THE HUMANE SOCIETY
OF THE UNITED STATES

May 29, 2012

Docket Clerk
U.S. Department of Agriculture
Food Safety and Inspection Service
George Washington Carver Center, Room 2-2127
5601 Sunnyside Avenue
Beltsville, MD 20705-5272

Re: Docket ID No. FSIS-2011-0012, Modernization of Poultry Slaughter Inspection Rule

The Humane Society of the United States (HSUS) submits the following comments on the proposed rulemaking regarding inspection of poultry carcasses in federally-inspected slaughter facilities, as addressed in FSIS Docket ID No. FSIS-2011-0012, Modernization of Poultry Slaughter Inspection Rule. *See* 77 Fed. Reg. 4407 (Jan. 27, 2012) ("Proposed Rule"). As explained below, there are major legal failings in the proposed rule. The comments below focus on two flaws: the complete failure to address humane slaughter issues and the legal insufficiency of the agency's environmental impact statement.

I. The Proposed Rule Unlawfully Fails to Explain A Deviation from FSIS Policy Regarding Humane Slaughter

The Proposed Rule, along with FSIS' follow-up April 26, 2012 Federal Register notice, wholly fail to address any animal welfare implications of the Proposed Rule. This is a profound failure, not only because the rule has the potential to negatively impact literally billions of birds who will be slaughtered annually in the U.S., but because the agency has expressly linked inhumane poultry slaughter with an increased risk of adulterated product. The proposed rule's analyses and conclusions regarding adulteration risks are therefore deficient because FSIS arbitrarily failed to address this connection between inhumane slaughter and food safety as it relates to the likely increase in the speed of the stunning and slaughter process made possible by this rule.

As an initial matter, The HSUS encourages FSIS to revisit the humane slaughter issue and to, at minimum, encourage transition to compressed atmosphere killing slaughtering systems. Such systems are far more humane and, as explained in the attached paper, they would thus eliminate much of FSIS' concern regarding the correlation between inhumane poultry slaughter and adulterated product.[1]

FSIS expressly links inhumane slaughter to regulatory noncompliance, and increased adulteration and therefore it cannot reasonably ignore the Proposed Rule's impact on the prevention of inhumane slaughtering. Here, the Proposed Rule's stated objectives are: To improve food safety; and to remove regulatory burdens from the slaughter industry (i.e., to improve efficiency and profitability of the slaughtering industry.)[2] Having put in place policies, directives, and notices all aimed at minimizing the cruelty and attendant food safety threats in the slaughter process, the agency is not free to simply ignore this aspect of the slaughter process as it apparently has done here.

As other commenters have pointed out in this administrative record, there is every reason to expect that allowing line speed increases for post-scald lines will effectively allow and, indeed, encourage speeding up all aspects of the slaughter process, including live hang, stunning and slaughtering at many if not most facilities. Nothing in the Proposed Rule contradicts this logical assumption. But the Proposed Rule does not attempt to explain how speeding up the already incredibly fast slaughter and stunning process can possibly accommodate the agency's required systematic approach to monitoring these processes to promote humane slaughter and thereby minimize food safety threats. This sort of humane slaughter inspection is precisely what FSIS has long required of its inspectors during every single slaughtering shift at every inspected poultry slaughter plant.

For example, FSIS documents confirm that detecting inhumane poultry slaughtering is a "critical" part of the agency's inspectors' jobs:

> In poultry operations, employing humane methods of handling and slaughtering that are consistent with good commercial practices increases the likelihood of producing unadulterated product. FSIS regulations describe the operating procedures

[1] See Shields, Raj, *An HSUS Report: The Welfare of Birds at Slaughter,* attached, and available at http://www.humanesociety.org/assets/pdfs/farm/hsus-the-welfare-of-birds-at-slaughter.pdf (last accessed May 27, 2012).

[2] Proposed Rule at p. 4408, 4438 ("The lower production costs may also lead to increased sales of domestic and exported products in the long run. We estimate these economic benefits to be at least $258.9 million.") (emphasis added).

that poultry processors must follow to ensure sanitary processing, proper inspection, and the production of poultry products that are not adulterated. Under 9 CFR 381.71, FSIS condemns poultry showing, on antemortem inspection, certain diseases or conditions. Bruising is one condition that may result in condemnation (9 CFR 381.89). Bruises are likely to result when birds are not treated humanely. Moreover, the PPIA (21 U.S.C. 453(g)(5), as well as agency regulations (9 CFR 381.90), provide that carcasses of poultry showing evidence of having died from causes other than slaughter are considered adulterated and condemned. The regulations also require that poultry be slaughtered in accordance with good commercial practices, in a manner that results in thorough bleeding of the poultry carcass, and ensures that breathing has stopped before scalding so that the birds do not drown (9 CFR 381.65(b). Compliance with these requirements helps ensure that poultry are treated humanely. The PHV or IIC on a daily, per shift basis, when the establishment slaughters; will systematically observe the conditions in the pre-scald areas. They will be checking for mistreatment of birds or handling them in a way that will cause death or injury or prevent thorough bleeding or result in excessive bruising. FSIS Directive 6100.3 outlines the procedures that the PVH or IIC should take when they make these observations. As an on-line inspector, it will be critical to notify the PHV when you observe cadaver birds at the post-mortem inspection station. The evidence of bright red cadaver birds means that the birds will still breathing prior to entering the scald vat. This indicates that the establishment is not adhering to good commercial practices and will result in the PHV documenting the noncompliance. You play a critical role in verifying good commercial practices by communicating your findings at the post-mortem inspection station to the PHV.[3]

Implicit in the statement above, is that even at present speeds, inspectors must try to vigilantly inspect the process because this industry is sending

[3] FSIS, Poultry Postmortem Inspection 3-17-09 at p. 5, available at http://www.fsis.usda.gov/pdf/psit_postmortem.pdf (last accessed May 27, 2012) (emphasis added) (last accessed May 27, 2012); *see also* FSIS Directive 6910.1 rev. 1 (Dec. 12, 2009) ("[] during the review, the DVMS will be assessing whether or not a systematic approach is being applied by the establishment to ensure that poultry are handled and slaughtered in a manner that is consistent with good commercial practice.")

live, breathing birds into tanks of scalding water. As noted above, the entire slaughter process is likely to speed up in many facilities once post-scald lines speed up as companies take advantage of this Proposed Rule's goal of increasing output. Accordingly, the agency needs to offer a reasoned explanation of how it will be possible for inspectors in the "pre-scald area" to "systematically observe" 3 or more birds per second "[] checking for mistreatment of birds or handling [] that will cause death or injury or prevent thorough bleeding or result in excessive bruising."[4] It is far from self-evident, especially given the tacit admission above that even at present speeds FSIS and this industry somehow cannot manage to prevent conscious birds from regularly being dunked into vats of scalding water despite FSIS' understanding that such cruelty increases adulteration risks.

As a matter of common sense, at some point a process will be moving so quickly that "systematic" observation of these processes during every operating shift—which FSIS deems to be "critical"— is simply impossible. The evidence above, standing on its own, strongly suggests the process is already far too fast to allow for systematic inspection, and FSIS offers no reasoned explanation for why speeding it up will not make compliance with mandatory "commercial best practices" as required by FSIS regulations, directives and notices completely impossible.

In sum, the agency was legally obligated to explain at least the following obvious questions:

1. What is the anticipated scope of pre-scald line-speed increases? In other words, how many plants are likely to speed up pre-scald lines in response to the Proposed Rule?
2. How is it possible to systematically inspect humane slaughter practices at plants with line speeds that would require inspectors to observe birds hung, stunned and killed at a rate of up to 3 birds per second?
3. How does the inability to systematically inspect birds for mistreatment impact each of the Proposed Rule's analyses and conclusions regarding adulteration risks in facilities operating at faster line speeds?

As noted above, the Proposed Rule offers no insight on these critical questions because the rule does not address any humane slaughter implications at all.

If FSIS wants to abandon its settled policies, regulations and directives concerning humane poultry slaughter and good commercial practices related

[4] *Id. citing* FSIS Directive 6100.3.

thereto, it is free to do so if it offers a reasoned explanation therefore. It is not free to do as it has done here, which is to silently pretend that one critical aspect of the slaughter inspection process that has an acknowledged impact on food safety is now simply a non-issue. "An agency cannot ignore a substantial diversion from its prior policies." *See Ramaprakash v. FAA,* 346 F.3d 1121, 1124 (D.C.Cir.2003) (agency must "provide a reasoned analysis indicating that prior policies and standards are being deliberately changed, not casually ignored"); *Nat'l Cable & Telecomms. Ass'n v. Brand X Internet Servs.,* 545 U.S. 967, 981, 125 S.Ct. 2688, 162 L.Ed.2d 820 (2005) ("unexplained inconsistency" in agency practice is a reason for holding a policy reversal "arbitrary and capricious" under the APA, unless "the agency adequately explains the reasons for a reversal of policy"). This is a significant legal failing, and if the agency does not revisit this issue, and provide reasoned answers to the questions above the rule will be extremely vulnerable to legal challenges.

II. The Proposed Rule's Environmental Impact Analysis is Legally Deficient

The Proposed rule fails to satisfy the requirements of the National Environmental Policy Act ("NEPA"). The environmental impacts of the Proposed Rule at the local, state, and nationwide level have the potential to be significant. In a few short paragraphs on these impacts, the Proposed Rule improperly relies on anticipated compliance with dozens of differing, potentially conflicting environmental laws as an indicator that environmental impacts of the rule will be insignificant. Instead of addressing environmental impacts as NEPA requires, the agency glosses over the cumulative impact potential and does not even bother to address more localized impacts of the Proposed Rule. In addition, FSIS invokes a categorical exemption to NEPA, yet it improperly fails to analyze whether an exception to that exemption may apply here.

Indeed, under the Council on Environmental Quality ("CEQ") regulations, the adoption of a new federal regulatory scheme, but for which various potentially significant environmental impacts would not occur, would appear to demand a full-fledged Environmental Impact Statement ("EIS"), although USDA has failed to prepare even a more cursory Environmental Assessment ("EA"). Hence, the CEQ regulations provide that the assessment of whether environmental impacts are "significant" – and thus should be evaluated in an EIS – "requires considerations of both context and intensity." 40 C.F.R. § 1508.27. Importantly, "context" "means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region . . . and the locality." *Id*. at § 1508.27(a) (emphasis added); *see also Anderson*, 371 F.3d at 492 (determining that an

EIS was required regarding a whale hunt because, although the hunt would not impact the overall gray whale population, there were "'substantial questions' as to the significance of the effect on the *local* area") (italics in original). "Intensity" "refers to the severity of impact," and requires consideration of various factors that agencies must address in evaluating whether impacts are sufficiently serious to warrant preparation of an EIS. 40 C.F.R. § 1508.27(b).

Based on these criteria, this Proposed Rule appears tailor made for an EIS. Indeed, although "courts have found that '[t]he presence of one or more of [the CEQ significance] factors should result in an agency decision to prepare an EIS,'" *Fund for Animals v. Norton*, 281 F. Supp. 2d 209, 218 (D.D.C. 2003), and that an EIS should be prepared on an action that may be significant in either a national or a local context, *Anderson*, 371 F.3d at 492, in this instance, many of the CEQ criteria for significance are implicated, and the action under review affects both "society as a whole," as well as the "localit[ies]" where the specific slaughter plants are located. 40 C.F.R. § 1508.27(a). First, as described below the action plainly "affects public health or safety," 40 C.F.R. § 1508.27(b)(2), since, once again, but for the Proposed Rule, slaughter facilities could not ramp up their operations and slaughter more animals, thereby increasing demand on water supplies and the danger of spills or other water contamination. *See, e.g.*, *Tomac v. Norton*, 240 F. Supp. 2d 45, 51 (D.D.C. 2003) (finding EA inadequate because it did not adequately address impact of decision on "air and water" quality in affected area). Second, by the same token, the action entails "unique or unknown risks," *id*. at § 1508.27(b)(5), since, although there is evidence that communities near slaughter facilities may experience water shortages and pollution due to increased slaughter operations facilitated by this Proposed Rule, no NEPA document has ever analyzed the actual health "risk" that this pollution poses to any community. *Id*. Finally, "the effects" of the rule "on the quality of the human environment" are certainly "highly controversial," *id*. at § 1508.27(b)(4), as extensive national and local media coverage of this Proposed Rule makes obvious.

A. FSIS Improperly Invokes a Categorical Exemption without Fully Analyzing its Applicability Here

In the Proposed Rule, FSIS improperly invokes a categorical exemption to NEPA, without addressing any possible exceptions to that exemption which may apply here. Particularly where, as here, there are indicia that an agency action may indeed entail environmental impacts that would otherwise go unstudied, reviewing courts deem categorical exclusion claims "deficient [if] [the agency] fails to explain why [the action] does not fall within an exception to the categorical exclusions." *Jones*, 792 F.2d at 828; see also

Riverhawks v. Zepeda, 228 F. Supp. 2d 1173, 1190 (D. Or. 2002) (agency improperly invoked its categorical exclusion and violated NEPA by failing to "negate the presence of extraordinary circumstances" before proceeding with its proposed action) (emphasis added); *Greenpeace U.S.A. v. Evans*, 688 F. Supp. 579, 585 (W.D. Wash. 1987) (ruling for plaintiff where agency "provided no reasoned explanation – indeed, no explanation at all – of how [mitigating] conditions would prevent application of an exception to the categorical exclusions"); *Alaska State Snowmobile Ass'n, Inc. v. Babbitt*, 79 F. Supp. 2d 1116, 1136-37 (D. Alaska 1999) (agency "abused its discretion" by merely "restat[ing] the categorical exclusion," and holding that the agency should, "at a minimum, explain its decision that no exceptions applied"), vacated as moot on other grounds, 2001 WL 770442, at *1 (9th Cir. Jan 10, 2001).

In this case, however, although USDA was certainly taking an extraordinary action – i.e., adopting rules that are likely to increase poultry slaughter by millions of birds per year and at slaughter facilities throughout the nation – the Proposed Rule contains no hint that USDA ever even considered whether the "extraordinary circumstances" criteria applied to its decision. The local, regional and national environmental impacts of the rule, on just two aspects of the Proposed Rule's environmental impact: water pollution and over-use of water are discussed below. But notably, the Proposed Rule does not show that FSIS has undertaken any environmental review whatsoever. As a result, the pertinent case law compels the conclusion that USDA has, but has failed to sustain, the burden of demonstrating that it may invoke a categorical exclusion here.

B. The Proposed Rule's Potential to Seriously Negatively Impact Fresh Water through Increased Potential for Dangerous Discharges and Increased Use of Scarce Fresh Water

According to the Proposed Rule, there are currently 663 slaughter lines operating daily in "270 young chicken and turkey establishments with one or two 8-hour shift(s), on about 5 or 6 days of the week."[5] FSIS conservatively estimates that reducing current restrictions on line speeds will result in an increase of an average of 6 percent for the line speed.[6] Moreover, FSIS estimates the economic benefits of the proposed rule's allowance for faster slaughter facility processing will be "at least $258.9 million (3 cents per bird for 99.9 percent of 8.64 billion birds) annually."[7] Thus, in line with the Proposed Rule's reliance on Executive Order 13563, FSIS estimates the

[5] Proposed Rule at p. 4436.
[6] Proposed Rule at p. 4438.
[7] *Id.*

Proposed Rule will spur greater productivity, causing more birds to be slaughtered at 99.9 percent of U.S. slaughter facilities.

The industry presently slaughters 8.64 billion birds per year. *Id.* Despite the foregoing, in its environmental review discussion, the agency disingenuously suggests that not that many more birds will actually be slaughtered cumulatively. In doing so, the agency makes vague statements such as "by allowing establishments to reduce their hours of operations, the faster line speeds permitted under this proposed rule will result in a small, if any, increase in water use or runoff by establishments that operate under the New Poultry Inspection System." First, the agency's assumption that poultry slaughter operations will opt to reduce hours is utterly unfounded and arbitrary, and cannot be reconciled with another claim in the same paragraph: "expected sales of poultry products will determine the number of birds that poultry establishments slaughter." The agency does not grapple with the impact of high and increasing "expected sales" which would obviously magnify the impact of the rule. In effect, the agency bizarrely seems to assume that despite the massive effort that went into the Proposed Rule, and its reliance on an executive order aimed at maximizing efficiency and productivity that the poultry industry will not be slaughtering more birds as a result of the rule.

The agency is not free to posit only those hypotheticals that it thinks may help it avoid engaging in NEPA review. Rather it must take a hard look at what happens if this rule works as the agency intends it to: regulatory limits are relaxed and more birds are slaughtered. *Center for Biological Diversity v. Nat'l Highway Traffic Administration*, 538 F.3d 1172, 1220 (9th Cir. 2008) "If an agency decides not to prepare an EIS, it must supply a convincing statement of reasons to explain why a project's impacts are insignificant. The statement of reasons is crucial to determining whether the agency took a hard look at the potential environmental impact of a project.") (Internal quotations removed).

There are compelling reasons to believe more birds will be slaughtered in response to this Proposed Rule and as global demand for poultry products may increase. To take one example, powerful poultry industry trade groups are presently working with the federal government to open up India as a market for U.S. Poultry products. Indeed, the National Chicken Council hopes to achieve that end as soon as possible and it states that "[b]y conservative estimates, if India's trade barriers were eliminated, the value of

U.S. poultry exports to India each year would surpass $300 million."[8] Because the environmental impact analysis in the Proposed Rule fails to consider predictable increases in the number of birds slaughtered, it falls short of NEPA's requirements.

There can be no reasonable dispute that the more than 200 existing federally inspected poultry slaughter facilities have collectively and individually the potential to pollute fresh water. EPA studies have shown that pollutants including oil and grease, fecal coliforms, ammonia as nitrogen, and total nitrogen have been "[] detected in the untreated wastewater" of poultry slaughter facilities "at treatable levels in a significant number of samples, typically five times the baseline value in more than 10 percent of the untreated wastewater samples."[9] Additionally, studies have shown that water coming into contact with chicken excrement can contain bacteria capable of causing serious human illness, including multi-drug resistant *E. coli*, *Campylobacter,* and the leading cause of food poisoning-related death, *Salmonella*, which is a growing problem in the United States.[10]

Based on the flawed premise that increases in the number of birds slaughtered nationwide will be "small," the Proposed Rule assumes little to no increased water pollution as a result of the changes it makes. This is legally deficient because it includes no analysis regarding how increased slaughter may impact water pollution and effect local communities near such facilities, entire regions, and the national environment as a whole. See *Center for Biological Diversity*, 538 F.3d at 1223 (finding EA deficient where agency failed to supply "any analysis or supporting data" supporting conclusion that "a small reduction (0.2% compared to baseline) in the growth of carbon emissions would not have a significant impact on the environment"). Moreover, even if in general slaughter rates do not increase nationwide, the rule wholly fails to analyze more particularized impacts on any given state or

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[8] National Chicken Council press release, India Fails to Lift Restrictions on US Poultry in Consultations; USTR Requests Formation of WTO Dispute Settlement Panel (May 11, 2012) available at http://www.nationalchickencouncil.org/india-fails-to-lift-restrictions-on-us-poultry-in-consultations-ustr-requests-formation-of-wto-dispute-settlement-panel/ (last accessed May 29, 2012).

[9] EPA, Technical Development Document for the Final Effluent Limitations Guidelines and Standards for the Meat and Poultry Products Point Source Category (40 CFR 432), EPA-821-R-04-011, available at http://water.epa.gov/scitech/wastetech/guide/mpp/upload/2008_07_15_guide_mpp_final_tdd07.pdf (last accessed May 29, 2012).

[10] Chai, S. J., et al. 2012. *Salmonella enterica* Serotype Enteritidis: Increasing Incidence of Domestically Acquired Infections. Clinical Infectious Diseases 54: S488–97.

community as individual plants or segments of the industry increase slaughter rates.

In addition, the present rule fails to mention let alone analyze increased chicken slaughter's potentially massive impact on water use. USDA is well aware that poultry slaughter is an immense drain on water supplies. Indeed the agency's own publications report that

> [i]t takes an average of 7 gallons of water to process each bird. The southeastern part of the United States is struggling to meet the water needs of its residents, and water costs are at a premium. 'In 2005, some poultry processing plants in the South had to cut back on the number of birds they processed because water was not available. The drought has encouraged the privatization of water, with new companies being developed just to sell one of our most precious natural resources,'[11]

The EPA has found that chicken slaughter plants can use more than 9 gallons per bird and they generate more waste water per live-weight pound than even cattle and pig slaughterhouses:

> Using the reported mean live weight per bird of 3.83 pounds, 9.3 gallon per bird translates into 2,428 gallon per 1,000 lb LWK, which is significantly higher than the mean flow of 639 gallon per 1,000 lb LWK used for meat processing. For 34 turkey processing plants, the mean wastewater flow was 31.2 gallon per bird with individual plant values ranging from 9.6 to 71.4 gallon per bird. Again, no standard deviation was reported. Based on the reported mean live weight per bird of 18.2 pounds, the mean flow of 31.2 gallon per bird translates into 1,714 gallon per 1,000 lb LWK. Again, this value is substantially higher than that for meat processing, but also substantially lower than the value calculated for chickens.[12]

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[11] *Chillin Chickens Which method Works Best*, Agricultural Research, April 2008 http://www.ars.usda.gov/is/ar/archive/apr08/chicken0408.pdf (last accessed May 27, 2012) (emphasis added).

[12] EPA, Technical Development Document for the Final Effluent Limitations Guidelines and Standards for the Meat and Poultry Products Point Source Category (40 CFR 432), EPA-821-R-04-011, at p. 6-7, 6-8 available at http://water.epa.gov/scitech/wastetech/guide/mpp/upload/2008_07_15_guide_mpp_final_tdd06.pdf (last accessed May 29, 2012). In the same document, EPA also points out, that poultry slaughter waste water may contain "[ ] pathogens of enteric origin, such as *Salmonella sp*. and *Campylobacter jejuni*, gastrointestinal parasites, and pathogenic enteric viruses.*)*

From this, it follows that increasing the number of birds killed increases the demand on already limited water supplies, and increases the amount of wastewater generated. Aside from the bald conclusion that FSIS doesn't expect individual or cumulative environmental impacts, the agency does not address the implications of these facts as applied to its proposed rule.

EPA's studies of water use at poultry slaughter facilities also directly undermines FSIS' unsupported conclusion here that industry-wide changes in poultry slaughter practices will universally not have individual or cumulative environmental impacts. EPA has explained that such sweeping generalizations regarding poultry slaughter wastewater are not supportable, not that FSIS even attempted to support them here. Thus EPA has stated that

> "[] the results obtained in these sample episodes in combination with other sources of information suggests that there is a considerable degree of variation among facilities even within each segment of the industry in both the volume of wastewater generated per unit of production and the concentrations of specific pollutants." The sampling episode results demonstrate that the differences between two facilities with the same activity such as only first processing of broilers or first processing of cattle with on-site rending and hide processing can be substantial. This suggests that differences in-plant waste management practices, such as minimizing water use and separate collection of solid wastes, are critical factors in determining the volume of wastewater and the masses of individual pollutants generated per unit of production. Thus, it seems reasonable to conclude that any mean or median values characterized as typical values probably will describe the wastewater generated at a relatively small fraction of the total number of facilities in each segment of the MPP industry.[13]

Against this backdrop, the agency's sweeping, generalized and conclusory claims that the Proposed Rule "will not have a not have a significant individual or cumulative effect on the human environment" ring hollow.[14] The Agency has arbitrarily ignored the local, regional and nationwide impacts on water supplies associated with increased chicken slaughter at virtually every federally inspected poultry slaughter facility. In addition, the

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[13] *Id.* at pp. 6-19, 6-20.
[14] Proposed Rule at 4451.

rule fails to address other cumulative impacts, such as increased truck traffic to and from slaughter facilities resulting from increased slaughtering. To meet the minimum requirements of NEPA, the agency must at least attempt to explain each of these impacts, and support its conclusion of no significant impact with a reasoned analysis.

C. FSIS' NEPA Analysis Improperly Relies on Hoped-For Industry-wide Compliance with Environmental Laws

The agency will not be able to sustain the Proposed Rule's conclusion that "poultry slaughter establishments are required to meet all local, State, and Federal environmental requirements. Thus, FSIS has determined that allowing establishments to operate under faster line speeds provided in the proposed PSR will not have a not have a significant individual or cumulative effect on the human environment."[15] Obviously, virtually every single entity regulated by the federal government must likewise "meet all local, State, and Federal environmental requirements." If that was all it took for an agency to avoid NEPA review on a rule that affected hundreds of facilities and communities scattered around the country, then NEPA would be a paper tiger. In addition, The Agency fails to account for how varying state and local laws may affect environmental impacts throughout the U.S. In other words, what may not be regulated as an environmental impact by one state or local community may well be so regulated by another. For example, as the Washington Post reported:

> "Companies have also taken advantage of loopholes in regulations. Perdue, the country's second-largest chicken producer, trucks millions of gallons of waste a year from its Delaware slaughterhouses into Maryland, where the loads are injected into fields. Delaware limits such dumping, but Maryland does not."[16]

Thus, invoking hoped-for compliance with dozens of differing local and state laws does not provide any sort of consistent means of assessing environmental impacts as NEPA requires where, as here, a rule will affect hundreds of facilities operating in many different jurisdictions throughout the U.S. Accordingly, hoped-for compliance with other environmental laws is not a legally sufficient justification for avoiding NEPA environmental review here. *See Manatee County v. Gorsuch*, 554 F. Supp. 778 (M.D. Fla. 1982)

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[15] *Id.*

[16] Peter S. Goodman, *An Unsavory Byproduct: Runoff and Pollution*, Washington Post, A1 (Aug. 1, 1999) available at http://www.washingtonpost.com/wp-srv/local/daily/aug99/chicken1.htm (last accessed May 28, 2012).

(NEPA was violated during ocean dumping actions by EPA under the Marine Protection, Research and Sanctuaries Act).

III. Conclusion

For the reasons stated above, the HSUS respectfully Requests that FSIS set aside the Proposed Rule or amend it to address the serious shortcomings discussed above.

Respectfully Submitted, May 29, 2012

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Attachment to HSUS Comments on:

Docket ID No. FSIS-2011-0012, Modernization of Poultry Slaughter Inspection Rule

An HSUS Report: The Welfare of Birds at Slaughter

Sara Shields, Ph.D.,[*] and Mohan Raj, Ph.D.[†]

Abstract

The customary slaughter method of birds killed for human consumption involves the stunning of several live birds at one time using electrical water baths supplied with constant voltages. The birds are hung upside-down on shackles prior to conveyance through the electrified bath. This system, which is used globally, is increasingly under scrutiny as research suggests that it can be both inhumane and ineffective. Scientists have demonstrated that handling, inversion, and shackling are traumatic and stressful to birds and that shackling itself may be painful. In some cases, birds may also receive painful pre-stun electric shocks. There is growing evidence that the existing electrical water-bath stunner settings, including those used in U.S. slaughter plants, may not render birds immediately unconscious. Further, birds may miss the stunner completely and remain conscious when their throats are cut and possibly when they reach the scald vat. Since the existing, constant voltage, electrical water-bath systems that involve stunning several birds simultaneously are increasingly considered inhumane, alternative technologies that use gas mixtures to render birds unconscious have been developed to improve animal welfare. To date, the most effective and least aversive method of stunning birds prior to slaughter is Controlled Atmosphere Killing (CAK), which rapidly and efficiently gasses birds while they are in transport crates.

Introduction

In 2007, more than 9 billion birds were slaughtered for food in the United States alone.[1] The vast majority, overwhelmingly chickens,[‡] are first hung upside-down on metal shackles by their legs and then stunned using an electrified water-bath system before they are killed. Stunning is practiced in order to render birds unconscious and insensible, and to immobilize them before slaughter.[2,3] However, there is growing concern that stunning several birds at any one moment using an electrified water bath supplied with a constant voltage is inhumane, as birds experience stress and pain before, during, and sometimes after this process.

Newer systems, including Controlled Atmosphere Stunning (CAS) and Controlled Atmosphere Killing (CAK) methods employing naturally occurring gases, are increasingly seen as better alternatives for improved animal welfare, worker conditions, and carcass quality.[§] Despite the fact that birds make up more than 95% of all land animals slaughtered for food in the United States,[4,5] at present, the U.S. Department of Agriculture (USDA) does not include them under the protections of the Humane Methods of Slaughter Act of 1958.[6]

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[*] Dr. Shields serves as a consulting farm animal welfare scientist for the Humane Society of the United States.
[†] Dr. Raj is a Reader in Farm Animal Welfare at the University of Bristol, School of Veterinary Science, and the world's leading expert on the slaughter of birds for human consumption.
[‡] As chickens are the species slaughtered in the greatest number both globally and in the United States, they will be the focus throughout this paper, although some discussion of the welfare of turkeys during slaughter will also be included.
[§] The terms CAS and CAK are sometimes used interchangeably, but it is imperative that birds do not regain consciousness while on the shackle line. Therefore, CAK systems, which eliminate this potential, are highly preferred and will be the focus throughout this paper.

Electrical Water-Bath Stunning

Multiple-bird electrical water-bath stunning is the most common pre-slaughter stunning method under commercial conditions where large throughput rates are required—i.e., in countries where poultry slaughter and processing are partially or fully mechanized. Most birds arrive at the slaughter plant in transport crates (or modules) on trucks, are unloaded onto a conveyer belt, hung upside-down in metal shackles, and conveyed through the electrical water-bath stunner, their heads passing through the electrically charged water. The animals are then killed by automated knife cut to the throat and subsequent exsanguination. Following the bleed-out process, birds enter the scald tank in preparation for the next step, mechanical plucking of feathers. The United States has one of the fastest throughput rates, with some line speeds as fast as 140-180 birds per minute.[7]

When birds pass through the electrified water bath, current flows in the direction of head to feet, through the whole body towards the shackle line, which is grounded (in contact with the earth). When correctly applied, electrical stunning stimulates the brain with an electric current of sufficient magnitude to induce generalized epilepsy and is thought to be accompanied by unconsciousness and insensibility.[8] However, there are many welfare problems associated with the process of uncrating and shackling live birds, and the operation of existing multiple-bird electrical water-bath stunning technology. These bird welfare concerns are global in nature, applicable to all parts of the world, including the United States, where chicken slaughter is highly mechanized.

Uncrating

In developed countries, chickens are transported to processing plants in one of two types of modules. In one system, common in the United States, birds are tipped out of their transport crates upon arrival at the slaughter plant. During this process, forceful ejection of birds by "thumping" the modules or removing uncooperative individuals with a metal bar can cause bruising and lacerations.[9] Additionally, if chickens are dumped at a faster rate than hanging operators can shackle them, crowding and smothering on the supply belt can occur.[10] The process of removing birds from crates is undoubtedly traumatic, and birds are likely to experience fear and distress.

Shackling

Prior to electrical water-bath stunning, chickens must be shackled. While metal shackles are uniform, the leg sizes of chickens vary. Hanging operators may use considerable force to pull thick shanks into narrow shackles,[11,12] and birds may struggle violently if their legs do not fit properly.[13] Bruising of the surface of leg muscles occurs.[14] Tight-fitting shackles may provide good electrical contact between the legs and metal shackles but increase the severity of the pain associated with shackling. Evidence that shackling, in general, is painful is based on the presence of nociceptors (pain receptors) in the skin over the legs of birds and the close similarities between birds and mammals in nociception.[15,16] This pain is likely to be worse in birds suffering from diseases or abnormalities of leg joints or leg bones,[17,18] especially those with dislocated joints or bone fractures induced by rough handling during catching, crating, and uncrating.[19] Moreover, hanging upside-down is a physiologically abnormal posture for chickens. Handling, inversion, and shackling are traumatic and stressful, as reported in multiple studies that measured physiological indicators of stress.[20,21,22,23] Because of this, approximately 90% of birds flap their wings vigorously,[24] which may lead to dislocated joints and broken bones.[25]

Pre-Stun Electric Shocks

It is well-documented in the scientific and trade literature that some birds inadvertently experience painful electric shocks prior to being stunned in the electrified water bath.[26,27,28,29,30] This can happen when a bird's leading wing makes contact with the water before the head or if wing-flapping occurs at the entrance to the stunner.[31] Turkeys are especially prone to pre-stun shocks,[32] because their wings hang lower than their heads when hung inverted on a shackle.[33] In a survey of six different turkey slaughter plants in the U.K., pre-stun electric shocks were observed in five facilities.[34] In this study, the average number of turkeys receiving electric

shocks prior to stunning was 43%, with some plants reaching up to 87%. In some slaughter plants, pre-stun shocks occurred because the ramp at the entrance to the stun bath was electrically live,[35] although modifications to the entry ramps of chicken stunners may prevent overflow of electrically charged water.[36] However, the prevalence of such entry ramp designs in commercial slaughter plants globally, including within the United States, is not known. It has been suggested that fast line speeds are less likely to produce pre-stun shocks in turkeys, because the wing and head are immersed in the water bath together,[37] yet faster line speeds, as discussed herein, present separate welfare concerns.

Ineffective Stunning

Ineffective stunning of birds in the electrical water-bath system is a global concern. Recent scientific evidence published in 2006 and multiple studies conducted over the preceding few decades suggest that electrical water-bath stunning may not be instantaneous or effective in all the birds. Although it is theoretically possible to induce immediate unconsciousness using electricity of sufficient magnitude, evidence that this occurs in commercial practice is lacking, and the research published in 2006 suggests that the electrical settings currently in use in U.S. slaughter plants, which are becoming used more commonly in the rest of the world, may not render all birds immediately unconscious.[38,39] This is mainly because the precise settings needed to produce an instantaneous state of unconsciousness and insensibility are not easily achieved as control of all the biological and electrical variables in water-bath stunners is difficult.[40]

The criteria used to evaluate the effects of electrical stunning on birds also raise concerns. For example, brain functioning in sheep and pigs following electrical stunning has been investigated experimentally using electroencephalogram (EEG) recordings. Their EEG activity resembles grand mal epilepsy followed by a flat or isoelectric phase indicating unconsciousness.[41] However, scientific literature suggests that the EEG recordings of chickens following electrical stunning differ from those of mammals in that the epileptic activity more closely resembles a petit mal seizure, which is a milder form of epileptic attack in humans. These kinds of seizures are not associated with immediate unconsciousness in humans, leaving open the possibility that electrical stunning does not produce immediate unconsciousness in all birds.[42,43,44,45] Because the brain of a chicken responds to electrical stunning differently than a human's, however, the subjective experience of the bird during a petit mal seizure may also differ. When the occurrence of an epileptiform EEG recording is followed by a quiescent phase, this is thought to be a reliable indicator of unconsciousness and insensibility, and is used in studies of electrical stunning as a measure of the effectiveness of the stun.[46,47]

Although the electrical parameters of stun baths at poultry slaughter plants vary widely,[48,49] research suggests that commonly used settings in U.S. facilities may be inadequate to consistently produce an effective stun in all the birds. The typical wave form, pulse width, frequency, and current settings used in the United States are based on achieving good carcass and meat quality rather than on scientific evidence that they effectively produce unconsciousness and insensibility in every bird. Most of the U.S. broiler chicken industry implements a form of electrical stunning that involves application of a low current setting with a high frequency pulsed direct current (DC) and a reduced (short) pulse width.[50,51,52,53] Depending on the length of the water bath and the line speed,[54] the duration of the electric stun usually lasts 10-12 seconds.[55] The U.S. stunners may be set at 10-28 volts, delivering 10-45 mA per bird, and the frequency of the current varies between 350-500 Hz.[56,57,58] Although precise control of each of these electrical settings relative to the others is important, specific stun settings necessary for an effective and immediate stun are not mandated in the United States.

There has been very little research into the effectiveness of electrical settings commonly used in stun baths at U.S. poultry slaughter plants, but the results of research published in 2006 demonstrate that the parameters used might not render birds immediately unconscious or may not stun them effectively. Work at the University of Bristol's School of Clinical Veterinary Science by co-author Mohan Raj and his colleagues has demonstrated that the sine wave alternating current (AC) is more effective at producing EEG recordings indicative of unconsciousness and insensibility than the pulsed DC used in the United States.[59] The efficacy of stunning decreases as frequency increases,[60] and using either AC or DC, the amount of current necessary for an effective stun increases with the frequency of the current. Using a pulsed DC, it was found that electrical frequencies

above 200 Hz (as commonly found in U.S. slaughter plants) would require an average current greater than 200 mA in order to consistently induce epileptiform activity in EEG recordings.[61] This current is far greater than the 10-45 mA per bird often found in U.S. facilities.

Of further concern is that the pulse width of the DC is also an important factor affecting the likelihood that a stun will be effective. While longer pulse widths are more likely to produce epileptic EEG recordings, reduced pulse widths are common commercially.[62]

There is an inherent conflict between the requirement for effective electrical water-bath stunning and the production of a high-quality carcass and meat free of defects. While the probability of inducing an effective stun decreases as the frequency setting increases, low frequency settings cause intense muscle contraction and consequent rupture of small blood vessels in the skin and/or flesh, causing carcass defects that lead to downgrading.[63] Therefore, higher stunning frequencies (> 300 Hz) have become more prevalent[64] in U.S. slaughter plants[65,66] to ensure carcass and meat quality, despite the existing potential for an ineffective stun and/or for the bird to recover consciousness following stunning. However, even low frequency pulsed DC settings are questionable on animal welfare grounds, because some birds will experience cardiac arrest at stunning, yet fail to show EEGs indicative of effective stunning.[67,68] In general, there is an apparent conflict between bird welfare and meat quality under existing multiple-bird, electrical water-bath stunning, which cannot be resolved due to the complexity and inherent problems with the systems.

Induction of seizures (convulsions), rather than neurophysiological evidence (such as EEG recordings of generalized epilepsy), have been used to justify electrical stunning variables used in the broiler chicken industry.[69] In one study carried out in the U.K. that examined the effects of various current levels, all broiler chickens experienced seizures, whether or not they showed neurophysiological signs of unconsciousness and insensibility.[70] Similarly, in another study, all birds exposed to an average current of 44 mA developed spasms (also referred to in the literature as tremors or seizures) followed by complete muscle relaxation, whether or not their EEG recordings indicated unconsciousness.[71] The unavoidable conclusion one could draw from these results is that the existing electrical water-bath stunning procedures may induce seizures in conscious birds, which is potentially an extremely painful procedure.

The water bath may contain up to 20 birds at any one time.[72] In a constant voltage multiple-bird stunner, as is used commercially, the total current equals the sum of the currents flowing though each bird individually.[73] Variation in electrical resistance or impedance in the current pathway caused by natural variability among birds causes differences in the amount of current that individual birds receive as they pass through the water bath.[74,75,76] Bird variation can be due to many factors, including body size, body muscle and fat content, and plumage condition (e.g., whether the feathers are wet, dry, or dirty), depth of immersion, and the tightness of shackles.[77,78,79] Some birds do not receive a current of sufficient magnitude to stun them effectively.[80] Electrical variables also affect current flow. The mineral content, dirt, and brine concentration all affect the conductivity of the water bath.[81,82] Stunning birds using a multiple-bird electrified water-bath system is a complex task, and it is extremely difficult, if not impossible, to adequately control the process.[83] Therefore, improper stunning occurs with alarming frequency;[84] one study using an average current level that is common in U.S. slaughter plants (44 mA) showed that only 36% of chickens had EEGs indicative of effective stunning.[85]

Indeed, it is the current, rather than the voltage, that is the important factor for inducing an effective stun.[86] When the voltage is held constant, the amount of current delivered to each individual bird in the water-bath stunner is inversely related to the bird's resistance. As well, there is a delay in the passage of the correct current amount through the brain of the bird as the current rises, depending upon the electrical impedance or resistance in the pathway, from zero to the maximum level.[87] Therefore constant voltage stunners are inherently less efficient in inducing immediate unconsciousness.

At the low voltage and current levels used in the United States, this period during which the electrical impedance breaks down and unconsciousness is induced could be extremely painful.[88]

To overcome the problem of variable electrical impedance in multiple-bird water-bath stunners, constant current stunners have been developed in the U.K. but have not been implemented in the slaughter plants. These stunners control current flow through individual birds by electrically isolating each one to ensure that all birds in a multiple-bird water-bath stunner receive the minimum current needed for an adequate stun.[89,90] By controlling the current rather than the voltage, stunning can be acheived in 0.25 seconds, overcoming the delay in inducing unconsciousness that is characteristic of constant voltage systems.[91] However, because shackles are only 15 cm (5.9 in) apart on the line and because processing speed can be as high as 220 chickens per minute, there is considerable doubt that it is possible to electrically isolate each bird for long enough to deliver the pre-set current. As such, commercial application of these systems has been limited.[92,93]

Birds may not be adequately stunned if they flap their wings when entering the stunner, delaying or interrupting contact with the electrified water bath. When the depth or duration of the stun is not sufficient, birds may experience pain and distress when they reach the killing (neck-cutting) machine and during at least part of bleed-out.[94,95] This is clearly unacceptable from humanitarian and bird welfare standpoints.

Over the past few decades, researchers and veterinarians working independently have suggested that electrically stunned birds may not be unconsciousness at all when shocked in an electrified water bath, but rather in a state of electrical paralysis.[96,97,98,99] Prolonged application (three seconds or more) of insufficient current level may cause immobilization and prevent birds from displaying outward signs of pain, without rendering them unable to experience pain, stress, or discomfort.[100,101] Because birds may experience electrically-induced paralysis, seizures, and cardiac arrest while still conscious and because stunning may be delayed and/or ineffective, the existing electrical water-bath stunning system in and of itself cannot be considered humane.

Missing the Stun Bath

Some birds are conveyed through the stunner without ever making contact with the electrified water bath itself, which is a global welfare problem. This can happen if birds struggle and lift their heads, if the height of the stunner is not correctly adjusted, or if birds are too short to reach the water bath.[102,103,104] Egg-laying hens whose productivity has waned, commonly referred to as "spent," are especially prone to missing the stun bath as they are more likely to struggle in the shackles.[105,106] In 2007, one of the top disease challenges facing poultry veterinarians in the United States was Runting Stunting Syndrome (RSS) in broiler chickens. RSS-affected flocks have poor growth and lack uniformity in size, hindering the slaughter process,[107] possibly worsening the problem of small birds missing the stunner. Birds missing the stunner remain fully conscious when their necks are cut. There are no public records of the number of birds who miss the stunner in U.S. poultry slaughter plants. Advances in electrical water-bath design, such as the installation of rump bars to limit movement and breast rub pads to calm birds, may better prevent birds from missing the stun bath,[108] yet smaller birds (especially runts) may still reach the killing machine while fully conscious. Additionally, as RSS-affected birds would remain physically in contact with the adjacent birds passing through the stunner, the possibility that the RSS birds would receive painful electric shocks in a conscious state could not be ruled out.

Neck-Cutting

Effectively stunned birds who have not undergone cardiac arrest at stunning must be killed quickly, otherwise they will regain consciousness.[109] The duration of a stun is dependent on the amount and frequency of the current.[110] Birds are in danger of regaining consciousness during bleed-out and of entering the scald vat while alive if the neck-cutting procedure is ineffective. A ventral cut, which severs both carotid arteries, is more effective at inducing a rapid death than a neck cut that severs only one carotid artery.[111,112,113] Unlike in the United States, ventral neck-cutting is not always practiced in some countries,[114] and, even in the United States, severance of both the carotid arteries in the necks of different sized birds is not always possible whilst using neck-cutting machines.

Entering the Scald Tank Alive

Occasionally, live birds who were not adequately stunned and/or who missed the killing machine, or who recovered from the stun due to poor neck-cutting practices are live or conscious when entering the scald tank.[115,116,117,118] In the United States, U.K., and many other industrialized countries, a worker is present on the slaughter line to manually cut the throats of birds who miss the automated blade. However, in high-throughput slaughter plants, line speeds can prevent the detection of live birds exiting the killing machine.[119] In U.S. plants with improper supervision, the rate at which birds enter the scald tank while still alive may be as high as 3%.[120] According to the USDA's Food Safety and Inspection Service "Poultry Slaughter Inspection Training" guide, "Poultry that die from causes other than slaughter are condemned under the cadaver category. These birds are not dead when they enter the scald vat. When submerged in the hot water, they drown…."[121] In 2007 more than 1.5 million chickens and turkeys were condemned under this category.[122]

Conclusions: Electrical Water-Bath Stunning

Historically, the development of electrical stunning devices was driven more by the need to facilitate processing and automation of slaughter than by concern for bird welfare.[123] Although water-bath stunning could theoretically produce a state of insensibility rapidly, the complexities of ensuring the correct electrical settings and the conflict between effective stunning and commercial interests in carcass and meat quality largely preclude these conditions in practice. However, the problem of dumping, handling, and shackling conscious birds remains, even if electrical variables could be satisfactorily controlled. Questions about the nature of the state of unconsciousness (or lack thereof) actually produced by electrical water baths raises further concerns about the system. In summary, the existing multiple-bird electrical water-bath stunning systems supplied with constant voltages are inadequate on welfare grounds as they do not ensure the least aversive slaughter possible.

Controlled Atmosphere Killing (CAK)

CAK in transport crates or modules provides higher welfare as it does not require live bird handling at the slaughter plants, hence avoiding the problems associated with dumping,[**] handling, and shackling live birds. As well, these systems do not risk pre-stun shocks and/or ineffective stunning. In the best CAK systems, birds in transport crates or modules are conveyed through a tunnel filled with increasing concentrations of carbon dioxide (CO_2), inert gases (argon or nitrogen), or a mixture of these gases. With CAK, birds are exposed to lethal concentrations of gases long enough that they are actually killed, rather than simply stunned,[124] whereas with Controlled Atmosphere Stunning (CAS), the gas or gases induce unconsciousness as the birds pass through before they are hung on shackles, while insensible, and conveyed to the killing machine for slaughter. In either system, hanging operators do not shackle the birds until after they exit the gas stunning system, so the birds do not endure the pain, fear, and stress associated with this step in the conventional procedure.

Several different naturally occurring gases are used in CAK and CAS systems, and each has different physiological effects on the birds. Breathable air consists of approximately 21% oxygen (O_2), 78% nitrogen (N), and 1% other gases (primarily argon, but with a small amount of CO_2). When inhaled in high concentrations, the inert gases (argon and nitrogen) cause hypoxia or anoxia, which is oxygen deprivation in the body. The organ most sensitive to a physiologic decrease in blood oxygen levels is the brain, and unconsciousness and eventual death result when the oxygen level is insufficient for normal brain functioning. In contrast, elevated CO_2 levels cause hypercapnia, an increase in CO_2 levels in the blood, which disrupts respiration and normal neuronal function, leading eventually to death.

With CAS, the potential exists for birds to regain consciousness after exiting the gaseous atmosphere while being shackled and conveyed to the neck-cutter, or during bleeding. Therefore, it is imperative that the birds are

[**] Some gas systems are designed in such a way that birds must still be dumped from their transport crates prior to entering the gas-filled chamber on a conveyer belt. While still retaining many of the welfare advantages of CAK systems, those that move birds through the gaseous atmosphere while they are still in their transport crates are considered optimal.

actually killed, rather than stunned, by the gas or gases.[125] In this way, the use of CAK fully obtains the welfare benefits of the method, as compared to CAS, in which the potential exists for birds to awaken from their unconscious state. Some commercial processors have continued to use the term "Controlled Atmosphere Stunning" even when they have a CAK system in place for various reasons. For example, birds subjected to CAK show residual heart activity for a few minutes after the cessation of other functions such as breathing.

Current Research on the Least Aversive Gas Mixtures

Some of the first research on the use of gas to stun birds was published in the 1950s,[126] and, by the late 1990s, continuing research led to the adoption of the first commercial gas stunning systems.[127] CO_2, a byproduct of the chemical and fertilizer industries, was initially examined in research studies for poultry slaughter plants, because it is easily obtainable and relatively inexpensive. However, interest in the inert gases, including argon and nitrogen, was sparked by human aviation physiology studies, which demonstrated that anoxia-induced unconsciousness is euphoric. It was on the basis of this research that studies into the least aversive gas mixtures began.

Inhalation of the inert gases is thought to be painless, as birds do not demonstrate aversive reactions with initial exposure. In carefully controlled behavior experiments, turkeys and chickens were willing to enter a chamber filled with argon in order to access food.[128,129] In contrast, there are both physiological and behavioral lines of scientific evidence suggesting that CO_2 may be unpleasant and possibly very distressing to inhale, as it is an acidic gas, pungent to inhale at high concentrations.[130,131] Birds have intrapulmonary chemoreceptors that detect CO_2, but are insensitive to hypoxia induced with argon and nitrogen, which are tasteless and odorless. Indeed, they show signs of respiratory distress when exposed to CO_2[132] and will often avoid an atmosphere containing high concentrations of carbon dioxide when tested in behavior experiments.[133,134]

Some scientists, however, contend that there are also problems with the use of inert gases to stun birds. The primary concern is that inert gases cause convulsions as the birds lose consciousness. Convulsions are thought to be reflexive reactions occurring only after the bird has lost consciousness; however, some have questioned this tenet, as discussed below, and argue the thrashing of one bird may frighten or physically harm, albeit briefly, other birds in the vicinity who have not yet lost consciousness. These convulsions can be aesthetically unpleasant to human observers and also involve leg and wing movements powerful enough to throw the bird against the walls of the chamber and against other birds.[135] Further, broken wing bones caused by convulsions reduce the quality of the carcass. For these reasons and because inert gases are not readily available in large quantities or are more expensive to obtain than CO_2, the poultry industry has been reluctant to broadly adopt this gas technology in the United States. In contrast, in the U.K., where the use of inert gases for stunning/killing birds has been approved, it is estimated that more than 75% of turkeys and 25% of broiler chickens slaughtered for human consumption are killed using inert mixtures.[136]

As a possible solution, two-step systems that first render the birds unconscious with a low level of CO_2 followed by a second stage with lethal CO_2 levels are being adopted commercially. Exposure to low concentrations of CO_2 (e.g., 30% by volume in air) does not cause convulsions to the extent that inert gases do and, despite its aversiveness, is thought to have an anaesthetic effect for a variety of species at low levels, reducing pain sensitivity.[137] The humaneness of exposure to low concentrations of CO_2 has been evaluated, and it has been argued that CO_2 levels of 30% or less may not be very much more aversive to inhale than the inert gas argon. This was demonstrated by scientists Bruce Webster and Daniel Fletcher at the University of Georgia in Athens in an experiment requiring hungry hens to enter a gas-filled chamber to access food. Nearly as many hens entered the feeding chamber and lost posture (an early sign of onset of unconsciousness) due to gas exposure when the chamber was filled with 30% CO_2 in air as compared to argon. Based on their analysis of hen behavior during their experiment and other published data, the researchers concluded that any bird welfare advantage of argon is relatively minor.[138] Similar results were found in another study that tested the aversiveness of various gas mixtures by exposing broiler chickens to a 10-second pulse of gas while the birds fed. Dorothy McKeegan, Faculty of Veterinary Medicine at the University of Glasgow, and her colleagues also found, based on the

tendency of chickens to cease feeding during gas delivery over the feed dish, that a low level of CO_2 is only mildly or moderately aversive.[139]

In a series of experiments published in 2007, McKeegan and her colleagues tested several gas mixtures and concluded that a two-step system—using 40% CO_2, 30% O_2, and 30% N in the first phase and 80% CO_2, 5% O_2, and 15% N in the second phase—was best from both an animal welfare and a meat quality perspective.[140,141] Not unexpectedly, behavioral observations at the processor showed that wing-flapping and jumping associated with convulsions were greater in the gas mixture tested that contained argon, and this led to fractured wings and hemorrhages that are considered unacceptable carcass quality problems by some processors. They concluded that the transition to a motionless state was longer but smoother using the 40% CO_2, 30% O_2, and 30% N in the induction phase.[142] A further concern was that a parallel laboratory study was not able to rule out the possibility that the initial vigorous behavioral response to the gas mixture containing argon occurred while chickens were still conscious.[143]

In spite of these concerns, research presented in 2006 and 2008 further evaluated gas aversion from the perspective of the birds themselves. Three different gas mixtures were presented to chickens at a feeding station fitted with gas outlets. The researchers at the Scottish Agricultural College found that the birds, given free choice, preferred to feed in the presence of inert gases, nitrogen and argon, with low CO_2 contents (less than 30% by volume).[144,145] The new studies reinforce the evidence that birds find inert gases less aversive than CO_2 at high concentrations.

Although the precise gas mixture is important, ongoing research should not prevent the poultry industry from adopting CAK technology. Regardless of the gas mixture used, CAK eliminates the problems associated with handling and shackling live birds, painful pre-stun shocks, and variations in current that may or may not adequately render birds insensible. Pending further research that will undoubtedly continue to refine and improve knowledge and understanding of the procedure, many gas mixtures currently provide higher welfare, including argon and nitrogen with less than 2% residual oxygen, and any mixture of argon, nitrogen, or other inert gases with up to 30% CO_2.[146]

Additional Benefits of CAK

In addition to the benefits associated with improved bird welfare, CAK also improves the working conditions for hanging operators. The job of shackling live birds is difficult, as the animals may resist and struggle; dirty, due to aerial dust, feather dander, excrement, and unsanitary working conditions; and environmentally challenging, as live-hang must be performed in low light to quiet the birds. By contrast, when CAK is used, hanging operators do not handle the birds until they are unconscious or killed, thereby eliminating these problems.[††147]

CAK also virtually eliminates carcass quality problems that can occur with electrical water-bath stunning. Poultry processors that have adopted gas technology have claimed that they have better product quality with fewer broken bones, blood spots, and bruising, and better bleed-out.[148,149]

Conclusion

After a comprehensive review of the scientific literature, the Scientific Panel on Animal Health and Welfare, an official advisory body to the European Commission, stated:

[††] For additional information, see: An HSUS Report: Human Health Implications of Live Hang of Chickens and Turkeys on Slaughterhouse Workers at www.hsus.org/web-files/PDF/farm/HSUS-Human-Health-Report-on-Poultry-Slaughter-Live-Hang-Workers.pdf.

> Since welfare is poor when the shackling line and water bath electrical stunning method is used, and birds are occasionally not stunned before slaughter, the method should be replaced as soon as possible. At present, the inert gas stun/killing method is the best alternative.[150]

The existing U.S. standard for electrical stunning of birds killed for human consumption does not conform to the guidelines of the World Organisation for Animal Health (OIE), which recommends as optimum a minimum of 100 mA delivered using 50 Hz sine wave alternating current per chicken.[151]

It is ethically imperative that slaughter be both quick and painless, particularly in countries such as the United States, wherein birds killed for food are not afforded legal protections to govern their welfare at slaughter. Given the current state of pre-slaughter stunning technology, CAK is the method that provides conditions for slaughtering birds with a minimum of avoidable pain and suffering. Further benefits, including better working conditions for hanging operators, avoiding food safety risks, and improved carcass quality, solidify that this technology is strongly preferred to the existing multiple-bird electrical water-bath stunning systems supplied with constant voltages. The OIE has commented positively on novel and higher welfare gaseous stunning and killing methods,[152] and it is imperative that the U.S. industry implement these technologies to improve animal welfare.

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