

DEPARTMENT OF INTERIOR

Fish and Wildlife Service

50 CFR Part 20

RIN 1018-AE09

Migratory Bird Hunting; Temporary Conditional Approval of Tungsten-Iron Shot as Nontoxic for the 1997-98 Season

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) amends Section 20.21(j) and temporarily approves tungsten-iron shot as nontoxic for the 1997-98 migratory bird hunting season. The toxicological report and extensive literature search and analysis suggests that tungsten and tungsten-iron are nontoxic under conditions for the proposed shot configuration. Analysis of the toxicity study reveals no adverse effects over a 30-day period when dosing mallards with 8 BB-size tungsten-iron shot.

EFFECTIVE DATE: September 1, 1997.

FOR FURTHER INFORMATION CONTACT: Paul R. Schmidt, Chief, or Carol Anderson, Wildlife Biologist, Office of Migratory Bird Management (MBMO), (703) 358-1714.

SUPPLEMENTARY INFORMATION: Since the mid-1970s, the Service has sought to identify shot that, when spent, does not pose a significant toxic hazard to migratory birds and other wildlife. Currently, steel shot and bismuth-tin shot are approved by the Service as nontoxic. The Service believes approval for other suitable candidate shot materials as nontoxic is feasible. Compliance with the use of nontoxic shot is increasing over the last few years. The Service believes that this level of compliance will continue to increase with the availability and approval of other nontoxic shot types. The Service is eager to consider these other materials for approval as nontoxic shot.

Federal Cartridge Company's (Anoka, MN) candidate shot is made from sintering tungsten and iron, which forms a two-phase alloy. Shot made from this material has a density of approximately 10.3 gm/cc, or 94 percent of the density of lead. The tested shot will contain nominally 55 percent tungsten and 45 percent iron, by weight; whereas, the marketed shot will contain nominally 40 percent tungsten and 60 percent iron, by weight. The pellet will have sufficient iron to attract a magnet.

The Service, in consultation with the U.S. Geological Service, Biological Resources Division, considers the higher tungsten ratio of the tested shot more potentially toxic and that the lower ratio of the marketed shot poses significantly less risk.

Federal's application includes a description of the new tungsten-iron shot, a toxicological report, and results of a 30-day dosing study (Test 1) to assess the toxicity of this shot in game-farm mallards as outlined in 50 CFR 20.134(c)(2). The toxicological report incorporates toxicity information (a synopsis of acute and chronic toxicity data for birds, acute effects on mammals, potential for environmental concern, toxicity to aquatic and terrestrial invertebrates, amphibians and reptiles), and information on environmental fate and transport (shot alteration, environmental half-life, and environmental concentration). The toxicity study is a 30-day dosing test to determine if the candidate shot poses any deleterious effects to game-farm mallards.

Toxicity Information: There is considerable difference in the toxicity of soluble and insoluble compounds of tungsten and iron. Elemental tungsten and iron are virtually insoluble and, therefore, are expected to be nontoxic. After completion of the literature review, there appears to be no basis for concern of toxicity to wildlife for the candidate shot material (metallic tungsten and iron) via ingestion by fish, birds, or mammals (Bursian et al. 1996; Gigiena 1983; Patty 1981; Industrial Medicine 1946; Karantassis 1924).

Environmental Fate and Transport: Tungsten is insoluble in water and, therefore, not mobile in hypergenic environments. Tungsten is very stable with acids and does not easily complex. Preferential uptake by plants in acid soil suggests uptake of tungsten in the anionic form associated with tungsten minerals rather than elemental tungsten (Kabata-Peddis 1984).

Environmental Concentration: The expected environmental concentration (EEC) is defined as the concentration of a chemical in a particular environmental compartment that is based on an estimate or modeling simulation of use, disposal, transport, and fate of a chemical. Calculation of the EEC for a terrestrial ecosystem is on 69,000 shot per hectare (Pain 1990), assuming complete erosion of material in 5 cm of soil. The EEC for tungsten in soil is 32.9 mg/kg of shot material left in the soil after the initial degradation of the shot. This calculated amount is based on shot composed of 62.9 percent tungsten-iron alloy, 11.87 percent

tungsten, and 25.31 percent iron. Adverse effects on biota are not expected to occur for shot components, given the Hazard Quotients (HQs).

Calculation of the expected environmental concentration (EEC) for an aquatic ecosystem assumes complete erosion of the shot in one cubic foot of water. The EEC in water for tungsten was 10.5 mg/L left in the water after the initial degradation of the shot. This calculated amount is based on shot composed of 62.9 percent tungsten-iron alloy, 11.87 percent tungsten, and 25.31 percent iron. Given these HQs, adverse effects on biota are not expected to occur for shot components.

An extensive literature search and review provides information on the toxicity of elemental tungsten to waterfowl and other birds. Ringelman et al.'s (1993) investigation of the effects of ingested tungsten-bismuth-tin (TBT) shot on captive mallards found no acute toxicity. Orally dosing 28-week old game-farm mallards with 12 to 17 pellets (1.03g) of TBT shot revealed no evidence of intoxication over a period of 32 days. No birds died during the trial. Gross lesions were not observed during the postmortem examination. Histopathological examination did not reveal any evidence of toxicity or tissue damage. Tungsten was not detectable in kidney or liver samples. The authors concluded that TBT shot presents virtually no potential for acute intoxication in mallards.

A study by Kraabel et al. (1996) assessed the effects of embedded tungsten-bismuth-tin shot on mallards. The authors' conclusion was that TBT is not acutely toxic when implanted in mallard muscle tissue. Inflammatory reactions to TBT shot were localized, and had no detectable systemic effects on mallard health.

Nell (1981) fed laying hens 0.4 or 1g/kg tungsten in a commercial mash for five months to assess the reproductive performance. Weekly egg production was normal and hatchability of fertile eggs was not affected.

Large doses of tungsten given to chickens either through injection or by feeding saw an increase in tissue concentration of tungsten and a decreased tissue concentration of molybdenum (Nell 1981). The loss rate of tungsten from the liver occurred in an exponential manner with a half-life of 27 hours. The alterations in molybdenum metabolism seem to identify with tungsten and not of molybdenum deficiency. Death due to tungsten occurred when tissue concentrations were increased to 25µg/g liver. At this concentration, the

activity of xanthine dehydrogenase was zero.

In Federal's dosing study, eight male and 8 female adult mallards were given 8 #4 steel shot, 8 #4 lead shot, or 8 BB's of tungsten-iron and observed over a 30-day period. An additional 8 males and 8 females were given no shot. All tungsten-iron birds survived the test with a slight increase in body weight. There were no changes in hematocrit, hemoglobin concentration, and ALAD activity, as well as 25 plasma chemistry parameters. Five of the 16 tungsten-iron birds had a mild hepatocellular biliary stasis, but the authors felt this was not remarkable. No other histopathological lesions were found. There was some absorption of tungsten in the femur, kidney, and liver, with some effect on the bile. In general, however, no adverse effects were seen when mallards were given 8 BB-size tungsten-iron shot and monitored over a 30-day period. Fifty percent of the lead-dosed birds (5 males and 3 females) died during the 30-day test while there were no mortalities in the other groups. Lead-dosed birds were the only ones to display green excreta, lethargy, and ataxia. Alteration of body weights was not significant in any of the treatments, although lead-dosed birds which died during the trial lost an average of 30 percent of their body weight. Hematocrit, hemoglobin concentrations, and ALAD activity were significantly depressed at day 15 in the lead-dose females, while lead-dose males had significantly depressed hematocrit and hemoglobin concentration in comparison to the other three groups. There were no significant differences in these whole-blood parameters at day 30.

As a result of the toxicological report and toxicity test the Service concludes that tungsten-iron shot, nominally 40–55 percent tungsten and 60–45 percent iron, by weight with <1 percent residual lead, does not impose significant danger to migratory birds and other wildlife and their habitats. The Service has some concern that the absorption of tungsten into the femur, kidney, and liver may have some potential effect on the spectacled eider (*Somateria fischeri*), a species already subject to adverse weather, predation, and lead poisoning when waterfowl are harvested in its Yukon-Kuskokwim Delta (Y-K Delta) habitat in Alaska. Until the results of reproductive/chronic toxicity tests, which includes the assessment of reproduction, fertility rates, and egg hatchability (egg weight, shell thickness, and content analysis) have been completed and the Service has reviewed the results, tungsten-iron shot cannot be

conditionally approved for the Y-K Delta habitat in Alaska.

The first condition of final unconditional approval is the concurrent running of an adverse condition test (Test 2) and a reproductive/chronic toxicity test (Test 3) on game-farm mallards as outlined in 50 CFR 20.134 (c)(2) and in consultation with the Service's Office of Migratory Bird Management and the U.S. Geological Survey's Division of Biological Resources. This study includes assessment of reproduction, fertility rates, and egg hatchability (egg weight, shell thickness, and content analysis). The test requires the applicant to demonstrate that tungsten-iron shot is nontoxic to waterfowl and their offspring.

The second condition of final unconditional approval is testing for residual lead levels. In the **Federal Register** of August 18, 1995 (60 FR 43314), the Service indicated it would establish a maximum level for residual lead. The Service, in consultation with the USGS—Division of Biological Resources, determined the maximum environmentally acceptable level of lead in any nontoxic shot is trace amounts or <1 percent and is incorporating this requirement into this rule and will incorporate it into any subsequent final rule that may be promulgated. Federal documented that the tungsten-iron shot had no residual lead levels equal to or exceeding 1 percent.

The third condition of final unconditional approval involves enforcement. In the August 18, 1995, **Federal Register** (60 FR 43314), the Service indicated that final unconditional approval of any nontoxic shot would be contingent upon the development and availability of a noninvasive field testing device. Several noninvasive field testing devices are under development to separate tungsten-iron shot from lead shot. Furthermore, tungsten-iron shot can be drawn to a magnet as a simple field detection method.

This rule amends 50 CFR 20.21(j) by temporarily approving tungsten-iron shot as nontoxic for the 1997–98 migratory bird hunting season throughout the United States except for the Y-K Delta habitat in Alaska. It is based on the original request made to the Service by Federal Cartridge Company on August 20, 1996, the toxicological report, and acute toxicity study. Results of the toxicological report and 30-day toxicity test undertaken for Federal Cartridge Company indicate the apparent absence of any deleterious effects of tungsten-iron shot when

ingested by captive-reared mallards or to the ecosystem.

Public Comments and Responses

The January 31, 1997, proposed rule published in the **Federal Register** (62 FR 4877) invited public comments from interested parties. The closing date for receipt of all comments was April 1, 1997. During this 60-day comment period, the Service received five comment letters. Of these comment letters, three were from individuals and two from industry organizations. Individuals expressed support for the temporary approval of tungsten-iron shot. Individuals "... would love the opportunity to try the new shot" and believed that "... any nontoxic alternative that approaches the effectiveness of lead should be explored."

The Bismuth Cartridge Company (Bismuth) is concerned that the Service should ensure that all applicants for non-toxic shot approval are subject to comparable requirements and conditions. The Service does ensure that any candidate nontoxic material will comply with current regulations set forth in 50 CFR 20.134 for nontoxic shot approval. Applications for approval must include a description of the candidate shot, a toxicological report on the candidate shot, and a 30-day dosing test with mallards. As new information becomes available, applications may be revised to include this information, which will assist the Service in evaluating the candidate material.

Furthermore, Bismuth stated that "...no testing of reproductive tissues (i.e., gonads) was conducted in association with Federal's 30-day toxicity testing." The current regulations do not require that gonads be chemically analyzed for metals in Test 1. The Service notified Federal that this would not be a requirement during the Test 1 phase because Federal demonstrated that there was existing data on the effects of tungsten and iron on the reproductive tissues in the scientific literature. Once the shot is conditionally approved, guidance for further testing is provided to the applicant. Following satisfactory completion of Tests 1, 2, and 3, or their equivalent, and publication of a summary of these results in the **Federal Register** for public comment, the candidate material is concomitantly proposed for inclusion in 50 CFR 20.21(j).

Bismuth is also concerned that Federal is not being held to as strict a requirement as they were during their application process for approval of bismuth-tin. Bismuth states that they

conducted additional assays to demonstrate that bismuth-tin shot's residual lead levels were at levels well below the <1 percent standard. Their concern lies in the fact that the proposed rule does not state that the applicant will need to provide data demonstrating the absence of any carcinogenic materials in its shot. The Service required the applicant to demonstrate that the candidate shot contains no significant trace levels of lead or other toxic or carcinogenic materials. The Service indicated in the August 18, 1995, **Federal Register**, that a maximum level of residual lead would be established. The Service, in consultation with the USGS—Division of Biological Resources (formerly the National Biological Service), determined the maximum environmentally acceptable level of lead in bismuth-tin shot is trace amounts or <1 percent. This requirement was incorporated in the final rule approving bismuth-tin shot. This same requirement applies to tungsten-iron shot.

Winchester states "the shot sample submitted for the acute toxicity portion of the required testing was significantly different from the shot that is being marketed and requested for approval." Winchester analyzed samples of shot they obtained at retail and found that the tungsten-iron alloy phases varied. "Since the application indicates that the shot is heated to *thermal* equilibrium and not *chemical* equilibrium, this is not surprising." Furthermore, two different phases of intermetallic compound (Fe_2W and FeW) and pure tungsten were also present in the marketed shot. The Service requested additional information from Federal regarding the details of the manufacturing process of the tungsten-iron shot. Federal states the tungsten-iron shot is sintered at 1520°C under a tight time and temperature tolerance. The Fe_7W_6 compound is formed at thermal equilibrium, which takes into account all energy factors, unlike chemical equilibrium. The shot is then quickly cooled to ambient temperatures much like quenching steel. High cooling rates of the tungsten-iron shot, in part due to the small size of the tungsten-iron shot, preclude the formation of compounds other than Fe_7W_6 . The Fe_7W_6 that forms at the 1520°C sintering temperature is cooled too quickly to change to other compounds. Transformation to other compounds is sluggish; x-ray diffraction analysis confirms the absence of the other intermetallic compounds. The Toxicity Test 1, and subsequent Toxicity Tests 2 and 3, will be conducted using

tungsten-iron shot representing a "worst-case" scenario, i.e., the shot being tested has a higher concentration of the Fe_7W_6 compound than the shot Federal plans to manufacture for public use.

Winchester also raised their concern about the fact that the "soft" matrix of this tungsten-iron shot is as hard or harder than current gun barrels which have been designed for steel shot. The Service agrees that this should be a concern for the consumer. Federal recognized that the hardness of the tungsten-iron shot would require a new wad to protect shotgun bores from scouring. Federal designed a wad made of high-density polyethylene which features three inner petals overlapped by three outer petals so there are no exposed wad slits to allow the shot to contact the barrel or chokes. The wad's outer petals are designed to shear back or off once it exits the barrel. Additionally, tungsten-iron shot is not recommended for use with older shotguns or for fine double guns not designed to handle steel. Federal advises that these tungsten loads should only be shot through barrels and chokes approved for use with steel shot.

Furthermore, Winchester is concerned that the payloads and/or pellet counts in the marketed shot have generally not been found to be effective, efficient harvesters of game at anything but very modest ranges. The primary shortcoming is insufficient pattern density to ensure the necessary number of pellet strikes for consistent, clean bagging of game. It is reasonable to expect the possibility of a high crippling rate for either of these very low pellet count loads. Previous uses of low pellet count, relatively high energy pellets have generally not yielded satisfactory results. Federal recognized that tungsten-iron shot has different ballistic properties than that of steel and bismuth-tin shot. Consequently, they conducted ballistic tests using ballistic software modeling and test-firing the tungsten shot. Their research indicated that a relatively light payload with a high velocity was the best alternative. Tests show that the new loads shot tight patterns like steel; offered ballistic advantages of high velocity; had better downrange energy than steel, bismuth, or lead; and produced better penetration than the other pellet materials. The Service expects that crippling rates may increase slightly with the advent of any new nontoxic shot; however, continued education and training of waterfowl hunters will help keep crippling loss to a minimum. The effectiveness of any shot is a function of the shooter's ability to place the pellets on the bird, the

pellet's energy at point-of-contact, and the pellet's ability to penetrate. Hunters should test different loads with their guns before hunting with any new shot so that adjustments can be made to their technique in order to reduce crippling losses. Initial field testing in Canada has shown that the tungsten-iron shot performed exceptionally well.

References

A list of references is available and will be provided upon request.

NEPA Consideration

In compliance with the requirements of section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4332(C)), and the Council on Environmental Quality's regulation for implementing NEPA (40 CFR 1500–1508), the Service prepared an Environmental Assessment (EA) in December, 1996. This EA is available to the public at the Office of Migratory Bird Management, U.S. Fish and Wildlife Service, ms 634—ARLSQ, 1849 C Street NW., Washington D.C. 20240. Based on review and evaluation of the information in the EA, the Service determined the action to amend 50 CFR 20.21(j) to extend temporary conditional approval of tungsten-iron shot as nontoxic for 1997–98 and 1998–99 migratory bird hunting seasons would not be a major Federal action that would significantly affect the quality of the human environment.

Endangered Species Act Considerations

Section 7 of the Endangered Species Act (ESA) of 1972, as amended (16 U.S.C. 1531 *et seq.*), provides that, "The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act" (and) shall "insure that any action authorized, funded or carried out ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of (critical) habitat ..." Pursuant to section 7 of the ESA, MBMO sought review and concurrence that this action \geq is not likely to adversely affect \geq threatened, endangered, proposed, and category 1 species. Based on review and evaluation of the toxicity testing and available information, the Service determined that no adverse impact on endangered and threatened species would result from the proposed action. The results of this review may be inspected by the public in, and will be available to the public from, the Office of Migratory Bird Management, U.S. Fish and Wildlife Service, ms 634—

ARLSQ, 1849 C Street NW, Washington D.C. 20240.

Regulatory Flexibility Act, Executive Order 12866, and the Paperwork Reduction Act

The Regulatory Flexibility Act of 1980 (5 U.S.C. 601 *et seq.*) requires the preparation of flexibility analyses for rules that will have a significant effect on a substantial number of small entities, which includes small businesses, organizations or governmental jurisdictions. The economic impacts of annual hunting on small business entities were analyzed in detail and a Small Entity Flexibility Analysis (Analysis), was issued by the Service in 1995. The Analysis documented the significant beneficial economic effect on a substantial number of small entities. The primary source of information about hunter expenditures for migratory game bird hunting is the National Hunting and Fishing Survey, which is conducted at 5-year intervals. The Analysis utilized the 1991 National Hunting and Fishing Survey and the U.S. Department of Commerce's County Business Patterns from which it was estimated that migratory bird hunters would spend between \$10 and \$59 million at small businesses in 1995. The approval of tungsten-iron as an alternative shot to steel and bismuth-tin will have a minor positive impact on small businesses by allowing them to sell a third nontoxic shot to the hunting public. However, the overall effect to hunting expenditures in general would be minor. Therefore, the Service determined this rule will have no effect

on small entities since the approved shot merely will supplement nontoxic shot already in commerce and available throughout the retail and wholesale distribution systems. The Service anticipates no dislocation or other local effects, with regard to hunters and others. This rule was not subject to Office of Management and Budget (OMB) review under Executive Order 12866. The Service has examined this regulation under the Paperwork Reduction Act of 1995 and found it to contain no information collection requirements.

Unfunded Mandates Reform

The Service has determined and certifies pursuant to the Unfunded Mandates Act, 2 U.S.C. 1502 *et seq.*, that this rulemaking will not impose a cost of \$100 million or more in any given year on local or State government or private entities.

Civil Justice Reform—Executive Order 12988

The Service, in promulgating this rule, determines that these regulations meet the applicable standards provided in Sections 3(a) and 3(b)(2) of Executive Order 12988.

Authorship

The primary author of this final rule is Carol Anderson, Office of Migratory Bird Management.

List of Subjects in 50 CFR Part 20

Exports, Hunting, Imports, Reporting and recordkeeping requirements, Transportation, Wildlife.

Accordingly, Part 20, Subchapter B, Chapter 1 of Title 50 of the Code of Federal Regulations is amended as follows:

PART 20—[AMENDED]

1. The authority citation for Part 20 continues to read as follows:

Authority: 16 U.S.C. 703–712 and 16 U.S.C. 742 a–j.

2. Section 20.21 is amended by revising paragraph (j), introductory text, and adding paragraph (j)(2) to read as follows:

§ 20.21 Hunting methods.

* * * * *

(j) While possessing shot (either in shotshells or as loose shot for muzzleloading) other than steel shot, or bismuth-tin (97 parts bismuth: 3 parts tin with <1 percent residual lead) shot, or tungsten-iron (nominally 40 parts tungsten: 60 parts iron with <1 percent residual lead) shot or such shot approved as nontoxic by the Director pursuant to procedures set forth in 20.134, provided that:

(1) * * *

(2) Tungsten-iron shot (nominally 40 parts tungsten: 60 parts iron with <1 percent residual lead) is legal as nontoxic shot for the 1997–98 migratory bird hunting season, except for the Yukon-Kuskokwim Delta habitat in Alaska.

Dated: August 7, 1997.

Donald J. Barry,

Acting Assistant Secretary for Fish and Wildlife and Parks.

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