U.S. DEPARTMENT OF AGRICULTURE

Food Safety and Inspection Service

Preliminary Cost-Benefit Analysis

Chicken Parts and Not Ready-To-Eat Comminuted Poultry Performance Standards

I. Interventions

Chicken parts and not ready-to-eat comminuted poultry (NRTECP) establishments that initially do not meet the new performance standards will be faced with decisions regarding corrective actions. For some establishments the changes necessary to meet the new standards will be deemed too costly, and no changes will be made. For others the consequences of not meeting the standard will outweigh the costs of achieving compliance, and corrective actions will be taken. The type of corrective actions, and the degree to which they're implemented, will ultimately be the choice of the individual company or establishment.

For those establishments initially not meeting the standards that choose to make improvements, changes will have to be made to their production processes to lower the prevalence of *Salmonella* and *Campylobacter* in their products. There are a variety of options available to these establishments, including pre-harvest interventions such as vaccination programs, well-timed feed withdrawal, drinking water interventions, clean and dry litter and transportation, and supplier contract guarantees of pathogen-free flocks. Establishments could also choose to make changes to their processing steps. For example, establishments can add additional cleaning shifts, apply chemical antimicrobials to parts and comminuted components, and provide additional sanitation training to employees.[1]

For the purposes of the cost-benefit analysis, FSIS used the cost of adding antimicrobial solutions to poultry parts as a proxy for the range of costs of interventions and changes which could be implemented. While the true cost of corrective actions will vary by establishment, FSIS used what it determined to be the most likely form of intervention to estimate costs. This decision was influenced by a review of Food Safety Assessments triggered by broiler *Salmonella*

[1] FSIS. (2010). Compliance Guideline for Controlling Salmonella and Campylobacter in Poultry, Third Edition. Available at: http://www.fsis.usda.gov/wps/wcm/connect/6732c082-af40-415e-9b57-90533ea4c252/Compliance_Guide_Controling_Salmonella_Campylobacter_Poultry_0510.pdf?MOD=AJPERES

sets in which the majority of establishments added antimicrobials to the production process as a corrective action, and by the results of the FSIS Poultry Checklist[2] which showed that the majority of establishments are not currently applying antimicrobials to raw poultry parts and comminuted components.

Peroxyacetic acid (also known as Peracetic acid or PAA) was chosen as the chemical antimicrobial for the cost estimate. PAA is a commonly used antimicrobial[3] which has been shown to achieve large pathogen reductions in poultry products,[4] making it a good representative antimicrobial agent on which to base the cost estimate. Since it is effective at reducing both *Salmonella* and *Campylobacter*, the decision to use PAA also enabled FSIS to combine the cost estimate for both pathogen performance standards.

II. Baseline

FSIS used data from the Raw Chicken Parts Baseline Survey[5] (RCPBS), the Not Ready-To-Eat Comminuted Poultry Exploratory Sampling Project[6] (NCPESP), and the Public Health Information System (PHIS) to identify establishments that produce product covered under new performance standards. Table 1 provides an itemization of establishments by product and

[2] FSIS. (2014) Poultry Checklist Summary Results. Report available at: http://www.fsis.usda.gov/wps/wcm/connect/902e9de8-712c-4d74-a223-c9ef4b37464a/poultry-checklist.pdf?MOD=AJPERES

[3] Results from an industry survey show that PAA is the "predominant antimicrobial in post-chill applications". McKee. (2012) Salmonella Control in Poultry Processing. *65th Annual Reciprocal Meat Conference.* Available at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CDAQFjAA&url=http%3A%2F%2Fwww.meatscience.org%2FWorkArea%2FDownloadAsset.aspx%3Fid%3D8648&ei=6o5jU8zlMYTmsATI4IEg&usg=AFQjCNG7Iez6v48YsIDDqhTqxAJqQ9eAYQ&sig2=jRLkPWCN2f95zCYpNAm6Kg&bvm=bv.65636070,d.cWc

[4] Chiller water treated with a peroxyacetic acid (200 ppm) was shown to be effective in reducing both *Salmonella* and *Campylobacter* on inoculated chicken carcasses. Bauermeister et al. (2008) The Microbial and Quality Properties of Poultry Carcasses Treated with Peracetic Acid as an Antimicrobial Treatment. *Poultry Science. Volume 87 (11)* pg.2390-2398.

[5] FSIS. (2012) Nationwide Microbiological Baseline Data Collection Program: Raw Chicken Parts Survey. Report available at http://www.fsis.usda.gov/wps/wcm/connect/a9837fc8-0109-4041-bd0c-729924a79201/Baseline_Data_Raw_Chicken_Parts.pdf?MOD=AJPERES

[6] FSIS. (2014) *Salmonella* Verification Sampling Program. Federal Register Notice available at: https://federalregister.gov/a/2012-29510

HACCP processing size. A total of 481 establishments will be affected, including 20 establishments that produce two or more products under the new performance standards.

Table 1. Establishments Producing Chicken Parts and NRTE Comminuted Poultry[1] (RCPBS, NCPESP, PHIS)

Parts Production	Comminuted Production	Very Small	Small	Large	Total
Chicken Parts	No Comminuted	101	144	122	367
	Chicken	0	4	6	10
	Turkey	0	2	0	2
	Chicken & Turkey	0	1	1	2
No Chicken Parts	Chicken	10	36	9	55
	Turkey	2	16	21	39
	Chicken & Turkey	0	5	1	6
Total	-	113	208	160	481

[1]Table only shows establishments producing enough product to be tested under new performance standards.

FSIS further stratified the chicken parts and comminuted poultry establishments to incorporate production volumes using data from the RCPBS and PHIS. For chicken parts production, FSIS maintained the production volume categories as defined in the RCPBS report (see footnote 5). Large volume establishments were defined as producing 70,000,000 pounds or more of chicken parts per year, medium volume establishments were defined as producing 1,000,000 pounds or more but less than 70,000,000 pounds of chicken parts per year, and low volume establishments were defined as producing less than 1,000,000 pounds of chicken parts per year. For comminuted poultry, FSIS defined high volume establishments as those that produce greater than 250,000 pounds of comminuted product per day, medium volume establishments as those that produce greater than 6,000 pounds but less than or equal to 250,000 pounds per day, and low volume establishments as those that produce 6,000 pounds per day or less. The number of establishments stratified by HACCP size and production volume category is displayed in Table 2.

Table 2. Chicken Parts and NRTECP Establishments by HACCP Size and Production Volume (RCPBS, PHIS)

HACCP Size	Production Volume	Chicken Parts Establishments	NRTECP Establishments
Large	1	83	11
	2	43	23
	3	3	4
Small	1	6	2
	2	78	20
	3	67	42
Very Small	1	0	1
	2	31	2
	3	70	9
Total	-	381	114

In order to estimate the percentage of establishments which are already implementing some type of antimicrobial intervention, FSIS used the results of the Poultry Checklist Survey.[7] For the purposes of the cost analysis, establishments which reported using any type of antimicrobial agent[8] at the processing step were considered because such a response indicates that they have the equipment in place to apply antimicrobials. Table 3 lists the survey results for chicken parts and comminuted poultry.

Table 3. Establishments Using Antimicrobial Agent Interventions (Poultry Checklist)

Product	HACCP Size		
	Large	Small	Very Small
Chicken Parts	56%	26%	10%
Comminuted Poultry	79%	29%	19%

FSIS also used the Poultry Checklist Survey to estimate the percentage of establishments that are already testing chicken parts and comminuted poultry for *Salmonella* and *Campylobacter*. The survey did not identify any establishments that tested for *Campylobacter*

[7] See footnote 2.
[8] The following responses were included as antimicrobial agents: bacteriophages, bromine/bromine derivatives, chlorine/chlorine derivatives, organic acids, and other antimicrobial agents.

without also testing for *Salmonella*, however a number of establishments do test for *Salmonella* only, and others for both. Table 4 displays the survey results for establishment testing.

Table 4. Establishments Testing for *Salmonella* and *Campylobacter* (Poultry Checklist)

Product	**Chicken Parts**			**Comminuted Poultry**		
HACCP Size	Large	Small	Very Small	Large	Small	Very Small
Salmonella Only	15%	14%	3%	42%	15%	6%
Salmonella and Campylobacter	13%	1%	0%	15%	15%	3%

III. Expected Costs - Industry

The poultry industry will incur costs to implement interventions needed to meet the performance standards. Due to the uncertainty in the number of establishments which will choose to make changes, FSIS estimated costs assuming that 30%, 40%, and 50% of establishments initially not meeting the standards will add interventions. For the purpose of estimating costs, FSIS also assumed that establishments that make changes will choose to apply antimicrobials to chicken parts and to the poultry parts intended to be turned into comminuted product. In order to meet the standard, establishments will pay for the installation of capital equipment, operating costs and maintenance, the antimicrobial agents, employee training, the costs of HACCP reassessment and validation, and for sampling.

Using data from the two product sampling programs, FSIS estimated the percentage of establishments which will initially not meet the new performance standards and the percentage of total product produced at those establishments. The results of this estimate are displayed in Table 5. FSIS did not include estimated costs associated with not meeting the *Campylobacter* standard in its industry cost estimate. Instead, FSIS made the assumption that the interventions applied to meet the *Salmonella* standard would also achieve the *Campylobacter* standard.

Interventions intended to reduce *Salmonella* will generally also reduce *Campylobacter*,[9] therefore establishments not meeting both standards will likely be able to use corrective actions which reduce the prevalence of both pathogens. In addition, of those establishment-products that were sampled and are predicted to fall short of the *Campylobacter* standard, approximately 69% are expected to also not meet the *Salmonella* standard. This large overlap suggests that using the *Salmonella* figures (which represent higher shares of establishments not meeting the standard in every product) to account for both pathogens will still provide a reasonably accurate estimation of total costs.

Table 5. Initial Share of Establishments and Production Volume Expected to Not Meet the Performance Standards (2015 Risk Assessment[10])

Product	Metric	*Salmonella*	*Campylobacter*
Chicken Parts	Performance standard[1]	8 of 52	4 of 52
	Production volume share	73%	85%
	Establishment share	63%	46%
NRTE Comminuted Chicken	Performance standard[1]	13 of 52	1 of 52
	Production volume share	93%	56%
	Establishment share	62%	24%
NRTE Comminuted Turkey	Performance standard[1]	7 of 52	1 of 52
	Production volume share	61%	20%
	Establishment share	58%	9%

[1]The performance standard is defined as a maximum allowable number of positive samples in a 52 sample moving window. FSIS chose performance standards that were expected to accomplish a reduction in *Salmonella* and *Campylobacter* illnesses of at least 30% and 33%, respectively, with the exception of *Campylobacter* in chicken parts (32%) and comminuted turkey (19%). A detailed explanation of the criteria used to make these decisions can be found in the 2015 Risk Assessment (see footnote 10).

All facilities subject to the performance standards will be categorized and listed on the FSIS website as follows:

[9] See footnote 1.
[10] FSIS. (2015). Public Health Effects of Raw Chicken Parts and Comminuted Chicken and Turkey Performance Standards. Report available at: http://www.fsis.usda.gov/wps/wcm/connect/afe9a946-03c6-4f0d-b024-12aba4c01aef/Effects-Performance-Standards-Chicken-Parts-Comminuted.pdf?MOD=AJPERES

- Category 1. Consistent Process Control: Establishments that have achieved 50 percent or less of the performance standard during all completed 52-week moving windows over the last six months.
- Category 2. Variable Process Control: Establishments that meet the standard for all completed 52-week moving windows but have results greater than 50 percent of the standard during any completed 52-week moving window over the last six months.
- Category 3. Highly Variable Process Control: Establishments that have exceeded the performance standard during any completed 52-week moving window over the last six months.

Based on previous history, it is assumed that facilities will have the incentive to try to be listed as a Category 1 facility. The Agency's policy of web-posting establishments' process control performance has stimulated improvement in industry performance, as was shown in the Agency's experience after announcing in 2006 that it was considering posting the names of broiler and turkey slaughter establishments in Category 2 and Category 3. Within two years of the announcement, but before names were actually posted, the number of broiler slaughter establishments that had been in Category 3 decreased by 66 percent.

Chicken Parts

FSIS used sample results from the RCPBS to estimate the number of chicken parts establishments expected to not meet the standard by HACCP size and by production volume. Then, using the distribution of establishments already applying antimicrobial interventions displayed in Table 3, FSIS estimated how many of those establishments expected to not meet the standard apply antimicrobials and therefore have the necessary equipment, and how many would need to purchase new equipment. FSIS assumed that low volume establishments would purchase a single hand-held sprayer at a cost of approximately $425,[11] medium volume establishments

[11] FSIS calculated this cost estimate using guidance developed by the Pennsylvania State University Department of Food Science, Texas Tech University Department of Animal Science and Food Technology, and Washington State

would purchase three (one for each major part sampled – breast, leg, wing) automated spray or dip machines at a cost of approximately $55,591[12] each, and large volume establishments would purchase six automated spray or dip machines at a cost of approximately $55,591 each. FSIS assumed that establishments would spend approximately 20% of their total equipment and installation costs annually in the form of operating, maintenance, and insurance costs. FSIS is seeking comment on the accuracy of these cost assumptions.

Since it is impossible to predict which establishments will choose to implement changes to meet the new performance standards, FSIS assumed a uniform distribution so that every establishment not meeting the standard was equally likely to make changes. This distribution is analytically consistent with the 2015 Risk Assessment and was applied to the predicted set of establishments not meeting the standard, by HACCP size and production volume category, for each assumed level of compliance (30%, 40%, 50%). For example, to compute the cost of equipment implementation for the HACCP size large, production volume large establishments, FSIS multiplied 83 establishments (Table 2) x 63% of establishments not meeting the standards (Table 5) x (1-56%) HACCP size large establishments without antimicrobial equipment (Table 3) x 30% compliance level of establishments not meeting the standard x 6 automated antimicrobial machines x $55,591 cost per machine = $2.32 million total implementation cost for HACCP size large, production volume large establishments, split evenly between year 1 and year 2 (assumed implementation plan). This results in a year one cost of $1.16 million, a year 2 cost of $1.39 million (year 2 implementation cost + 20% of year 1 implementation cost for operating,

---

University Department of Food Science and Nutrition. Available at: http://www.meathaccp.wisc.edu/validation/assets/acid_spray_intervention_booklet_from_Penn_State_2005.pdf

[12] Cost estimated based on addition of TSP rinse system, with an estimated installation cost of approximately $40,000 adopted from pg. 38978 of the Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule, available at: http://www.fsis.usda.gov/wps/wcm/connect/e113b15a-837c-46af-8303-73f7c11fb666/93-016F.pdf?MOD=AJPERES. Cost adjusted for inflation by a factor of 1.3898 using the Bureau of Labor Statistics All Urban Consumer Price Index, available at: http://www.bls.gov/cpi/cpid1404.pdf

maintenance, and insurance), and year 3-10 costs of $0.46 million (total implementation cost x 20% for operating, maintenance, and insurance). These costs annualized over 10 years at a 7 percent discount rate results in an annualized cost of $0.67 million. This calculation must be reproduced for the remaining HACCP size and production volume strata and summed to estimate the total annualized capital equipment cost of $1.86 million, assuming a level of establishments not meeting the standard of 30%. The results of the capital equipment cost estimates are displayed in Table 6.

Table 6. Chicken Parts Capital Equipment Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Estimated Equipment Costs ($mil)
30%	1.86
40%	2.48
50%	3.10

[1]Costs annualized at a discount rate of 7% over 10 years.

In addition to the equipment needed to apply the antimicrobial solution to product, establishments will incur costs for the antimicrobial agents themselves. FSIS used cost estimates of $0.00807 per mL of PAA[13] and $2 per 1000 gallons of water[14] to price a gallon of 180-200 ppm PAA solution at approximately $0.032.[15] In order to account for uncertainty in the types and prices of antimicrobials which industry will implement, FSIS calculated bounding estimates using solution costs of $0.022 per gallon (-$0.01) and $0.042 per gallon (+$0.01).

Just as it is impossible to predict the establishments which will choose to make changes to their chicken parts interventions, it is also impossible to determine exactly what volume of

[13] Price estimate adopted from a University of Georgia Food Science Extension Outreach Program experiment, calculations available at: http://www.fsis.usda.gov/wps/wcm/connect/2fc604e6-52d2-4638-91f9-9b5e6bd038df/New_Technology_C-28___C-29_Lactic-Peroxyacetic_Wash_FY2003.pdf?MOD=AJPERES. Cost adjusted for inflation by a factor of 1.0995 using the Bureau of Labor Statistics All Urban Consumer Price Index, available at: http://www.bls.gov/cpi/cpid1404.pdf

[14] http://water.epa.gov/lawsregs/guidance/sdwa/upload/2009_08_28_sdwa_fs_30ann_dwsrf_web.pdf

[15] 4 mL of PAA combines with 1 gallon of water to obtain a 180-200 ppm solution (see footnote 13). (4mL x $0.00807) + (1/1000 gal *$2) = $0.0323/gal

product will be treated and how much antimicrobial solution will be required. Not all product from establishments not meeting the standard are equally contaminated, consequently, product treated at one establishment does not necessarily result in the same reduction in prevalence that product treated at another establishment might. Therefore, the same illness reduction goal may be met with varying amounts of treated product. FSIS used the simplifying assumption that for each level of compliance, that compliance percentage of product would receive treatment. In other words, since 73% of product volume is expected to initially not meet the standard, 22%, 29%, and 37% of all chicken parts are expected to be treated, respectively, so that 30%, 40%, and 50% of establishments initially not meeting the standard come into compliance.

In addition, FSIS estimated the volume of antimicrobial solution that would be required to treat the differing volume of parts. The amount of solution needed to treat a pound worth of chicken parts will differ depending on the type of parts. For example, smaller parts such as wings will have a larger ratio of surface area to weight than larger parts such as legs, and will therefore require more antimicrobials to achieve full product coverage. Differences may also occur as a result of the way the solution is applied. For example, a product dip machine may achieve full product coverage with less antimicrobial solution than a spray machine would because of the potential for wasted solution in the form of spray that does not contact product. FSIS assumed that the average surface area of a chicken part is approximately 250 cm^2, the average weight of a chicken part is approximately 6 ounces, and the amount of solution required to ensure full product coverage is approximately 2 mL per cm^2 of surface area. FSIS is seeking comment on the accuracy of these assumptions. Using these figures FSIS estimated that a gallon of antimicrobial solution will cover approximately 28.4 pounds of chicken parts product.[16]

[16] 1 gal = 3785.41 mL; 3785.41 mL / 0.2 mL/cm^2 = 18927.05 cm^2; 18927.05 cm^2 / 250 cm^2/part = 75.71 parts; 75.71 parts x 6 oz. = 454.25 oz.; 454.25 oz. / 16oz/lb. = 28.39 lbs.

Table 7 displays estimates for product coverage and the cost of antimicrobials. The overall volume of parts produced was ascertained from RCPBS data, then multiplied by the percentage expected to be treated (22%, 29%, 37%) depending on the level of establishments meeting the standard, as explained previously. The gallons of antimicrobial solution calculated for each product volume level was then multiplied by the antimicrobial cost estimate. For example, 22,873 million pounds of product (RCBPS) x 22% or product expected to be treated (assuming 30 % compliance level of establishments not meeting the standard) / 28.4 pounds of product per gallon of solution x $0.034 (-$0.01, +$0.01) price per gallon = approximately $6.02 million ($4.25 million, $7.80 million) in annual antimicrobial costs. Keeping with the implementation plan assumed for the capital equipment, this results in approximately $3.01 million ($2.13 million, $3.90 million) in first year costs (50% of the total annual costs), and $6.02 million ($4.25 million, $7.80 million) in recurring costs from year two onward. Annualized over 10 years at a 7 percent discount rate, this results in annualized costs of approximately $5.65 million ($4.00 million, $7.29 million).

Table 7 Chicken Parts Antimicrobial Solution Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Affected Annual Volume (Million lbs.)	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	5,009.22	5.65	4.00	7.29
40%	6,678.96	7.53	5.33	9.72
50%	8,348.70	9.41	6.67	12.16

[1]Costs annualized at a discount rate of 7% over 10 years.

Establishments will also accrue costs as they implement sampling programs for *Salmonella* and *Campylobacter*. Using the same approach taken for capital equipment costs, FSIS used establishment estimates from the RCPBS and establishment testing percentages from the Poultry Checklist Survey (see Table 3) to estimate testing costs. For those establishments already testing for both pathogens FSIS assumed there would be no additional costs, otherwise

any establishment making changes would have to pay for the additional testing of one pathogen (if the establishment already tested for *Salmonella*) or both pathogens (if the establishment did not test for either).

While screening for pathogens is used for process validation and control, the practice does not contribute directly to pathogen reduction; therefore FSIS assumed that HACCP size very small establishments would choose to forego testing to save themselves the expense. This assumption is supported by the results of the Poultry Checklist Survey, which shows that 97% of very small chicken parts establishments and 91% of very small NRTECP establishments do not test for *Salmonella* or *Campylobacter*. FSIS assumed that all HACCP size large establishments which do not meet the standard would choose to implement testing programs given their resources. For HACCP size small establishments, FSIS assumed that only those implementing interventions (the level of establishments not meeting the standard) would also choose to test for pathogens. For high volume establishments FSIS assumed 6 to 12 samples taken per day, for medium volume establishments 3 to 6 samples per day, and for low volume establishments 1 to 2 sample per day. FSIS is seeking comment on the accuracy of these assumptions.

FSIS applied the percentages of establishments already testing for pathogens to the predicted establishments not meeting the standard. Then FSIS applied the preceding assumptions to calculate the number of establishments adopting sampling programs and the number of samples per day those establishments would require. In order to determine the sampling costs, FSIS used results from a 2005 FSIS industry survey of poultry slaughter and processing plants[17] to estimate, by HACCP size, the number of plants which have an in-house lab available and the number of plants which would use contract labs. FSIS assumed that for

[17] RTI International. (2005) Survey of Meat and Poultry Slaughter and Processing Plants Final Report. Table 6-7. Available at: http://www.fsis.usda.gov/wps/wcm/connect/fcba64f6-8fd9-4b60-96f4-a6b0d400f5b9/SRM_Survey_Slaughter___Processing_Plants.pdf?MOD=AJPERES

each pathogen (2 per sample) those establishments using contract labs would incur costs of approximately $30.00, and those with in-house labs would incur costs of approximately $20.00.[18] FSIS further assumed that there would be labor costs involved with the sampling, equal to 15 minutes of a Quality Control (QC) Technician's time. FSIS estimates that the hourly wage rate of a QC Technician is approximately $23.18.[19] To account for the additional costs establishments must pay employees for benefits such as paid leave, health insurance, and retirement and savings, FSIS applied a benefits factor of 1.43[20] to the hourly wage rate to estimate a total compensation rate of $33.16 per hour. Therefore the additional sampling cost is equal to approximately $8.29. FSIS is seeking comment on the accuracy of these estimates. Finally, FSIS applied the price per sample to the projected number of additional samples to estimate total sampling costs, shown in Table 8.

For example, to estimate the costs to HACCP size large, production volume large establishments, FSIS multiplied 83 establishments (Table 2) x 63% of establishments not meeting the standards (Table 5) x $28.84 weighted testing cost=[94.5% in-house lab (footnote 19) x $20 per pathogen + (1-94.5%) contract lab (footnote 19) x $30 per pathogen + $8.29 sampling cost] x 1.59 weighted number of tests needed per sample=[15% *Salmonella* only sampling (Table 4) x 1 test per sample + (1-15%-13%) no sampling (Table 4) x 2 tests per sample] x 9 samples per day (low estimate of 6, high estimate of 12) x 260 days per year = $5.61 million ($3.74 million, $7.48 million) annual testing costs for HACCP size large, production

[18] Agency expert opinion.
[19] Estimate obtained from the Bureau of Labor Statistics May 2013 National Industry-Specific Occupational Employment and Wage Estimates, for First-Line Supervisors of Production and Operating Workers (Occupational Code 51-1011) in the Animal Slaughtering and Process Industry (NAICS code 311600)Available at: http://www.bls.gov/oes/2013/may/naics4_311600.htm
[20] The estimated benefits percent share of total compensation for private industry30.1%, with the remaining 69.9% attributed to wages and salaries. Therefore, the factor needed to multiply to wage rate to determine total compensation rate is: (30.1% / 69.9%) + 1 = 1.43. BLS Report available at: http://www.bls.gov/news.release/ecec.nr0.htm

volume large establishments. Similar calculations are performed for the remaining HACCP size large establishments and for small establishments testing for *Salmonella* only. For small establishments which currently do not test, a similar calculation is performed with the addition of a 30%, 40%, or 50% factor representing the level of establishments not meeting the standard. The results of these estimates are summed and annualized to create the total annualized sampling estimates displayed in Table 8.

Table 8. Chicken Parts Pathogen Sampling Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	7.94	5.30	10.59
40%	8.40	5.60	11.20
50%	8.85	5.90	11.80

[1]Costs annualized at a discount rate of 7% over 10 years.

In order to ensure that their HACCP systems are functioning correctly, each establishment which implements new interventions will need to reassess and validate their HACCP plan. FSIS assumed that the reassessment will be performed by a Quality Control (QC) Manager, and will take approximately two hours to complete.[21] FSIS estimates that the hourly wage rate of a QC Manager is approximately $37.90.[22] To account for the additional costs establishments must pay employees for benefits, FSIS applied a benefits factor of 1.43[23] to the hourly wage rate to estimate a total compensation rate of $54.22 per hour. Therefore, the cost of each one-time HACCP plan reassessment is approximately $108.44. FSIS multiplied this cost

[21] This assumption is consistent with the annual reassessment component of the Pathogen Reduction; Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule, pg. 38983. Available at: http://www.fsis.usda.gov/wps/wcm/connect/e113b15a-837c-46af-8303-73f7c11fb666/93-016F.pdf?MOD=AJPERES

[22] Estimate obtained from the Bureau of Labor Statistics May 2013 National Industry-Specific Occupational Employment and Wage Estimates, for Industrial Production Managers (Occupational Code 11-3051) in the Animal Slaughtering and Process Industry (NAICS code 311600)Available at: http://www.bls.gov/oes/2013/may/naics4_311600.htm

[23] See footnote 20.

by the number of establishments making changes to their processes to determine the total cost to the chicken parts industry for HACCP plan reassessment.

In addition to costs associated with HACCP plan reassessment, establishments will incur costs for employee training. Production employees will need to learn how to mix the antimicrobial solution, operate any new equipment, and perform any additional observational tasks to ensure that the process is effectively applying antimicrobials to the product. FSIS assumed that one production employee would need to be trained per processing shift and that very small establishments would operate with one shift, and small and large establishments would operate with two shifts. Furthermore, FSIS assumed that training would take approximately one hour and would be led by the QC manager. FSIS estimated the total hourly compensation rate of a production employee to be $12.41.[24] Therefore, for very small establishments the one-time training would cost approximately $66.63, and for small and large establishments the one-time training would cost approximately $79.04.[25] These costs will be realized on the year establishments choose to implement new interventions.

Establishments will accrue additional costs due to employee turnover. As the production employees responsible for ensuring proper antimicrobial application leave over time, new hires will need to be trained to replace them. To estimate annually recurring training costs, FSIS used a turnover rate of 25.6%[26] and applied it to the one-time training costs previously calculated. For very small establishments, training due to labor turnover will cost approximately $17.06

[24] Wage estimate of $11.12 obtained from the Bureau of Labor Statistics May 2013 National Industry-Specific Occupational Employment and Wage Estimates (see footnote 22), for the Butchers and Other Meat, Poultry, and Fish Processing Workers (Occupational Code 51-3020) in the Animal Slaughtering and Process Industry (NAICS code 311600). FSIS assumed that companies would compensate these employees with only the legally required benefits, estimated at 8.1% of total compensation (see BLS report referenced in footnote 22). FSIS multiplied the wage rate by a benefits factor of 1.12 ((8.1% / 69.9%) + 1) to obtain a total compensation rate of $12.41 per hour.
[25] Very small: 1 production employee at $12.41 + one QC manager at $54.22 = $66.63. Small and large: 2 production employees at $12.41 + one QC manager at $54.22 = $79.04.
[26] Annual total separations rate for nondurable goods, Bureau of Labor Statistics Job Openings and Labor Turnover Survey, available at: http://www.bls.gov/news.release/jolts.t16.htm

annually, and for small and large establishments, training due to labor turnover will cost approximately $20.23 annually. These costs will begin the year after establishments choose to implement new interventions.

Table 9 displays one-time HACCP plan reassessment, one-time training, and recurring training costs associated with establishments implementing interventions. FSIS assumes costs for retraining will be negligible.

Table 9. Chicken Parts HACCP Plan Reassessment and Employee Training Costs

Level of Establishments Not Meeting the Standard	Component	Cost Estimate ($1000)
30%	HACCP Reassessment	7.81
	One-time Training	5.45
	Recurring Training	1.40
	Total Costs Annualized[1]	2.83
40%	HACCP Reassessment	10.41
	One-time Training	7.27
	Recurring Training	1.86
	Total Costs Annualized[1]	3.77
50%	HACCP Reassessment	13.01
	One-time Training	9.09
	Recurring Training	2.33
	Total Costs Annualized[1]	4.72

[1]Costs annualized at a discount rate of 7% over 10 years.

Not Ready-to-Eat Comminuted Poultry

The costs associated with not ready-to-eat comminuted poultry (NRTECP) are similar to the costs associated with chicken parts. As with parts, the components that are used to create NRTECP will be treated with antimicrobials using spray or dip machines, and like parts, comminuted product will be sampled. FSIS used sampling data from the NCPESP to estimate the number of establishments not meeting the standard by HACCP size and product volume. Eight establishments produce both comminuted chicken and comminuted turkey. Since none of the eight are considered high volume, FSIS assumed that these establishments would not have

separate equipment for different species and would instead rotate product along the same processing line. This enabled FSIS to combine the chicken and turkey establishments into one NRTECP population.

FSIS predicts that approximately 61% of the 114 NRTECP-producing establishments will initially fall short of at least one of the *Salmonella* standards (either chicken or turkey). Those that choose to implement antimicrobial interventions will use similar equipment to what is used to apply solution to chicken parts. Therefore, as was done with parts, FSIS estimated that low volume establishments would purchase a hand sprayer at approximately $425, medium volume establishments would purchase three automated spray or dip machines at a cost of approximately $55,591 each, and large volume establishments would purchase six automated spray or dip machines at a cost of approximately $55,591 each.

Using results from the Poultry Checklist Survey (see Table 2) FSIS estimated the percentage of establishments already applying antimicrobials and the percentage of those that are not. Then, using the same uniform distribution assumption and the same calculation procedures as were used with chicken parts interventions, FSIS created cost estimates for each level of establishments not meeting the standard. These estimates are displayed in Table 10.

Table 10. Comminuted Poultry Capital Equipment Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Estimated Equipment Costs ($mil)
30%	0.29
40%	0.38
50%	0.48

[1]Costs annualized at a discount rate of 7% over 10 years.

FSIS made the same cost assumptions and the same steps used to compute antimicrobial costs for chicken parts to estimate the cost to establishments to treat NRTECP components. One gallon of antimicrobial solution is expected to cost $0.032, varying by approximately $0.01 per

gallon in either direction. Each gallon of solution is estimated to be able to provide 28.4 pounds worth of product coverage. Daily volume data for ground product from PHIS were extrapolated (assuming on average 5 working days per week, for 260 working days per year) to approximate the total amount of product which would be treated per year for each level. The cost estimates for antimicrobials are shown in Table 11.

Table 11. NRTECP Antimicrobial Solution Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Affected Annual Volume (Million lbs.)	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	862.86	0.89	0.61	1.17
40%	1,150.48	1.19	0.81	1.56
50%	1,438.10	1.48	1.01	1.96

[1]Costs annualized at a discount rate of 7% over 10 years.

FSIS made the same assumptions about product sampling for NRTECP as it did for chicken parts. All HACCP size large establishments that initially do not meet the standard will begin to test if they aren't already doing so, no HACCP size very small establishments will implement a testing program, and the number of HACCP size small establishments that begin to test will be equally proportionate to the compliance level. High volume establishments will take 6 to 12 samples per day, medium volume will take 3 to 6 per day, and very small volume will take 1 to 2 per day. The distribution of in-house laboratories by HACCP size is the same distribution used for parts, taken from the 2005 FSIS industry survey. The same cost estimates for pathogen testing were also used ($20.00/pathogen/sample for in-house labs and $30.00/pathogen/sample for contract labs, plus $8.29/pathogen/sample labor costs), and the steps for arriving at the annualized estimates are the same as those used for chicken parts. The results of the sampling cost estimate calculation are displayed in Table 12.

Table 12. NRTECP Pathogen Sampling Cost Estimates[1]

Level of Establishments Not Meeting the Standard	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	1.33	0.88	1.77
40%	1.42	0.92	1.85
50%	1.55	1.01	2.01

[1]Costs annualized at a discount rate of 7% over 10 years.

Comminuted poultry establishments also must reassess their HACCP plans and train employees to ensure proper antimicrobial implementation. In addition to these one-time costs, establishments will accrue costs for further training of new employees due to turnover. To estimate the costs associated with these actions, FSIS followed the same procedures as was described earlier for chicken parts. The results of these cost estimates are displayed in Table 13.

Table 13. NRTECP HACCP Plan Reassessment and Employee Training Costs[1]

Level of Establishments Not Meeting the Standard	Component	Cost Estimate ($1000)
30%	HACCP Reassessment	2.26
	One-time Training	1.62
	Recurring Training	0.42
	Total Costs Annualized[†]	0.83
40%	HACCP Reassessment	3.02
	One-time Training	2.16
	Recurring Training	0.55
	Total Costs Annualized[†]	1.11
50%	HACCP Reassessment	3.77
	One-time Training	2.70
	Recurring Training	0.69
	Total Costs Annualized[†]	1.39

[1]Costs annualized at a discount rate of 7% over 10 years.

Implementation Timeline

Establishments will take time to implement the changes to their processes, and not all establishments will decide to make these changes immediately. In order to assess how costs would affect industry over time, FSIS made an assumption about the timing of implementation.

Within the first year of performance standards taking effect, FSIS assumed that 50% of the establishments that will eventually take action will have implemented changes (e.g. assuming that 50% of establishments initially not meeting the standard will eventually make changes to meet the standard, 25% of those establishments will do so in the first year). FSIS assumes that the remaining 50% will make changes and will meet the standards in the second year.[27]

Note, however, due to the 52-week moving window for determining performance with the new standards, an establishment that has exceeded the maximum allowable percent positive and is listed as a Category 3 establishment on the FSIS website will not be re-categorized as a Category 2 or Category 1 establishment until a number of negative samples are recorded and the positive test results fall off the 52-week window, at which point the establishment will have to maintain a level below the standard for six months. The amount of time that it would take an establishment to be re-categorized in this way is dependent on the efficacy of the remediation efforts taken.

Under the six-month period, establishments can expect to remain in a category no shorter than 26 weeks. This lower bound is based on a scenario where an establishment has all their positives clustered at the beginning of the moving window. Alternatively, if an establishment has all their positives clustered at the end of the moving window, it would take a minimum of 69 weeks to change category. However FSIS does not believe these extreme scenarios are likely. FSIS conducted an analysis of its current set-based verification sampling and determined that the appearance of *Salmonella* positives was essentially random. This suggests that positives would be more evenly distributed over the moving window and not clustered.

[27] These assumptions are consistent with those made for the new broiler carcass standards (75 FR 27288). Available at: http://www.fsis.usda.gov/wps/wcm/connect/49d574f1-b0cc-4777-ab08-98f1c50455f2/2009-0034.pdf?MOD=AJPERES

By spreading the expected implementation of interventions equally over two years, the costs for capital equipment, HACCP plan reassessment, and initial employee training are also dispersed between the first and second year. Antimicrobial costs will be 50% of the annual cost estimated for the first year, since only 50% of the establishments will have made changes, and then reach the full level for the second year and years forward. Likewise, sampling costs will be 50% of those estimated in the first year, and then reach the full costs for every year after. Recurring training costs to account for turnover are applied similarly, but begin at 50% in the second year, and reach full level in the third year (it is assumed that employees undergoing the initial training will not immediately leave, therefore turnover training costs begin to accrue one year after interventions are implemented). While the actual timeline of implementation will not occur in such a stepwise manner, making this assumption allows FSIS to create a straightforward approximation of costs annualized over 10 years. Industry costs by year are displayed in Table 14. Annualized industry costs are made available in Table 15.

Table 14. Total Industry Costs – Implementation Timeline

Level of Establishments Not Meeting the Standard	Cost Component	Year 1 Costs ($mil)	Year 2 Costs ($mil)	Year 3-10 Costs ($mil)
30%	Capital Equipment	3.40	4.09	1.36
	Antimicrobial Solution	3.50	7.00	7.00
	Sampling	4.96	9.93	9.93
	HACCP Reassessment & Training	0.01	0.01	*
	Total Costs	11.88	21.03	18.29
40%	Capital Equipment	4.39	5.27	1.76
	Antimicrobial Solution	4.67	9.34	9.34
	Sampling	5.26	10.52	10.52
	HACCP Reassessment & Training	0.01	0.01	*
	Total Costs	14.32	25.13	21.61
50%	Capital Equipment	5.67	6.81	2.27
	Antimicrobial Solution	5.83	11.67	11.67
	Sampling	5.57	11.14	11.14
	HACCP Reassessment & Training	0.01	0.02	*
	Total Costs	17.09	29.64	25.08

*$1,900 at 30%, $2,500 at 40%, $3,100 at 50% – values too small to display in table.

Table 15. Total Industry Costs Annualized[1]

Level of Establishments Not Meeting the Standard	Cost Component	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	Capital Equipment	2.15	-	-
	Antimicrobial Solution	6.54	4.61	8.46
	Sampling	9.27	6.18	12.36
	Reassessment & Training	*	-	-
	Total Costs	17.96	12.94	22.97
40%	Capital Equipment	2.86	-	-
	Antimicrobial Solution	8.72	6.14	11.28
	Sampling	9.82	6.52	13.05
	Reassessment & Training	*	-	-
	Total Costs	21.4	15.52	27.19
50%	Capital Equipment	3.58	-	-
	Antimicrobial Solution	10.89	7.68	14.12
	Sampling	10.40	6.91	13.81
	Reassessment & Training	*	-	-
	Total Costs	24.87	18.17	31.51

[1]Costs annualized at a discount rate of 7% over 10 years.

*$3,800 at 30%, $5,100 at 40%, $6,400 at 50% – values too small to display in table.

IV. Expected Costs – Agency

FSIS does not expect the Agency to incur any budgetary impacts as a result of introducing new performance standards. The two major components of the performance standards – product sampling and follow-up actions – will be implemented in such a way that they are resource neutral. FSIS is not expanding the number of samples it will analyze. Instead, it will reallocate samples from other programs, specifically the young chicken and turkey sampling programs for *Salmonella* and *Campylobacter*, as FSIS sampling moves to a moving window (explained in detail in the accompanying Federal Register Notice). Therefore the number of samples being collected and analyzed will remain the same, and FSIS will not need to invest in additional laboratory equipment or additional personnel.

The resources required for enforcement actions, namely Food Safety Assessments (FSAs), will also remain unchanged. FSIS intends to maintain its combination risk-based and district-directed FSA scheduling protocol. This will ensure that Enforcement Investigations and Analysis Officers and other FSIS personnel are not overburdened with the number of FSAs scheduled. By maintaining and reallocating resources, there will inevitably be trade-offs in performance with the areas where resources are being taken away. FSIS did not attempt to monetize these trade-offs due to their complexity and the uncertainty around them. FSIS will conduct an ongoing retrospective analysis to confirm the effects on Agency resources. To do so, FSIS will examine the following:

- Allocation of sampling data
- Number, length, and outcome of food safety assessments initiated as a result of the proposed performance standards.

This review will enable FSIS to better assess the effects of the change in policy and identify areas that could be further improved.

V. Expected Benefits

As establishments make changes to their production processes and reduce the prevalence of *Salmonella* and *Campylobacter* in chicken parts and NRTECP, public health benefits will be realized in the form of averted illnesses. As discussed in the 2015 Risk Assessment, using a distribution of foodborne illnesses by commodity,[28] estimates of the proportion of poultry consumed as chicken parts and NRTECP, and estimates of annual *Salmonella* and *Campylobacter* foodborne illnesses,[29] FSIS estimated the number of annual illnesses attributed to products under the new performance standards. FSIS then estimated the number of illnesses which could be averted under the new performance standards.[30] The results of this calculation are shown in Table 16.

[28] Painter et al. (2013) Attribution of Foodborne Illnesses, Hospitalizations, and Deaths to Food Commodities by using Outbreak Data, United States, 1998–2008. *Emerging Infectious Diseases, Volume 19 (3).* Available at: http://dx.doi.org/10.3201/eid1903.111866

[29] Scallan et al. (2011) Foodborne illness acquired in the United States—major pathogens. *Emerging Infectious Diseases, Volume 17 (1).* Available at: http://dx.doi.org/10.3201/eid1701.P11101

[30] See footnote 10.

Table 16. Annual Illnesses Averted (2015 Risk Assessment)

Product	Level of Establishments Not Meeting the Standard	*Salmonella*	*Campylobacter*
Chicken Parts	50%	29,000 (18,900 – 45,400)	14,300 (8,400 - 23,100)
	40%	19,900 (13,100 – 31,400)	11,400 (6,700 – 18,500)
	30%	11,000 (7,200 – 17,100)	8,600 (5,000 – 13,900)
NRTECP	50%	5,500 (3,500 – 8,300)	1,800 (1,000 – 2,700)
	40%	4,400 (2,800 – 6,600)	1,400 (800 – 2,200)
	30%	3,300 (2,100 – 5,000)	1,000 (600 – 1,600)

FSIS used cost of illness estimates for *Salmonella* of $2,423[31] and for *Campylobacter* of $2,067[32] to quantify the effect that these averted illnesses would have on the economy. Since benefits will only accumulate once interventions are made, FSIS assumed that the annual level of public health benefits will mirror the expected implementation timeline (50% in the first year, 100% every year thereafter). A range of estimates was calculated to reflect the uncertainty in the underlying foodborne illness distribution.[33] Table 17 displays estimated public health benefits, along with lower and upper bounds, associated with potential levels of compliance.

Table 17. Public Health Benefits Annualized[1]

Level of Establishments Not Meeting the Standard	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	50.87	31.84	79.89

[31] The FSIS estimate for the cost of *Salmonella* ($2,423 per case,—2010 dollars) was developed using the USDA, ERS Foodborne Illness Cost Calculator: *Salmonella* (June 2011) http://webarchives.cdlib.org/sw1rf5mh0k/http:/www.ers.usda.gov/Data/FoodborneIllness/ (archived link – calculator currently being updated). FSIS updated the ERS calculator to incorporate the Scallan (2011) case distribution for Salmonella (see footnote 29).

[32] Batz, Hoffmann, and Morris. (2014). Disease-Outcome Trees, EQ-5D Scores, and Estimated Annual Losses of Quality-Adjusted Life Years (QALYs) for 14 Foodborne Pathogens in the United States. *Foodborne Pathogens and Disease, Volume 11 (5):* 395-402.

[33] See footnote 28

40%	79.66	50.43	125.89
50%	109.10	68.80	171.24

[1]Benefits annualized at a discount rate of 7% over 10 years.

VI. Summary of Net Benefits

Table 18 displays the total costs and benefits expected from the implementation of performance standards for chicken parts and comminuted poultry. All values have been annualized over 10 years at a 7% discount rate. For all the levels considered, the performance standards result in net benefits.

Table 18. Summary of Estimated Net Benefits[1]

Level of Establishments Not Meeting the Standard	Cost/Benefit Component	Primary Estimate ($mil)	Low Estimate ($mil)	High Estimate ($mil)
30%	Industry Costs	18.0	12.9	23.0
	Public Health Benefits	50.9	31.8	79.9
	Net Benefits	32.9	18.9	56.9
40%	Industry Costs	21.4	15.5	27.2
	Public Health Benefits	79.7	50.4	125.9
	Net Benefits	58.3	34.9	98.7
50%	Industry Costs	24.9	18.2	31.5
	Public Health Benefits	109.1	68.8	171.2
	Net Benefits	84.2	50.6	139.7

[1]All costs (savings) annualized at a discount rate of 7% over 10 years.

VII. Effect on Small Businesses

FSIS examined how the introduction of new performance standards would affect small businesses, using small and very small HACCP size establishments as a proxy. Cost estimates were calculated for these establishments, both in the aggregate (Table 19) and on average (Table 20). It should be noted that the averages reported are averages across establishments choosing to add interventions. Those small and very small establishments that are already in line with the performance standards and those that choose not to make changes will incur no costs.

Table 19. Estimated Total Annualized[1] Costs to Small and Very Small Establishments

	Total Costs Annualized			
Level of Establishments Not Meeting the Standard	**Affected Establishments**	**Primary Estimate ($mil)**	**Minimum Estimate ($mil)**	**Maximum Estimate ($mil)**
30%	62	3.64	2.98	4.31
40%	82	4.67	3.78	5.56
50%	103	5.7	3.52	6.81

[1]Annualized over 10 years at a 7% discount

Table 20. Estimated Average Annualized[1] Cost per Small and Very Small Establishment

Product	**Small ($1000)**	**Very Small ($1000)**
Chicken Parts	67.4	7.9
NRTECP	53.7	9.1

[1]Annualized over 10 years at a 7% discount

VIII. International Trade Implications

The addition of performance standards to chicken parts and NRTECP could result in benefits to US poultry exports. Establishments that choose to improve their processes to meet the new standards will produce a higher quality product, which will benefit those firms' reputations. Such increases in product safety reputation have the potential to grow the sales of

those exporting firms.[34] In addition, as the average quality of exported product improves, the US poultry industry could benefit from a widespread increase in reputation and sales.

Such benefits to exporters could be tempered at the outset due to the large number of establishments initially not meeting the performance standard. Since FSIS anticipates approximately 67% of chicken parts establishments and approximately 61% of NRTECP establishments to initially not meet the standard, there is the potential for a shock to reputation despite the fact that the overall quality of US product will not have diminished. In order to prevent the high initial rate from negatively impacting exports, FSIS will have to make it clear that the introduction of performance standards is a positive step in the safety of US poultry, and that initial results are not necessarily indicative of problems of food safety. In doing so FSIS may be able to partially mitigate any adverse trade effects, and as the quality of product begins to improve, these effects will be eliminated entirely.

FSIS expects the new performance standards to have little to no impact on poultry imports. Since these are not *minimum* performance standards (i.e. passing results will not be required for establishments to sell product into commerce), the standards will have no effect on equivalent inspection systems and import eligibility. Therefore the introduction of standards will not create any barriers to trade and will not directly cause any changes in the quantity of product imported by the US. Improvements in the quality of domestic poultry as a result of new standards could potentially indirectly affect the amount of imports; however such impacts would likely be minimal.

[34] Buzby. (2003) International Trade and Food Safety: Economic Theory and Case Studies. *Agricultural Economic Report No. 828.* Available at: http://www.ers.usda.gov/publications/aer-agricultural-economic-report/aer828.aspx#.U4SydvldVyx