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PESTICIDE USE BY THE FEDERAL/COOPERATIVE ANIMAL DAMAGE CONTROL (ADC) PROGRAM, 1988-1991

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ABSTRACT: ADC personnel use many wildlife damage control methods including pesticide products. This paper presents a national overview of the kinds and amounts of chemical pesticides used by ADC in direct control activities during Fiscal Years (FY) 1988-1991. The pesticides used by ADC included aluminum phosphide, 4-aminopyridine, bone tar oil, brodifacoum, carbon, alpha-chloralose, cholecalciferol, DRC-1339, fenthion, glyphosate, immobilizing & euthanizing drugs, mineral oil, PA-14, phosphorus, polybutene, sodium cyanide, sodium fluoroacetate, sodium nitrate, strychnine, sulfur, and zinc phosphide. This summary shows that ADC personnel used remarkably small amounts of chemicals during FY 19881991. Overall amounts of pesticides used by ADC have changed little since that time period, although uses of some pesticide products have decreased (PA-14 and strychnine) while others increased (repellents, glyphosate, alpha-chloralose, and the Compound 1080 LPC). Pesticide uses by ADC program personnel are increasingly limited, selective, and environmentally safe if not environmentally benign.

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Chemical pesticides are important.in wildlife damage management. Much time and money is expended to develop and maintain vertebrate pesticide registrations, and to develop *effective* pesticide use procedures that avoid or minimize risks to humans and their environment. One of the leading organizations involved in this work is the Federal/Cooperative Animal Damage Control (ADC) program, which is managed by the U. S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), with many State and local cooperators.

Most ADC program research on wildlife damage control methods, including chemicals, is conducted by the Denver Wildlife Research Center (DWRC). In recent years, DWRC researchers have studied both lethal and nonlethal materials including alphachloralose, methyl anthranilate, diphacinone, strychnine, sodium cyanide, zinc phosphide, Compound 1080, sodium nitrate, carbon, DRC1339, PA-14, and others (USDA 1994; Appendix K; Ramey et al. 1994). The ADC program has used all of these pesticides and many others in recent years.

In 1987, APHIS began to prepare a comprehensive environmental analysis of 'wildlife damage management activities conducted by the ADC program and its cooperators throughout the United States. This analysis culminated in the production of a 3-volume final environmental impact statement (EIS; USDA 1994) that included a national summary of pesticide use by ADC together with a risk assessment of pesticides and other wildlife damage control methods. [The EIS may be obtained from USDA APHIS Animal Damage Control, 4700 River Road, Unit 87, Riverdale MD 20737-1234]. The present paper summarizes and amplifies pesticide use information that was presented in the EIS.

The ADC programmatic EIS was prepared by Dames and Moore, a private environmental consulting firm, with the assistance of many APHIS and ADC employees. Significant contributors to the pesticide use analysis included A. Chartrand, T. Hanson, and J. Pecoraro, all with Dames & Moore, and ADC program employees G. Connolly, G. McEwen, D. Mott, R Owens, L. Penry, G. Simmons, D. Slate, R Wadleigh, and E. Schafer. Special thanks are due to the 38 ADC State Directors whose prompt responses to a detailed questionnaire about control methods and their uses provided the data base from which national ADC pesticide use statistics were compiled. I also thank W. Clay, K. Fagerstone, M. Mendoza, S. Pahnateer, and E. Schafer for helpful review comments.

METHODS

A questionnaire was developed to collect information on control methods used by the ADC program. Each state director was asked to provide detailed information on each wildlife damage management method used by ADC personnel in the state at any time during a 4-year period (FY 19881991). For each chemical method, the state directors were asked to report the maximum amount used in any one of the 4 years. The reason for recording maxima rather than average amounts is that these data were to be used in the EIS risk analysis to estimate the maximum exposure expected to result from ADC activities.

The state director reports were compiled into a national summary for analysis and publication in the EIS (USDA 1994: Tables 4-4, 4-5, P-7). This summary covered all 50 states as well as U.S. territories and possessions.

The ADC program offers two kinds of help with wildlife damage problems --direct control and technical assistance. Direct control is wildlife damage management activities conducted or supervised by ADC personnel, whereas technical assistance consists of advice, recommendations, information, and materials provided by ADC employees to others to use in managing wildlife damage. ADC personnel routinely record the materials and methods they use in direct control, but they do not monitor damage control actions by nonemployees who may have received technical assistance from ADC. Therefore, the pesticide use summary presented in the EIS and summarized in this paper reflects direct control activities of ADC program personnel. '

Even ***though most*** wildlife scientists today use the metric system, metric terminology is not universal for pesticide labeling. Depending upon the product, a label may specify contents in terms of grams, pounds, ounces, gallons, milligrams, or other units. ADC program records of pesticide use are generally based on the units established on pesticide labels, and this pattern was preserved when the records were summarized for use in the EIS. In this paper, I have preserved the units shown in the EIS for the sake of consistency.

RESULTS

Active Ingredients (AIs) and Registration Status of Products Used by ADC

ADC employees used chemical pesticides containing approximately 20 different AIs during the 4-year study period (Table 1). This list includes 12 AIs for which APHIS maintained registrations for the ADC program or experimental/investigational use permits (alphachloralose, carbon, DRC-1339, mineral oil, PA-14, phosphorus, strychnine, sodium cyanide, sodium fluoroacetate, sodium nitrate, sulfur, zinc phosphide) and 8 other AIs registered by commercial manufacturers (aluminum phosphide, 4aminopyridine, bone tar oil, brodifacoum, cholecalciferol, fenthion, glyphosate, polybutene). In addition, small amounts of immobilizing and euthanizing drugs were used. Even though such drugs usually are not considered to be pesticides, they are included to make Table 1 a complete list of chemicals used by ADC during the study period.

Several of the AIs for which APHIS maintained registrations also were registered by commercial firms; these include carbon, DRC-1339 (Starlicide®), mineral oil, phosphorus, strychnine, sodium fluoroacetate, sodium nitrate, sulfur, and zinc phosphide. End-use products containing these AIs may be produced either by the ADC Pocatello Supply Depot (PSD), commercial manufacturers, or both. ADC personnel ordinarily used PSD products except where commercial formulations were more readily available.

Immobilizing and euthanizing drugs, including alpha-chloralose, are regulated under U.S. Food and Drug Administration (FDA) rules. The other chemical pesticides used by ADC (Table 1) are regulated by the U.S. Environmental Protection Agency (EPA) pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; see EPA 1988). Most pesticides used by ADC have nationwide (FIFRA Section 3) or state and local need

(FIFRA Section 24c) registrations. However, mineral oil, cholecalciferol, and some DRC-1339 and zinc phosphide formulations also were used under experimental use permits (FIFRA Section 5).

Product-specific Use Information: **Bird Chemicals**

4-Aminopyridine (Avitrol t).--Avitrol is a lethal frightening agent used to repel sparrows, pigeons, blackbirds, and starlings. Small amounts of grain containing 0.5% Avitrol were used in 13 states. In addition, 25% Avitrol on bread baits was used to kill and/or repel gulls from power dams, navigational locks, and landfills in 2 states.

alpha-chloralose.--This immobilizing agent was used experimentally in 7 states to remove Canada geese, ducks or coots from nuisance situations, for human health and safety, or to protect turf. No more than 100 grams was used in any one year. Birds immobilized with alpha-chloralose were moved away from capture sites and either killed or relocated.

DRC-1339 (StarlicideV.-This well-known bird toxicant was used mostly to kill blackbirds and starlings in livestock feedlots in Arizona, Idaho, Nevada, Washington, and 7 other states. Other uses (Table 1) include applications in structures, blackbird staging areas, gull colonies, and livestock pastures for a variety of purposes.

Fenthion (Rid-a-Bird®).-Small amounts of fenthion were used in Rid-a-Bird perches for the protection of human health and safety in Kentucky and Hawaii. This product received minimal use by ADC because of its potential to cause secondary toxicity in some situations.

Gtyphosate odeo®).--Rodeo® is a post-emergent, nonselective herbicide that is registered for use in aquatic environments. ADC personnel used this material in North Dakota and South Dakota to reduce the density of marsh vegetation (cattails used as blackbird roosting habitat) in order to reduce blackbird depredation on nearby sunflower fields. Rodeo® herbicide contains 4 pounds per gallon of the acid, glyphosate. Thus, the maximum annual ADC use of 356 gallons of Rodeo® herbicide equates to 1,424 pounds of glyphosate.

Mineral oil.--Small amounts of mineral oil were applied experimentally to gull eggs in Washington to prevent the eggs from hatching.

Polxbutene.--This transparent, tacky compound was used in Hawaii to repel or discourage birds from perching on ledges and window sills.

S chnine.--Small amounts of strychnine bird toxicant were used in Texas and Louisiana to kill pigeons, house sparrows, and blackbirds. These uses occurred prior to the 1988 temporary cancellation by EPA of all above-ground uses of strychnine. This cancellation remains in force as of January 1996.

Compound PA-14 (Teritol®).--PA-14 is a surfactant or wetting agent that decreases the insulating ability of birds' feathers, thereby causing hypothermia and death. PA-14 was used in the 1970s and 1980s to kill large numbers of blackbirds and starlings in roosts. Reduced interest in lethal bird control led to a cessation of use after 1989 and the APHIS registration for this product was canceled in 1992.

Product-specific Use Information: Mammal Chemicals

Aluminum phosphide (Phostoxin®. Detia-Rotox®~ Furnitoxin(t). --Several aluminum phosphide products are available for use as fumigants to kill prairie dogs and other burrowing rodents. ADC personnel used these materials in 5 states. The 450 pounds shown in Table 1 corresponds to approximately 123,000 tablets, each of which contained 3 grams of aluminum phosphide formulation. About 70 percent of the total ADC use occurred in New Mexico.

Bone tar oil (Maoic Circle®).--Magic circle and other deer repellents omen are recommended by

ADC in technical assistance. During the study period, this product also was used in direct control by ADC personnel in New Hampshire. Magic Circle deer repellent reportedly is no longer available.

Brodifacoum (Weather Blok®).--Approximately 37 pounds of Weather Blok rodent blocks were used in American Samoa to protect endangered birds and turtles from Polynesian rats.

Carbon.--See sodium nitrate.

Cholecalciferol (Quintox®).--Cholecalciferol, also known as vitamin D3, is increasingly used as a rodenticide especially for anticoagulant-resistant populations. ADC personnel used small amounts of quintox-treated bait experimentally in Vermont to test its potential for reducing damage to maple sap tubing by chipmunks and other rodents.

Immobilizing and eutlanizing drugs.--ADC personnel used small amounts of Ketaset®, Rompun®, and Beuthanasia-D® to sedate or euthanize target mammals of several species. The drugs were administered by direct injection to animals that had been captured by cage traps, snares, or other techniques.

Phosphorus.--See sodium nitrate.

Sodium cyanide.--The only registered pesticidal use of sodium cyanide in the United States is as a predacide. The primary use of M-44 cyanide capsules by ADC personnel is to kill coyotes and other canid predators of livestock. Each capsule contains approximately 1 gam (AI) of sodium cyanide. The maximum annual use (Table 1) represents the approximate amount contained in 101,000 M-44 cyanide capsules, which is the maximum number shipped annually from Pocatello Supply Depot during the study period (USDA 1994:Table 4-6). M-44 cyanide capsules were used by ADC in 17 western states.

Sodium fluoroacetate(Compound 1080®).-This toxicant, once widely used as a rodenticide, now is registered in the United States only for use in the Compound 1080 Livestock Protection Collar (LPC) to protect sheep and goats from coyotes. Although the LPC was registered for use in 5 western states during the 4-year study period, ADC personnel used it only in Texas.

Sodium nitrate.--Fumigant cartridges containing sodium nitrate are registered for both rodenticidal and predacidal uses. The ADC EIS (USDA 1994) reported sodium nitrate as the active ingredient in these cartridges. Actually, sodium nitrate is the principal active ingredient. Both cartridges also contain carbon (charcoal). In addition, the rodent cartridge contains phosphorus and sulfur plus several inert ingredients.

The amounts of sodium nitrate and other chemicals used in rodent gas cartridges (Table 1) represent about 3,730 rodent gas cartridges used by ADC personnel in 15 states, but mostly in New Mexico and Oregon. The ADC Pocatello Suppl Depot produces approximately I million rodent fumigant cartridges each year (USDA 1994:Table 4-6), mostly for use by farmers and others to kill woodchucks and other burrowing rodents in eastern states. APHIS currently (January 1996) is awaiting EPA approval to simplify the rodent gas cartridge formulation by deleting all ingredients but sodium nitrate and charcoal.

Coyote gas cartridges were used by ADC personnel during FY 1988-1991 to kill coyote pups in underground dens in 14 western states. The maximum annual use (Table 1) was approximately 3,200 coyote gas cartridges.

Strychnine.--Grain baits containing strychnine were used by ADC personnel in Texas, New Mexico, Oregon, and Nebraska to control gophers, ground squirrels, and prairie dogs. The formulation used most was 0.50% strychnine on steam-rolled oats. Smaller amounts of strychnine paste formulations also were used in Idaho and Washington to protect crops from jackrabbits and marmots. In Oregon, small numbers of strychnine salt blocks were used to kill porcupines in pine trees. The strychnine salt block registration was

canceled by APHIS in 1989, and other rodenticidal uses of strychnine declined in 1988 after all above-ground uses were temporarily canceled by EPA. However, ADC continues to use strychnine baits in underground placements for gophers.

Zinc phosphide.--Small amounts of zinc phosphide concentrates were used in Idaho to protect crops from marmots and in 7 other states to control rats, muskrats, and nutria. Much larger amounts were used in oat and other grain baits to control prairie dogs, ground squirrels, pocket gophers, mice, and other rodents in alfalfa fields, livestock pastures, rangelands, and other agricultural sites in 8 states. The maximum annual use of 531 pounds (Table 1) corresponds to approximately 27,000 pounds of gain bait containing 2% zinc phosphide.

DISCUSSION

The Magnitude of ADC Pesticide Use

Considering the geographic distribution of ADC personnel and the variety of wildlife damage problems they work on, it appears that the amounts of chemicals used by ADC personnel are remarkably small compared to other human uses of chemicals in the U.S. Some of the chemicals that ADC uses as pesticides in small quantities are used in huge amounts for nonpesticidal purposes. Examples include sodium nitrate, charcoal, sulfur, sodium cyanide, and mineral oil.

Sodium nitrate is an important agricultural fertilizer and is used in explosives manufacture. The estimated' U.S. production in 1982 was approximately 4.75 X 10' ° grams (HSDB 1989), or about 104.5 million pounds. The maximum annual use by ADC personnel (1,417 pounds; Table 1) comprises a very small fraction of that total. Likewise, the ADC use of 220 pounds of sodium cyanide annually comprises less than 1 ten-thousandth of 1 percent of the 250+ million pounds produced in the U. S. each year for use in gold extraction, electroplating, and other industrial applications (HSDB 1991).

It is clear, too, that the amounts of chemicals used in wildlife damage management are extremely small compared to the amounts used as insecticides and herbicides. In 1988 when the ADC progam used only about 1 gallon of the organophosphate fenthion, the U.S. production of organophosphate pesticides totalled approximately 93 million gallons (USITC 1988). The 356 gallons of Rodeo® herbicide (1,424 pounds of glyphosate) used annually by ADC is a very small amount compared to the 6.3 million pounds of glyphosate used annually in the U.S. (Gianessi 1986).

Because pesticide production quantities are confidential business information, firm statistics on the amounts of vertebrate pesticides sold or used in the U.S. are not available. However, I speculate that the total amounts of strychnine and zinc phosphide (AI) in vertebrate pesticide products sold in the U. S. each year in the late 1980s and early 1990s were in the range of 10-12 thousand pounds and 110-150 thousand pounds, respectively. If so, the amounts of each of these materials used by ADC personnel during these years amounted to approximately 0.4 to 0.5 percent of the total amounts sold in the U.S.

Trends in Pesticide Uses by the ADC Program

Decreasing Uses.--As noted in the presentation of product-specific information earlier in this paper, ADC use of several pesticides decreased during the 4-year study period. In particular, the use of PA-14 bird roost toxicant declined in the late 1980s and this APHIS registration was canceled in 1992. Above-ground uses of strychnine were temporarily canceled in 1988 and one APHIS strychnine registration, the porcupine salt block, was permanently canceled in 1989. ADC use of fenthion, already very low by the late 1980s, has virtually stopped in favor of other toxicants with less potential to cause secondary toxicity. Also, as noted previously, APHIS is moving to phase out the use of phosphorus and sulfur in rodent gas cartridges.

Increasing Uses.--Some pesticide uses by ADC increased during or after the 4-year period summarized in this paper (FY 1988-1991). These

include repellents *such* as methyl anthranilate, glyphosate herbicide for blackbird habitat management, alpha-chlotalose immobilizing agent for capturing ducks, geese and pigeons, and the Compound 1080 LPC for removal of specific coyotes that attack sheep and goats. Of these uses, only the Compound 1080 LPC is lethal.

Use of the Compound 1080 LPC by ADC accounted for an annual maximum of 0.05 pounds (AI) of 1080 released into the environment during the 4-year study period (Table 1). This is a very small amount compared to the 1,500-2,500 pounds that were sold annually in the U.S. for rodent and predator control uses during 1968-1972 (USHR 1973). Even though the ADC program currently is moving toward increased use of LPCs, the greatest amount of 1080 that could ever be used nationwide in this highly restricted technique would not exceed a few pounds annually. Expanded use of the LPC would be very desirable because this technique is completely selective for individual coyotes that attack collared sheep or goats (Connolly 1993). Other control methods are, at best, selective for the coyote as a species.

Decreasing ADC Investment in Pesticide Development.--Over the past decade, and particularly since the 1988 revisions of FIFRA, the DWRC has borne a heavy burden of investments to maintain APHIS registrations for vertebrate pesticides (Rainey et al. 1994). These investments now are decreasing since most of the required reregistration studies have been completed.

CONCLUSIONS

In my view, ADC program pesticide uses are consistent with current public attitudes *which* tend to question or oppose uses of chemicals in the environment (USDA 1994; Appendix L). ADC uses very small amounts of chemical pesticides. Use patterns are changing over time. In general, the development and use of toxicants is decreasing and emphasis on nonlethal materials is increasing. ADC pesticide uses are incxeasmgly limited, selective, and environmentally safe if not environmentally benign.

LITERATURE CITED

Connolly, G. 1993. Livestock protection collars in the United States, 1988-1993. Proc. Great Plains Wildlife Damage Control Workshop 11:25-33.

Gianessi, L. P. 1986. A national pesticide usage data base. Renewable Resources Division, Resmuces for the Future, Washington DC. 14pp.

Hazardous Substances Data Bank (HSDB). 1989. Sodium nitrate data bank. The National Library of Medicine, Toxicology Information Program, Bethesda MD.

Hazardous Substances Data Bank (HSDB). 1991. Sodium cyanide data bank. The National Library of Medicine, Toxicology Information Program, Bethesda MD.

Rainey, C. A., E. W. Schafer, Jr., K. A. Fagerstone, and S. D. Palmateer. 1994. Active ingredients in APHIS's vertebrate pesticides - use and reregistration status. Proc. Vertebrate Pest Conf. 16:124-132.

U. S. Department of Agriculture (USDA). 1994. Animal Damage Control Program Final Environmental Impact Statement. USDA Animal and Plant Health Inspection Service, Washington, DC. April 1994, 3 vols.

U. S. Environmental Protection Agency (EPA). 1989. The Federal Insecticide, Fungicide, arid Rodenticide Act as amended. Revised October 1988. 540/09-89-012, EPA Office of Pesticide Programs, Washington DC. 73pp.

U. S. House of Representatives (USHR). 1973. PREDATORY ANIMALS--Hearings before the Subcommittee on Fisheries and Wildlife Conservation and the Environment of the Committee on Merchant Marine and Fisheries, March 19-20, 1973. Serial No. 93-2, U. S. Government Printing Office, Washington DC. p. 79.

U. S. International Trade Commission (USITC). 1988. Quarterly pesticide report. Washington DC.

Table 1. Maximum amounts of chemical pesticides used annually by ADC personnel during Fiscal Years 1988
1991'.

Active Ingredient & Product Description	Amount Use& (A.L)
Bird Chemicals	
4-aminopyridine (Avitrol®) bird toxicant (0.5% grain baits)	1.4 pounds
4-aniinopyridine (Avitrol®) gull toxicant (25% concentrate)	0.09 pounds
alpha-chloralose for bird capture (99.5% on bread or corn baits)	100 grams
DRC-1339 bird toxicant for feedlots (98% concentrate)	115 pounds
DRC-1339 bird toxicant for other uses (98% concentrate)	36 pounds
Starlicide Completet bird toxicant (0.1% grain bait)	1.17 pounds
Fenthion (Rid-a-Bird® & BCF # 1 10) bird toxicant (9-11 % liquid)	1 gallon
Glyphosate (Rodeo®) herbicide for blackbird habitat management (53.8% liquid)	356 gallons
Mineral oil for treating gull eggs	15 gallons
Polybutene (Eaton's 4 the Birds®) bird repellent (80% paste)	50 ounces
Strychnine bird toxicant (0.35-0.6% grain baits)	0.27 pounds
Compound PA-14 Bird Stressing Agent (99.5% concentrate) (blackbird roost toxicant)	715 gallons
Mammal Chemicals	
Aluminum phosphide (Phostoxin®, Detia-Rotox(O, & Fumitoxin®) rodent burrow fumigant (55-57% tablets)	450 pounds
Bone tar oil (Magic Circle®) deer repellent (93.75% liquid)	0.12 grams
Brodifacoum (Weather Blok®) rodenticide (0.005% blocks)	0.002 pounds
Carbon (charcoal) rodent burrow fumigant (17.34% cartridges)	121 pounds
Carbon (charcoal) coyote den fumigant (35% cartridges)	600 pounds
Cholecalciferol (Quintox®) rodenticide (0.075% bait)	0.021 pounds

Table 1. --
cont.

Active Ingredient &Product Description	Amount Usedb (A.I.)
Immobilizing & euthanizing drugs (Ketaset®, Rompun®, Beuthanasia-D®)	NR°
Phosphorus rodent burrow fumigant (3.25% cartridges)	22.7 pounds
Sodium cyanide predacide (89% in M-44 Cyanide Capsules)	220 pounds
Sodium fluoroacetate predacide (1% in Compound 1080® Livestock Protection Collar)	0.05 pounds
Sodium nitrate rodent burrow fumigant (43.36% cartridges)	303 pounds
Sodium nitrate coyote den fumigant (65% cartridges)	1,114 pounds
Strychnine rodenticide (0.35-0.5% gain baits)	41.7 pounds
Strychnine marmot & rabbit pastes (1.6-4.9% pastes)	3.5 pounds
Sulfur rodent burrow fumigant (10.84% cartridges)	75.7 pounds
Zinc phosphide rodenticide (63% concentrates)	3.6 pounds
Zinc phosphide rodenticide (1.82-2% grain baits)	531 pounds

"From ADC Final EIS (USDA 1994; Tables 4-5, P-7) and related unpublished data.
"Amount Used" shows national totals of the greatest amounts used in each state in any 1 of the 4 years. A.I. _ Active ingredient.
`NR = Not reported (small amounts).