Trust, International Association of Aquatic Animal Medicine, International Association of Fish and Wildlife Agencies, North American Deer Farmers Association, North American Gamebird Association, Inc., National Pork Producers Council, National Cattlemen's Beef Association, National Fisheries Institute, National Turkey Federation, Pacific Coast Shellfish Growers Association, and the National Aquaculture Association.

By category, stakeholders include:

• Agencies – Fish and Wildlife Service, and Animal and Plant Health Inspection Service, US Geologic Survey, and FDA Center for Veterinary Medicine.

• Aquaculture: Marine Fish Dealers, American Tilapia Association, U.S. Trout Farmers Association, American Fisheries Society, World Aquaculture Society, Aquaculture Network Information Center, and Catfish Planet.

• Bees: American Beekeepers Federation, American Honey Producers Association, International Bee Research Association, Iowa State Entomology Index: Beekeeping, and Beekeeper's Home Pages Internet Resources.

• Caprine: American Dairy Goat Association.

• Game Birds: Mississippi State Gamebird Management, Pheasants Forever, Quail World, and North American Gamebird Association.

• Institutions: Auburn University (aquaculture and fisheries), Cornell University (aquaculture), Minnesota (avian), and Texas AMU (poultry science). • Lagomorphs: American Rabbit Breeders Association.

• Ovine: American Sheep Industry Association.

• Ratites: American Emu Association and The American Ostrich Association.

• Reptiles: The Gator Hole and Crocodilian Internet Resources.

• Ungulates: Alpaca Registry, National Bison Association, The White-Tailed Deer Farmer's Network, North American Deer Farmers Association, Deer Hunting Net, and North American Elk Breeders Association.

These stakeholders provide input to NRSP-7 as to their individual drug needs and support projects through the contribution of animals, facilities for drug testing, commercial drugs, data, and analytical methodology.

Stakeholder needs – Veterinary medicine has a key role in protecting the health and productivity of several billion farm animals worldwide, ensuring the quality of the food they yield, and in protecting the health of approximately one billion companion animals. Even though a large number of animals are treated with veterinary pharmaceuticals, the human healthcare market is about 35 times larger than the combined market for all non-human species, which had a global value in 2012 of $21.1 billion. This figure can be divided among three main modalities: veterinary pharmaceuticals, biologicals and medicated feed additives (MFAs). 63% of the $21.1 billion veterinary health market in 2011 is accounted for by pharmaceuticals ($13.3 billion), 25% by biologicals ($5.27 billion) and 12% by medicinal feed additives ($2.5 billion). Food animal healthcare comprised $12.45 billion of the total 2011 market; companion animal healthcare comprised $8.64 billion (http://finance.yahoo.com/news/global-veterinary-health-products-market-193000008.html). Moreover, this animal market is dominated by a large number of products that generate small revenues, and so the balance between the amount of R&D investment required relative to the likely return on this investment is a particularly crucial issue in veterinary drug development.

Minor species represent an excellent example of this disparate market. Agricultural production of fish, gamebirds, sheep, goats, ratites bees and deer in the United States is critically important to numerous regional economies in the United States. This diverse aggregation of minor species represents approximately $4.8 billion in state and local US farm revenues annually. Additionally, processing and export of minor species food and fiber products represents an additional $36.6 billion of revenue. Individually, however, these minor species represent drug markets too small to provide a sufficient return on the high cost of developing a new animal drug application.

Prior to NRSP-7, the FDA/CVM had approved the use of drugs for minor species as follows: none for rabbits, one for ducks and pheasants (none for other gamebirds), two for food fish, four for goats and twenty one for sheep (most of which have been withdrawn). Minor and specialty use needs have continued to accumulate, leaving the producer of these species without the drugs necessary for disease prevention and control. The Minor Use Animal Drug Program has received 354 Animal Drug Requests submitted by animal producers, researcher investigators at federal, state, and university laboratories, veterinarians, and animal industry personnel for approval of a specific drug for the control of a certain disease in a particular animal industry. Of these requests, more than 40 have been identified as priority projects for NRSP-7.

Measuring stakeholder use – Animal produces who use unapproved drugs for the treatment of livestock face the liability of illegal drug residues as well as the risk of ineffective dosages. Before the Minor Use Animal Drug Program, these producers had little choice, but to use unapproved drugs when faced with outbreak situations. Without these drugs, animal suffering

and mortality would greatly increase, as would the cost of producing animal-derived food product. The FDA/CVM is aware that veterinarians and livestock producers were using unapproved drugs without the safeguards that approved drugs carry. Because there is widespread use of unapproved drugs in minor species and the level of use is small, approval of drugs for the minor use needs does not generally result in a measurable increase in sales to the pharmaceutical company. Thus, it is not possible to achieve a measure of stakeholder use of NRSP-7 data and drug approvals through increases in drug sales. One major exception to this situation is in the area of aquaculture. Increases in sales and usage of NRSP-7 developed drug approvals can be monitored through medicated feed records and pharmaceutical company shipment records.

Two robust measures of stakeholder use include the conversion of published Public Master Files to New Animal Drug Applications and the addition of the minor use on the label of the pioneer product for the pharmaceutical stakeholder and the "in-kind" contributions of producers in supporting the research of NRSP-7. Of the 32 Public Master Files supported entirely by NRSP-7 research, 52 label claims have been added to products for minor uses. Additionally, a total of 73 label claims have been developed containing data generated by NRSP-7. Thus, pharmaceutical companies have been strongly supportive of the Program and taken advantage of the opportunity to support the prudent use of antibiotics even though such action increases their liabilities out of proportion to profits. The second metric of stakeholder support, in-kind contribution of resources and facilities, has accounted for an estimated $982,800 over the last five years of the Program (see Appendix F).

Implementation

Objectives

1. Identify the animal drug needs for minor species and minor uses in major species.
2. Generate and disseminate data for the safe, effective, and legal use of drugs intended for use in minor animal species.
3. Facilitate FDA/CVM approvals of drugs for minor species and minor uses.
4. Provide alternatives to antibiotic use in food animals through the identification and FDA/CVM approval of naturally occurring biotherapeutics and feed additives.

Projected Outcomes

1. To date 354 drug requests have been submitted by stakeholders to the Minor Use Animal Drug Program for the development of data in support of the submission of a New Animal Drug Application (NADA). Through a prioritization process that has included (i) constraints imposed by concerns of antimicrobial resistance, (ii) limitations of availability of certain expensive or rare animal species, (iii) appropriate efficacy models, and (iv) high risk/benefit liabilities and lack of economic incentives for pharmaceutical manufacturers, the number of highest priority projects has been estimated at 40. Budget cutbacks have reduced our current active projects to nine, with active research limited to 3 to 5 per year.
2. NRSP-7 has published 211 articles in peer-reviewed journals, averaging 6.6 per year over the term of the program. For the last five years, however, publications have increased to

nearly 10 per year. Thus, although FDA/CVM drug approvals have waned due to increasing costs, the Program has increased its efforts to supply critical data needs to minor species producers. The data generated by the Program is also shared with the Food Animal Residue Avoidance Database (FARAD program to further increase visibility. For a detailed description of NRSP-7 dissemination of data and information, see Outreach and Communication.

3. Since its inception in 1983, the Minor Use Animal Drug Program has been responsible for generating 32 Public Master Files supporting 52 New Animal Drug Applications, an average of 1.6 New Animal Drug Applications per year. Included in these approvals were one for rabbits, nine for game birds, 16 for fish, lobster and shrimp, 15 for meat and dairy goats, eight for bison and reindeer, one for foxes and two for honey bees (Table 2). For the 5-year period of this review, NSRP-7 was responsible for three Public Master Files – Progesterone Solid Matrix for sheep (NADA 141-302), Lincomix for the control of American foulbrood in honey bees (NADA 111-636) and Chloramine-T for the control of mortality in freshwater-reared salmonids due to bacterial gill diseases (NADA 141-423). Further, the Program has supplied supplemental data to the US Fish and Wildlife Services in support of 21 New Animal Drug Applications.
4. Modeling after the IR-4 Program's work with HopGuard for varroa mites in honey bees, NRSP-7 has initiated discussion with BetaTech for inclusion of their hops beta acids into the Program. NRSP-7 would assess the potential of these beta acids to serve as a substitute for antibiotics as growth promoters in animal feeds. Objective 4 would also provide a more direct visibility of the Program's efforts to support prudent use of antibiotics in food producing animals. This additional objective will draw more support from Congressional members who, in the past, have been reluctant to unconditionally support the Program for fear this support would be interpreted as increasing antibiotic use in animals.

Management, Budget, and Business Plan

1. Organizational structure

NRSP-7 is composed of a Technical Committee and four Administrative Advisors representing state experiment station directors. These Administrative Advisors provide liaison among the directors of the state experiment stations, USDA/NIFA, FDA/CVM, various animal organizations, and others coordinating the efforts of this program. The organizational structure of the Minor Use Animal Drug program follows:

Administrative Advisory Committee

The Administrative Advisory Committee is composed of one appointee by Experiment Station Directors from each of the four regions (North Central, Northeast, Southern, and Western). The chair of the committee is selected internally. The role of the Administrative Advisory Committee is to provide liaison among the directors of the agricultural experiment stations in the four regions, colleges of veterinary medicine, the USDA/NIFA, the FDA/CVM, various animal organizations, and with those coordinating the efforts of this program. This committee

establishes and sets policy consistent with the mission of the project. This committee also advises on budget and administrative matters relating to the program.

Technical Committee

The Technical Committee is composed of the following representatives: • National Animal Drug Coordinator (Chair)

• Regional Animal Drug Coordinators representing each of the four regions (North Central, Northeast, Southern, and Western)

• Administrative Advisory Committee Chair (non-voting)

• USDA/NIFA Representative (non-voting)

• FDA/CVM liaison to NRSP-7 (non-voting)

In addition to the above committee, the FDA/CVM has a group of Minor Use Animal Drug reviewers that meets with the Technical Committee generally once a year at the semi-annual meetings of the Technical Committee. This FDA/CVM group consists of representatives from the Division of Therapeutic Drugs for Food Animals, the Division of Human Food Safety, the Division of Production Drugs, and the Environmental Sciences Staff. The National Animal Drug Coordinator is salaried on a part-time basis and maintains an office. The Regional Animal Drug Coordinators are not compensated by salary except for secretarial or technical services.

Cooperating Agencies and Principal Leaders:

US Department of Agriculture/NIFA Dr. Gary Sherman, USDA/NIFA Representative

US Food and Drug Administration/Center for Veterinary Medicine Dr. Meg R. Oeller, FDA/CVM Liaison Dr. Amy Omer, FDA/CVM Liaison Dr. Dorothy Bailey, FDA/CVM Liaison

Administrative Advisors Dr. George Smith, Michigan AES Dr. Margaret E. Smith, (Chair) New York AES Dr. Frances D. Galey, Wyoming AES Dr. Philip H. Elzer, Louisiana AES

National Coordinator Dr. John G. Babish, New York

Regional Coordinators Dr. Lisa Tell, California AES Dr. Rodman G. Getchell, New York AES Dr. Thomas Vickroy, Florida AES Dr. Ronald W. Griffith, Iowa AES

2. Funding activities

In the past, Research for the Minor Use Animal Drug Program was funded through a USDA special research grant administered by NIFA in cooperation with the NRSP-7 Technical Committee. Currently, however, NRSP-7 has been dependent on “off-the-top” Regional Research funds allocated to the Minor Use Program. Table 1 below summarizes the five-year

funding of NRSP-7 the Minor Use Animal Drug Program (MUADP), for the years 2009 – 2013 inclusive. This period represents the previous NRSP approval term of the MUADP. Total funding from all sources including Cash and In-Kind was $9.7 million or approximately $2 million per year.

NRSP-7 is a cooperative program involving Experiment Stations, Veterinary Colleges, regulatory agencies, animal producers and pharmaceutical companies. FDA/CVM cash and in-kind support was $1.8 million or 1.9-times Hatch funding received during this period. Support by Stakeholders (producers and pharmaceutical companies) during this period was $5.7 million or 6-times all Hatch funding. All outside support totaled $9.7 million or 9.2-times the Hatch funding received by the MUADP over five years.

Overall, during the 2009-2013 period the NRSP-7 was largely supported by stakeholders with both cash and in-kind funding, while Hatch funding accounted for approximately 10% of the operational budget. This 10%, however, was essential to coordinate the necessary resources to achieve the level of productivity exhibited during this five-year period for our stakeholders.

Drug approvals are generally species and disease specific and additional label claims come with considerable added expense. Pharmaceutical company estimates place the cost of simply adding a label claim to a previously approved drug at $10 to $25 million. In the 2009-2013 period, NRSP-7 research made possible the addition of five new drug uses in minor species and successfully completed the human food safety study for fenbendazole in pheasants. For the 5-year period of this review, NSRP-7 was responsible for three Public Master Files/drug approvals These wre Progesterone Solid Matrix for sheep (NADA 141-302), Lincomix for the control of American foulbrood in honey bees (NADA 111-636) and Chloramine-T for the control of mortality in freshwater-reared salmonids due to bacterial gill diseases (NADA 141-423). Only NADA 141-302 received Program funding during the latest 5-year period, as research supporting NADA 111-636 was conducted at USDA/ARS and data for NADA 141-423 was developed during the previous 5-year period. Further, the Program has supplied supplemental data to the US Fish and Wildlife Services in support of 21 New Animal Drug Applications. Together all these Public Master Files have supported FDACVM approval for 73 drug products for use in minor food and fiber species. Over the last five years, NRSP-7 cost for adding a minor species claim to a drug label was approximately 2- to 5-times more efficient than industry.

Perhaps the most significant of this “in-kind” support, however, comes through the cooperation of the pharmaceutical companies that provide access to their proprietary data package prepared for the drug approval in a major species, estimated at approximately $100 million (http://www.ahi.org/about-animal-medicines/industry-statistics/). In addition, the pharmaceutical sponsors complete the approval package by adding the new use of the drug to their current label, and often contribute to the program in the form of providing the investigational drug for research, as well as direct financial aid. Without the generous support of the pharmaceutical manufactures, this program would not be possible.

The Regional Animal Coordinators are not compensated by salary for time contributed to the Minor Use Animal Drug Program. In two cases, secretarial and/or technical support services are budgeted from the Program. The funding of $20,000 for the National Drug Coordinator’s part-

time salary (30%) and the maintenance of an office has been donated to program research by the National Coordinator over the last two years.

Overall, the mean total expenditure per completed research for a drug approval or publication of a Public Master File was $668,089. Average federal expenditures per completed research for publication of a Public Master File was $409,907. Moreover, with 73 additional label claims, the total federal cost per label claim generated from NRSP-7 research has been $185,300. The process of generating the safety and efficacy data necessary for FDA approval of a drug is costly and time-consuming. At present, the estimated cost to a pharmaceutical company for research necessary to obtain FDA approval for a new drug exceeds $80 million, and requires 8 to 10 years of concentrated research effort. The addition of a new label claim is also costly, ranging from $10 to $25 million.

Even with the estimated increased cost per drug approval in recent years, the NRSP-7 program continues to demonstrate remarkable efficiency and cost effectiveness. Compared to an average investment of the pharmaceutical industry of $10 to $25 million for adding a label claim to an existing veterinary drug, information generated for additional label claims by the NRPS-7 program costs only approximately 15 to 35% of pharmaceutical industry costs (http://www.ahi.org/about-animal-medicines/industry-statistics/).

3. Research

Research projects are initiated by requests, usually from researchers or animal producers, to the program's regional coordinators to address a particular minor use animal drug need. These requests, known as ADRs (Animal Drug Requests), are prioritized according (i) to financial and regulatory feasibility, (ii) to importance to the animal industry, and the pharmaceutical manufacturer's commitment to the minor use animal drug approval. Once a request is accepted as a research project, study protocols are developed and reviewed by FDA/CVM. All research projects are conducted in accordance with FDA's Good Laboratory Practices regulations. This process is outlined schematically in Figure 1.

Research Planned for Upcoming Year - To date 354 drug requests have been submitted to the Minor Use Animal Drug Program for the development of data in support of the submission of a New Animal Drug Approval. Through a prioritization process that has included (1) constraints imposed by concerns of antimicrobial resistance, (2) limitations of availability of certain expensive or rare animal species, (3) appropriate efficacy models, and (4) high risk/benefit liabilities and lack of economic incentive for certain pharmaceutical manufacturers, the number of highest priority projects has been estimated at approximately 40. Of these, the Program has been actively working on nine projects.

Over the last five years the total Federal plus non-Federal cost for NRSP-7 to provide the data necessary to support a single label claim has risen to approximately $3.5 million. This increase is due to (1) more sophisticated analytical procedures for residue analysis, (2) the need to conduct all studies under Good Laboratory Practices and auditing of projects, and (3) more expensive environmental assessments. Federal costs per Public Master File are estimated at roughly half this amount or $1.75 million. With NRSP-7 total level of funding of approximately $300,000 per

year and cost per drug approval of $1.75 million, the expected time for achieving a drug approval is 5.6 years. Thus, it is anticipated that NRSP-7 will achieve one approval over the next five years.

This level of progress falls critically below the needs and expectations of our stakeholders and it is the objective of the Program to use the next year to evaluate the continued viability of the program in the face of continuing escalating costs and dwindling funding.

Over the next five years, the Program will work to organize on several fronts to establish the potential for increased funding. First, the Program will work to obtain more grants from the FDA/CVM Minor Use Minor Species (MUMS) grant program. Since the inception of the MUMS program at the FDA/CVM, NRSP-7 has taken advantage of this funding for several projects, but can increase this number in the upcoming year. This year I-010536 Strontium Chloride for otolith marking study has applied for MUMS funding to supplement the Program's Hatch Funding.

Second, NRSP-7 will critically review the current nine active projects with the goal of completing two or three of the most visible. Projects likely to be completed in the coming year include I-006013 Erythromycin in Salmonids, I-011389 CIDR implants for goats, I-010062 Fenbendazole in pheasants, and I-012056 Ivermectin block for cattle tick fever.

Additionally, the Program will solicit support from companies interested in developing markets for natural alternatives to antibiotic growth promoters. For example, BetaTech of Washington, DC, has developed data on the growth promoting and antibacterial properties of hops beta acids. In US patent 7,090,873 he has demonstrated the growth promoting properties of these alpha acids on cattle. The Program has had discussions with BetaTEch for interest in developing these applications for both major and minor species and the Company has been favorable to working with NRSP-7.

4. FDA/CVM approval

A successful research project is submitted to FDA's Center for Veterinary Medicine for review and inclusion in a Public Master File. The availability of the data for use on a label claim is announced through publication of the Public Master File in the Federal Register. A pharmaceutical sponsor may then reference, at no cost, the data in the Public Master File to support a new animal drug application for the minor use. The final step in the process is FDA/CVM approval of this application for the pharmaceutical sponsor, so that the product may be labeled and sold.

5. Assessment of outcomes

Productivity - In the 32 years, data supplied by the Program provided for the publication of 32 Public Master Files, 52 New Animal Drug Approvals and modification of 73 label claims to include minor species, an overall average of 1.6 New Animal Drug Approvals per year or 2.3 new label claims per year. Included in these New Animal Drug Approvals were one for rabbits,

nine for game birds, 16 for fish, lobster and shrimp, 15 for meat and dairy goats, eight for bison and reindeer, one for foxes and two for honey bees.

Additionally, NRSP-7 has published 211 articles in peer-reviewed journals, averaging 6.5 per year over the term of the program. For the last five years, however, publications have nearly doubled to 11.4 per year. Thus, although FDA/CVM drug approvals have waned due to increasing costs, the Program has increased its efforts to supply critical data needs to minor species producers. The data generated by the Program are also shared with the Food Animal Residue Avoidance Database (FARAD(program to further increase visibility and assist veterinarians.

Currently there are nine active research projects involving five animal species and seven different drugs (Table 2). Ruminant species remain the predominant group with a majority of Public Master Files (53%).

NRSP-7 has also provided information on therapeutics in minor species use through peer-reviewed publications, workshops and presentations to stakeholders and at professional meetings. Use of the Internet to optimize communications with stakeholders and program participants continues to improve in this rapidly changing medium. Moreover, NRSP-7 is the only initiative that generates information on the safe and effective use of therapeutics in minor species. Through NRSP-7, producers and veterinarians have the necessary information to reduce pain and suffering in commercially important minor species.

Completion of original objectives

A primary objective of NRSP-7 was to identify the animal drug needs for minor species and minor uses in major species. The Minor Use Animal Drug Program has received over 354 Animal Drug Requests submitted by researcher investigators at federal, state, and university laboratories, veterinarians, and animal industry personnel for approval of a specific drug for the control of a certain disease in an animal industry. Of these drug requests, the NRSP-7 Technical Committee has identified 40 of high priority. While in one sense NRSP-7 has completed one of our original objectives, withdrawal of available products, antimicrobial resistance, disease prevalence, husbandry practices, and the changing business relationships in the veterinary pharmaceutical industry preclude considering our current list of projects and potential projects as final.

The Program has generated and disseminated data for safe and effective minor speces uses and minor uses in major species through the publication of 211 articles in peer-reviewed journals, averaging 6.6 per year over the term of the program. For the last five years, however, publications have increased to nearly 10 per year. Another form of dissemination of NRSP-7 data is the publication of drug pharmacokinetic and residue depletion studies through FARAD (Food Animal Residue Avoidance Database). FARAD is a computer-based decision support system designed to provide livestock producers, extension specialists, and veterinarians with practical information on how to avoid drug, pesticide and environmental contaminant residue problems.

With respect ot facilitating FDA/CVM approvals for the above identified needs, In 32 years, the Program has provided data for the publication of 52 New Animal Drug Approvals and modification of 73 label claims to include minor species, an overall average of 1.0 Public Master File per year or 2.3 new label claims per year. For the 5-year period of this review, NSRP-7 was responsible for three Public Master Files. They included Progesterone Solid Matrix for sheep (NADA 141-302), Lincomix for the control of American foulbrood in honey bees (NADA 111-636) and Chloramine-T for the control of mortality in freshwater-reared salmonids due to bacterial gill diseases (NADA 141-423). Only NADA 141-302, however, received Program funding during the latest 5-year period, as research supporting NADA 111-636 was conducted at USDA/ARS and data for NADA 141-423 was developed during a previous 5-year period.

Integration

Program facilitation and coordination exists among animal producers, pharmaceutical manufacturers, FDA/CVM, USDA/NIFA, other government agencies, state agricultural experiment stations, and schools of veterinary medicine. Animal producers have provided the majority of drug requests and they frequently supply animals and facilities for target animal safety and residue depletion studies. Pharmaceutical companies participate through the sharing of analytical methodology and providing commercial drug product for testing (See Funding). The major contribution of the pharmaceutical manufacturer is, however, is the cost borne for the approval of drugs for a major species, approximately $100 million, and the cost of adding a label claim at $10 to $25 million (http://www.ahi.org/about-animal-medicines/industry-statistics/).

Since the beginning of the Minor Use Animal Drug Program, The FDA/CVM has supplied a full-time liaison to coordinate the drug approval process. In the last four years, they have added part of the time of two additional staff positions to support the Program. The four regional coordinators are associated with colleges of veterinary medicine or experiment stations. These coordinators have full responsibility for supervising the development of all data entering the Public Master Files. Regional Coordinators also present and publish results of their studies. USDA/NIFA provides two full time liaison personnel who, along with the Administrative Advisors and Technical Committee, oversee the prioritization of drug requests as well as project planning and implementation. Persons serving as Administrative Advisors are provided by the agricultural experiment stations from the four regions of the United States. The fundamental need for NRSP-7 to operate as a functionally integrated program has existed since its inception and NRSP-7 has spent 32 years cultivating the relationships necessary for optimal efficiency.

Outreach, Communications and Assessment

Public Master Files and New Animal Drug Allowances (NADAs) - The goal of the outreach and communication plan of NRSP-7 is to provide stakeholder access to information regarding program goals, accomplishments and impacts through a variety of channels. One form of outreach consists of the publication of the efficacy, target animal safety and drug residue depletion data generated as a Public Master File in the Federal Register and as a New Animal Drug Allowance (NADA) or Abbreviated New Animal Drug Allowance (ANADA). Publication in the Federal Register places the required studies in the public domain and a New Animal Drug Allowance provides the producer stakeholder the availability of the drug for the claimed minor

use. Table 2 lists the 33 Public Master Files and 52 New Animal Drug Allowances developed from data generated by NRSP-7.

Approvals and projects that have changed the outlook of two industries include the approvals of lincomycin hydrochloride water-soluble powder and tylosin tartrate powder for control of American Foulbrood in honey bees. These approvals represent a significant therapeutic addition to an industry working to reverse the declining honey bee population. Due to the small quantities of active ingredient required. the use of these products will not substantially increase sales of these drugs.The potential effect on the industry, however, is important. Secondly, the ivermectin/molasses block formulation study currently being conducted in Texas for the control of the cattle fever tick, has the potential of averting a major threat to the U.S. cattle population.

Several efficacy studies have supported the use of this novel formulation in cattle tick control. NRSP-7 labs in the Southern Region have worked with producers to assure a uniform distribution of ivermectin in the molasses blocks, insuring that cattle will receive uniform dosing.

Presentations and publications - Presentations, abstracts, publications and doctoral dissertations represent yet another form of communication to the stakeholders. Over the last 32 years, NRSP-7 has produced 211 peer-reviewed publications. Notably, while drug approvals have become more costly and time consuming to obtain over the last five years, NRSP-7 has nearly doubled its publication rate from 6.4 per year to 11.4 per year for the last five years. A listing of these publications follows this report.

Website - The Technical Committee has worked to develop the NRSP-7 website (www.NRSP7.org) as a communication tool for dissemination of information generated by the program. The site provides for the submission of Animal Drug Requests (ADR's), operational information and monitoring of project progress by Technical Committee members, access to the MUMS (Minor Use Minor Species) program and links to a variety of stakeholders' websites. The use of the Internet to optimize communications with stakeholders and program participants continues to improve in this rapidly changing medium. Since inception in 1999, the NRSP-7 website has been visited 13,251 times for an average of 2.4 hits per day. NRSP-7 believes that this represents a significant degree of interaction with stakeholders as well as the public at large.

Sharing NRSP-7 information with FARAD – Another form of dissemination of NRSP-7 data is the publication of drug pharmacokinetic and residue depletion studies through FARAD (Food Animal Residue Avoidance Database). FARAD is a computer-based decision support system designed to provide livestock producers, extension specialists, and veterinarians with practical information on how to avoid drug, pesticide and environmental contaminant residue problems.

The FARAD website (www.FARAD.org) provides: • Current label information including withdrawal times of all drugs approved for use in food-producing animals in the United States. • Official tolerances for drug and pesticides in tissues, eggs and milk. • Database with approximately 43,000 scientific articles and entries with data on residues, pharmacokinetics and the fate of chemicals in food animals.

By supplying FARAD with information developed on minor use animal drug residue depletion and pharmacokinetics, NRSP-7 affords the stakeholder yet another conduit for obtaining critical information to avoid illegal and potentially hazardous drug residues in food animals.

Steps to improve communications – Several changes have been incorporated in an effort to enhance communication both within the program and with stakeholders. First, monthly teleconferences are held by the Technical Committee to discuss potential projects, interactions with stakeholders and progress in studies. Second, stakeholders have been invited to be active non-voting participants in the annual spring teleconferences. The nature of the participation is ad hoc and representatives from different stakeholder groups are invited on a rotating basis, without representation from a single or specific group "assigned" to the committee.

Informatics have been better utilized to increase/improve communication with NRSP-7 participants and stakeholders. Improvements to web usage include posting pdf versions of publications and or dissertations that have been supported through NRSP7 funds as well as links to other appropriate pages (partners, producer and/or pharmaceutical company websites). Existing brochures and any newly developed media information packages are posted.

Projected Participation NRSP-7 functions through the coordination of efforts among animal producers, pharmaceutical manufacturers, Food and Drug Administration/Center for Veterinary Medicine, United States Department of Agriculture/Cooperative State Research, Education, and Extension Service, universities, State Agricultural Experiment Stations and veterinary medical colleges throughout the country. Working relationships between the Program and both the FDA/CVM and NIFA have been and should continue to be excellent. Also, USDA/ARS has been participating with NRSP-7 in the cattle fever tick studies in Texas. Participation has also been forthcoming from game bird growers that have donated birds for safety and efficacy studies. Pharmaceutical companies have also provided analysis of feeds and tissues samples in selected studies. When the pharmaceutical companies could not provide analysis, they have provided expertise in the development of analytical methods for the tissue residue studies in minor species.

Further participation is projected from companies manufacturing natural products to be used as alternatives to antibiotics as growth promoters in animal feeds. An example of this is BetaTech of Washington, D.C. BetaTech already has its hops beta-acids in the IR-4 biopestices program under evaluation for control of the varro mite in honey bee hives. Initial discussions with BetaTech and FDA/CVM on supporting a project in NRSP-7 have been positive. FDA/CVM has indicated they will support NRSP-7 and BetaTech efforts to approve their hops beta acids as a growth promoting feed additive as part of its program to oversee the reduction of antibiotic use as growth promoters.

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External Links NRSP-7: http://www.nrsp-7.org

FARAD: http://www.farad.org

CDC information on food borne antibiotic resistance [http://www.cdc.gov/narms/animals.html]

FDA information on antibiotic use in food animals [http://www.fda.gov/AnimalVeterinary/%20SafetyHealth/AntimicrobialResistance/JudiciousUseofAntimicrobials/default.htm]

American Veterinary Medical Association position on use ofantibiotics in food producing animals. [https://www.avma.org/KB/Policies/Pages/Judicious-Therapeutic-Use-of-Antimicrobials.aspx']

Public Master Files supporting approved New Animal Drug Applications for Minor Uses http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/MinorUseMinorSpecies/ucm279396.htm

Public Master Files (PMFs) in development http://www.fda.gov/AnimalVeterinary/DevelopmentApprovalProcess/MinorUseMinorSpecies/ucm287667.htm

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