

microbial population and retard further microbial growth on livestock carcasses. For beef carcasses, FSIS also recently authorized establishments to use acetic, citric, or lactic acids on inspected and passed carcasses before chilling in conjunction with the final wash without prior FSIS approval on an establishment-by-establishment basis.

FSIS is proposing that, to satisfy the proposed requirement for at least one antimicrobial treatment, acetic, lactic, or citric acid could be applied to carcass surfaces prior to entering the cooler. FSIS is preparing to propose in a separate rulemaking that these organic acids be listed, as approved antimicrobial agents, in 9 CFR 318.7 and 381.147 for livestock and poultry uses, respectively, in a solution of 1.5–2.5 percent concentration and in such a fashion that all carcass surfaces would be contacted.

FSIS invites comments on whether the use of these acids to satisfy the program requirements for an antimicrobial treatment should be limited to post-inspection application in conjunction with the final carcass wash or should be permitted at earlier stages of the slaughter and dressing process, such as after skinning but before evisceration and completion of postmortem inspection by FSIS inspectors, or during chilling. FSIS also invites comment on whether organic acid sprays should be considered an acceptable antimicrobial treatment in beef slaughter establishments in light of the reported acid-resistance of *E. coli* O157:H7, which is a pathogen of particular public health concern in beef.

A list of studies on the application of organic acids on meat carcasses is on file with the FSIS Docket Clerk and may be obtained from the Director, Slaughter Inspection Standards and Procedures Division, FSIS, U.S. Department of Agriculture, Washington, DC 20250.

(c) *Trisodium phosphate (TSP)*. The application of TSP to raw poultry carcasses by spraying or dipping with a solution of water and food grade TSP was recently approved by FSIS. Trisodium phosphate (TSP) is listed in the FDA regulations as GRAS for multiple purpose use, in accordance with good manufacturing practices. FDA has affirmed that application of TSP to raw poultry carcasses is consistent with the GRAS listing for TSP. Additionally, TSP (sodium phosphate, tribasic) is listed in the Food Chemicals Codex III (1981).

FSIS has granted interim approval for use of TSP at pre-chill and post-chill locations, and has begun rulemaking procedures to include this compound in 9 CFR 381.147(f)(4), Table 1, under the

new class of substances to be called “antimicrobial agents” (59 FR 551). TSP reduces bacterial levels, including pathogenic bacteria, on raw poultry carcasses when applied by spraying or dipping the raw poultry carcasses for up to 15 seconds post-chill or for up to 30 seconds pre-chill with an 8–12 percent solution of TSP in water. TSP may be applied to raw chilled poultry as a solution maintained at 45°F–55°F, and to raw poultry as a solution maintained at 65°F–85°F.

Industry, university, and Agriculture Research Service studies demonstrate TSP induced reductions in carcass *Salmonella* levels ranging from 90 to >99.9 percent (1.2 to 8.3 log<sub>10</sub>). The higher *Salmonella* reductions were associated with pre-chill TSP applications. Mean carcass *Salmonella* prevalence was reduced from up to 23 percent to approximately 1 percent. Industry studies demonstrate median reductions in carcass *Enterobacteriaceae* and *E. coli* levels of approximately 99.5 percent (2.5 log<sub>10</sub>). In a study conducted by an independent laboratory, *Campylobacter* average prevalence was reduced from 100 percent to 30 percent with mean numerical reductions of >99.9 percent (4 log<sub>10</sub>) following TSP application to raw, unchilled poultry carcasses. TSP application to raw poultry, under the above stated time, concentration, and temperature conditions of use, therefore, causes statistically significant reductions in these most common gram negative pathogens associated with raw poultry.

As part of the poultry chilling process, poultry carcasses may gain moisture up to the levels permitted in 9 CFR 381.66(d). Poultry establishments using TSP are not exempted from the moisture absorption and retention limits contained in 9 CFR 381.66(d). To preclude the potential for economic adulteration of poultry carcasses as a result of TSP treatments, federally inspected establishments applying TSP to raw poultry carcasses will include the TSP application in their washing, chilling, and draining method as outlined in 9 CFR 381.66(d)(8).

Commercial use of TSP has only recently begun in some poultry establishments. It is not yet widely used. A commercial study investigating the efficacy of TSP in reducing bacterial levels on beef carcasses is in progress.

Federally inspected establishments using TSP as an antimicrobial agent on raw poultry have consistently met local and State effluent phosphate discharge requirements by making minor modifications to their effluent flocculation methods.

FSIS is proposing to permit TSP to be applied to poultry carcass surfaces at any point prior to entering the chiller as one means to meet the proposed requirement for an antimicrobial treatment. FSIS intends to propose in another rulemaking a regulation to list TSP in part 381.147(f)(4), Table 1, as an approved antimicrobial agent. TSP would be applied in a solution of 8–12 percent concentration in such a fashion that all carcass surfaces would be contacted.

A list of studies done on the application of TSP to poultry carcasses is on file in the FSIS Docket Clerk's office, and is available from the Director, Slaughter Inspection Standards Division, FSIS, U.S. Department of Agriculture, Washington, DC 20250.

(d) *Chlorinated water*. The washing of carcasses with chlorinated water to reduce the amount of spoilage and pathogenic microorganisms on carcasses is a longtime practice in the poultry industry. As early as 1951, researchers noted the effectiveness of in-plant chlorination in lowering bacteria counts on product, increasing shelf life, reducing odors in the establishment, and reducing slime on equipment.

Chlorine is now used in most poultry establishments, primarily in chill water, to minimize bacterial cross-contamination and as an effective sanitizing agent on facilities and equipment, usually at FSIS-sanctioned levels of 20 to 50 parts per million (ppm) available chlorine.

A FSIS study published in 1992 showed significant microbial reductions on raw chicken carcasses and giblets immersed in chlorinated chill water. In this study, the addition of 25 ppm of chlorine in the chill water resulted in a significant decrease in aerobic plate counts, *Enterobacteriaceae*, and *E. coli*. Some reduction also occurred without chlorine in chill water indicating that chilling carcasses in this manner actually reduces the bacterial load on carcasses. The effect on *Salmonella* was a reduction in the amount of cross-contamination. Without chlorine, the percent of carcasses exiting the chiller with *Salmonella* versus the percent going in increased significantly. With the addition of chlorine, the differential was not significant. The conclusion was that chlorine aids in the control of cross-contamination in the chillers.

Chlorinated water has long been recommended for reducing bacteria in poultry processing establishments. In one study 34 ppm chlorine reduced salmonellae in broiler chill water to non-detectable levels, and resulted in significant reductions (10–13 percent) in