

UNITED STATES DEPARTMENT OF AGRICULTURE
FOOD SAFETY AND INSPECTION SERVICE

Petition for an Interpretive Rule)
Declaring Antibiotic-Resistant)
Salmonella Heidelberg, *Salmonella* Hadar,)
Salmonella Newport, and *Salmonella*)
Typhimurium in Meat and Poultry)
to be Adulterants)
_____)

Docket No. _____

CITIZEN PETITION

Submitted by:

Center for Science in the Public Interest

October 1, 2014

October 1, 2014

FSIS Docket Clerk
Department of Agriculture
Food Safety and Inspection Service
Room 2534 South Building
1400 Independence Avenue, S.W.
Washington, DC 20250-3700

I. REQUESTED ACTIONS

A. Requested Action In Brief

The Center for Science in the Public Interest (CSPI) is requesting that the Food Safety and Inspection Service (FSIS) declare each of four strains of antibiotic-resistant (ABR) *Salmonella* to be adulterants in meat and poultry. We request that the agency take this action through interpretive rulemaking on all four strains jointly or on each strain individually (if the agency concludes that one or more do not merit such treatment). Additionally, in light of the serious public health threat posed by antibiotic-resistant *Salmonella*, we request the agency outline sampling and testing protocols to monitor for the presence of the pathogens in raw meat and poultry products and, when found, seek the recall of adulterated meat or poultry from the food supply without waiting for human illnesses to occur, as the agency does today. We, furthermore, request that the agency grant this petition expedited review.

B. Background

This petition is a refiling of a petition CSPI filed in May 2011, in which it asked FSIS to declare four strains of ABR *Salmonella* as adulterants when found in ground meats and poultry (hereafter called “the CSPI 2011 petition”). This 2014 petition is asking for expanded relief in the form of a declaration covering all meat and poultry products, on the basis of evidence attained since 2011 demonstrating that both ground and intact poultry products are causing outbreaks from ABR *Salmonella*. We ask the agency to consider all meat and poultry in responding to this

petition, and if the agency determines that the evidence supports limiting an adulteration declaration to one or more types of meat, based on evidence supporting such a limitation, CSPI would not object.

On July 31, 2014, USDA denied the petition “without prejudice” and asked CSPI to provide the agency with additional evidence to support its petition. In response to that denial, CSPI is refiling this petition with expanded factual and legal support, such that FSIS can consider each of those strains, jointly and individually. The legal and factual basis for the petition is contained herein; additional studies provided to the FSIS in response to its request for more information are contained in the Appendix, which is incorporated by reference.

In support of this petition, CSPI has documented a total of 19 outbreaks related to all strains of ABR *Salmonella* in FSIS-regulated products: 10 in beef, one in pork, and eight in poultry including three in ground turkey. The cases of ABR salmonellosis associated with those meat and poultry outbreaks were linked to 2,358 illnesses, 424 hospitalizations, and 8 deaths. In contrast, there were no outbreaks linked to six strains of shiga-toxin producing *E. coli* (STECs) in FSIS regulated products in 2011, when FSIS declared those strains to be adulterants in non-intact beef.

C. Issuance of an Interpretive Rule

Pursuant to 5 U.S.C. § 553(e), 9 C.F.R. § 392, and 7 C.F.R. § 1.28, we submit this petition requesting the administrator of FSIS either jointly or individually issue an interpretive rule declaring ABR *Salmonella* Heidelberg, ABR *Salmonella* Hadar, ABR *Salmonella* Newport, and ABR *Salmonella* Typhimurium (these four strains are referenced collectively herein as ABR *Salmonella*), when found in meat and poultry, to be adulterants within the meaning of the Federal Meat Inspection Act (FMIA) and the Poultry Products Inspection Act (PPIA). Both the FMIA and the PPIA definitions, found at 21 U.S.C. §§ 601(m)(1) and 453(g)(1) (hereinafter collectively “adulteration definitions”) state in pertinent part that a carcass, part thereof, meat, or meat food

product, or poultry product is adulterated "if it bears or contains any poisonous or deleterious substance which may render it injurious to health but in case the substance is not an added substance, such article shall not be considered adulterated under this clause if the quantity of such substance in or on such article does not ordinarily render it injurious to health."

This petition demonstrates that ABR *Salmonella* meets the legal definition of "adulterant" as an added substance. In addition CSPI has responded to FSIS's request for further information that would support a finding that ABR *Salmonella* is an adulterant, even if it was not an added substance.

In 1994, FSIS used an interpretive rule to declare *E. coli* O157:H7 to be an adulterant, indicating by its action that the agency has wide latitude to declare dangerous pathogens to be adulterants through interpretive rules.¹ In 2011, it again used an interpretive rule to declare six other serotypes of shiga-toxin producing *E. coli* (STECs) to be adulterants.²

The use of interpretive rulemaking is appropriate for microbial pathogens in the food supply as those hazards are constantly changing. FSIS's mandate to protect consumers from contaminated meat and poultry requires the agency to move rapidly to identify contaminants that cause illness, sometimes even during the course of an outbreak, and to take action to remove adulterated products from the market.³ When FSIS declares a pathogen to be a per se adulterant, the agency can take immediate enforcement action to prevent threats to public health when it finds the pathogen in a regulated food, rather than simply responding to outbreaks of illness linked to that food after they occur, as is the agency's practice today.

¹ Michael R. Taylor, *Change and Opportunity: Harnessing Innovation to Improve the Safety of the Food Supply*, Address at the 1994 American Meat Institute Annual Convention (Sept. 29, 1994) (hereinafter "Taylor 1994").

² Shiga Toxin-Producing *Escherichia coli* in Certain Raw Beef Products, 76 Fed. Reg. 58,157 (Sept. 20, 2011).

³ As stated in the FMIA, "It is essential in the public interest that the health and welfare of consumers be protected by assuring that meat and meat food products distributed to them are wholesome, not adulterated, and properly marked, labeled, and packaged." Federal Meat Inspection Act 21 U.S.C. § 602 (2014).

Scientific and medical research demonstrates that meat and poultry contaminated with ABR *Salmonella* pose grave public health dangers. Evidence of public health significance of these four *Salmonella* strains is documented below:

***Salmonella* Heidelberg:** Since 1997, ABR *S. Heidelberg* has been linked to six outbreaks involving over 1,600 cases of illness, 273 hospitalizations, and three deaths. Outbreaks linked to FSIS-regulated products include:

- ABR *S. Heidelberg* has been linked to two multi-state outbreaks involving over 750 cases of illness, including 233 hospitalizations, in more than 30 states.⁴ The source of the ABR *S. Heidelberg* was chicken parts and products produced by Foster Farms in three facilities in two states. The first outbreak occurred between June 2012 and January 2013. The second outbreak occurred between March 2013 and July 2014.
- In 2011, there was an outbreak linked to ABR *S. Heidelberg* in ground turkey, causing 136 cases of illness, 37 hospitalizations, and one death.⁵
- A 2005 outbreak of ABR *S. Heidelberg* in chicken caused four illnesses and one hospitalization.⁶ (In another 2005 ABR *S. Heidelberg* outbreak in Tennessee, causing 19 illnesses and two hospitalizations, the food source was unknown.)⁷
- In 1997, an ABR *S. Heidelberg* outbreak in Maryland linked to pork caused 706 illnesses and two deaths.⁸

***Salmonella* Typhimurium:** Since 1996, ABR *S. Typhimurium* has been linked to 13 outbreaks involving 558 cases of illness, 67 hospitalizations, and no deaths.⁹ Outbreaks linked to FSIS-regulated products include:

- In 2011, a seven state outbreak of ABR *S. Typhimurium* in ground beef sickened 20 people and hospitalized eight.
- In 2009, ABR *S. Typhimurium*, again in ground beef, sickened 14 people and hospitalized six people in seven states.
- In 2003, an outbreak of ABR *S. Typhimurium* DT104-contaminated ground beef sickened 56 people and hospitalized 11 in nine states.

⁴ CDC, Multistate Outbreak of *Salmonella* Heidelberg Infections Linked to Chicken (Final Update), July 2013, available at <http://www.cdc.gov/salmonella/heidelberg-02-13/index.html> (last accessed Sept. 29, 2014); CDC, Multistate Outbreak of Multidrug-Resistant *Salmonella* Heidelberg Infections Linked to Foster Farms Brand Chicken (Final Update), July 2014, available at <http://www.cdc.gov/salmonella/heidelberg-10-13/> Last accessed Sept. 29, 2014.

⁵ Caroline Smith DeWaal & Susan V. Grooters, *Antibiotic Resistance in Foodborne Pathogens* (2013), available at http://cspinet.org/new/pdf/outbreaks_antibiotic_resistance_in_foodborne_pathogens_2013.pdf, (last accessed Sept. 29, 2014). (Hereinafter “DeWaal 2013”) The specific antibiotic resistance patterns for each outbreak is contained in this document.

⁶ DeWaal 2013.

⁷ DeWaal 2013.

⁸ DeWaal 2013.

⁹ ABR *S. Typhimurium* has been linked to numerous outbreaks associated with animal products not regulated by FSIS. Pasteurized and unpasteurized dairy products have been linked to 11 outbreaks accounting for 17,014 illnesses, 2,863 hospitalizations, and 19 deaths.

***Salmonella* Newport:** Since 1975, ABR *S. Newport* has been linked to 14 outbreaks involving 845 cases of illness, 126 hospitalizations, and four deaths. Outbreaks linked to FSIS-regulated products include:

- In 2009, ABR *S. Newport*-contaminated ground beef was associated with two separate outbreaks: one that sickened two people in Arizona, and one that sickened 68 people and hospitalized four across 14 states.
- In 2007, an ABR *S. Newport* outbreak sickened 43 and hospitalized 15 after they consumed contaminated ground beef in Arizona, California, Idaho, and Nevada.
- In 2002, ABR *S. Newport* in ground beef sickened 47, hospitalized 17, and killed one in New York, Michigan, Pennsylvania, Ohio, and Connecticut.
- In 1985, an outbreak of ABR *S. Newport* associated with ground beef in California sickened 298, hospitalized 22, and killed two.
- In 1983, a four state outbreak (Minnesota, South Dakota, Nebraska, and Iowa) of ABR *S. Newport* in ground beef sickened 18, hospitalized 11, and killed one.

***Salmonella* Hadar:** Since 2006, ABR *S. Hadar* has been linked to 2 multi- and single-state outbreaks involving 21 cases of illness, four hospitalizations, and no deaths. Outbreaks linked to FSIS-regulated products include:

- In 2011, ABR *S. Hadar*-contaminated ground turkey sickened 12 and hospitalized three in a 10 state outbreak.

ABR *Salmonella* is associated with greater rates of hospitalizations, increased mortality and morbidity,¹⁰ and causes illnesses that are harder to treat than traditional salmonellosis.¹¹ These harms to consumers impose an immediate and compelling obligation on the agency to use its interpretive authority to declare ABR *Salmonella* to be an adulterant. Moreover, FSIS should adopt preventive measures through a comprehensive sampling program to spare consumers of meat and poultry the increased physical harm (including potential death) and expense due to ABR foodborne illnesses. FSIS is clearly aware that ABR *Salmonella* can be injurious to health, and therefore an adulterant, a fact that is well documented by the FSIS recalls initiated when ground beef and other products contaminated with ABR *Salmonella* are associated with illnesses or outbreaks. The following recalls are representative:¹²

¹⁰ Frederick J. Angulo & Kåre Mølbak, *Human Health Consequences of Antimicrobial Drug—Resistant Salmonella and Other Foodborne Pathogens*, 41 *Clinical infectious diseases* 1613 (2005).

¹¹ Alessandra Carattoli, *Plasmid-mediated antimicrobial resistance in Salmonella enteritidis*, 5 *Current Issues Molecular Biology* 113 (2003).

¹² FSIS does not have the ability to mandate recall of contaminated product. Nonetheless, it regularly requests recalls.

- **Mechanically Separated Chicken Recalled Due to ABR *Salmonella* Heidelberg (2014).** FSIS announced a recall of mechanically separated chicken on Jan. 10, 2014, after it was associated with seven illnesses and two hospitalizations caused by ABR *Salmonella* Heidelberg. Of nine human isolates tested, two showed resistance to ceftriaxone, an antibiotic that is commonly used to treat serious *Salmonella* infections.
- **Ground Turkey Recalled Due to ABR *Salmonella* Heidelberg (2011).** FSIS announced the recall of ground turkey contaminated with multi-drug resistant *Salmonella* Heidelberg on Aug. 3, 2011, after it was associated with 79 illnesses in 26 states. The isolates from ground turkey samples were resistant to antibiotics including ampicillin, streptomycin, tetracycline, and gentamicin. Isolates from humans were also resistant to ampicillin and tetracycline, and some were resistant to streptomycin and gentamicin.
- **Turkey Burgers Recalled Due to ABR *Salmonella* Hadar (2011).** FSIS announced the recall of frozen, raw turkey burger products on April 1, 2011, due to association with a dozen illnesses from *Salmonella* Hadar. Isolates showed resistance to clinically important drugs including ampicillin, amoxicillin/clavulanate acid, cephalothin, and tetracycline.
- **Ground Beef Recalled Due to ABR *Salmonella* Typhimurium (2011):** FSIS announced the recall of ground beef contaminated with ABR *Salmonella* Typhimurium on Dec. 15, 2011 in response to 14 illnesses resulting in seven hospitalizations in four states. The outbreak strain was resistant to amoxicillin/clavulanic acid, ampicillin, ceftriaxone, cefoxitin, kanamycin, streptomycin, sulfisoxazole, and tetracycline.
- **Ground Beef Recalled Due to ABR *Salmonella* Newport (2009):** FSIS announced the recalls of ground beef contaminated with ABR *Salmonella* Newport on Aug. 6, 2009, and Dec. 4, 2009. The meat was linked to forty illnesses in eleven states. The outbreak strain was resistant to amoxicillin/clavulanate acid, ampicillin, cefoxitin, ceftiofur, cephalothin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline.
- **Ground Beef Recalled Due to ABR *Salmonella* Typhimurium DT 104 (2009):** FSIS announced the recall of ground beef contaminated with *Salmonella* Typhimurium DT 104 on July 22, 2009 linked to 14 illnesses in one state. The outbreak strain was resistant to ampicillin, chloramphenicol, streptomycin, sulfamethoxazole, and tetracycline.

Because a precondition for a recall request by FSIS is a determination that “products are adulterated or misbranded under the provisions of the FMIA or the PPIA,”¹³ these recalls demonstrate that ABR *Salmonella* is treated as injurious to health, and therefore an adulterant, by FSIS on a case-by-case basis. Without unequivocal action by FSIS in the form of an adulteration

¹³ Recall of Meat and Poultry Products, FSIS Directive, 8080.1, Rev. 7, at 2.

declaration, consumers lack the certainty that when ABR *Salmonella* in meat or poultry products is found, FSIS will promptly request that processors and retailers conduct a product recall. In fact, the agency's actions seem inconsistent and arbitrary.

For example, the recent outbreak linked to Foster Farms chicken demonstrated that the agency's discretionary power in requesting a recall, even in the midst of an ongoing outbreak, puts consumers at risk.¹⁴ During this outbreak, FSIS allowed contaminated products to remain on the market without a recall for nearly 10 months after the outbreak was announced.¹⁵ During this period, the size of the outbreak more than doubled, from 278 to 634 persons who were sickened by Foster Farms chicken products.

Once dangerous pathogens like ABR *Salmonella* have been repeatedly recalled during outbreak situations, FSIS should use its interpretive rulemaking powers to notify the public and the industry that those pathogens, when found in meat or poultry, will trigger timely requests for a product recall or other regulatory action. The agency's past willingness to use its interpretive powers to protect the public from dangerous *E. coli* strains provides a firm legal precedent on which the agency can address ABR *Salmonella*.

Once adulterant status is declared, the benefits to consumers would be manifold. It would be incumbent upon the agency to take steps to adopt adequate sampling and testing to detect the presence of the pathogen and remove contaminated meat from the food supply.¹⁶ Consistent with

¹⁴ The Foster Farms outbreak was first announced in October 2013 and continued unabated until July 2014. During this period, the number of illnesses increased from 278 to 634. See, CDC, Multistate Outbreak of Multidrug-Resistant Salmonella Heidelberg Infections Linked to Foster Farms Brand Chicken (Final Update), July 31, 2014, available at <http://www.cdc.gov/salmonella/heidelberg-10-13/>, (last accessed Sept. 29, 2014).

¹⁵ On July 12, 2014, ten months after the outbreak was first announced, FSIS issued a recall notice for certain Foster Farms chicken. Prior to this, the agency said that it could not determine with certainty the production dates and lots associated with the reported illnesses. If the pathogen was an adulterant, the fact of finding the pathogen itself on the chicken would have been sufficient to support a recall request, without the necessity for a trace back from specific ill persons to the specific lot and production date. See, Press release, California Firm Recalls Chicken Products Due to Possible Salmonella Heidelberg Contamination, July 12, 2014, available at <http://www.fsis.usda.gov/wps/portal/fsis/topics/recalls-and-public-health-alerts/recall-case-archive/archive/2014/recall-044-2014-release>, (last accessed Sept. 29, 2014).

¹⁶ Taylor 1994

a declaration of adulterant status, CSPI requests that the agency publish details of a testing program as effective as the ones announced in the 1994 Notice and the 2012 Notice on the six strains of STECs.¹⁷ FSIS already collects *Salmonella* samples as part of its Pathogen Reduction Program, so developing a sampling program for specific ABR *Salmonella* strains would not be unduly burdensome for the agency.¹⁸

C. Grant of Expedited Review

Because this petition requests action that would have an immediate benefit to public health by reducing recurrent food safety threats, the petitioners ask for expedited review. As stated in the FSIS petition procedures, 9 C.F.R. § 392.8(a):

“A petition will receive expedited review by FSIS if the requested action is intended to enhance the public health by removing or reducing foodborne pathogens or other potential food safety hazards that might be present in or on meat, poultry, or egg products.”

As discussed above, ABR *Salmonella* has a substantial history of outbreaks that proves its adverse public health effect and supports its adulterant status. The interpretive rule requested in this petition would mandate more effective monitoring for ABR *Salmonella*, and, when it is found, require the product be withheld or recalled from commerce, thus reducing the risk to consumers. In accordance with 9 C.F.R. § 392.8(b), the requested action is supported by scientific information that demonstrates that such an interpretive rule would reduce consumer exposure to foodborne

See also, e.g., Canadian Food Inspection Agency – Health Canada Food Sampling and Testing Terminology, *available at* <http://www.inspection.gc.ca/food/chemical-residues-microbiology/chemical-residues/terminology/eng/1332109097754/1332109200002> (last accessed Aug. 26, 2014).

Notably, initiating a corresponding testing and sampling program has also been held to be within the agency’s discretion as a “procedural rule” and thus also does not require formal rulemaking. *Texas Food Industry Ass’n v. Espy*, 870 F.Supp. 143, 147 (W.D. Tex. 1994).

¹⁷ FSIS Notice, Microbiological Testing Program for *Escherichia coli* in Raw Ground Beef (Final Draft, Oct. 11, 1994) (stating that “[t]o stimulate a reduction in the presence of [*E. coli*] O157:H7 in raw ground beef, FSIS will commence on October 17, 1994, a microbiological testing program for *E. coli* O157:H7.”); Shiga Toxin-Producing *Escherichia coli* in Certain Raw Beef Products, 77 Fed. Reg. 31,975 (May 31, 2012) (confirming the agency will implement routine verification testing for six Shiga toxin-producing *E. coli* on June 4, 2012).

¹⁸ If during the course of this process, additional ABR strains are identified that pose a threat to public health, CSPI requests that a broader adulteration declaration is issued. The agency has the authority under FMIA, PPIA, and legal precedent to act more broadly to regulate those pathogens in its products, and should consider any evidence on the public health impact of other ABR strains.

pathogens capable of causing severe illnesses. Expedited review is particularly warranted, as consumers have already waited over three years for the response to the CSPI 2011 petition that FSIS denied without prejudice on July 31, 2014. For those reasons, the petitioners request that FSIS grant this petition expedited review.

II. ABOUT THE PETITIONERS

The Center for Science in the Public Interest, founded in 1971 and located in Washington, D.C., is a nationally- and internationally-recognized nonprofit, non-governmental consumer advocacy organization focused primarily on nutrition, health and food safety issues.

CSPI has worked on food safety reform and enhanced public protection from contaminated food since the early 1990s, and has filed a number of petitions to improve U.S. food safety, including requests for: regulatory action requiring microbial testing by industry for *Listeria monocytogenes* in ready-to-eat meat and poultry products (2000); banning the use of spinal cord from cattle feed (2001); posting *Salmonella* testing results (2001); and setting a *Campylobacter jejuni* performance standard (2002). CSPI's Food Safety Program maintains a database of more than 7,000 U.S. foodborne outbreaks since 1990 with both an identified food source and etiology, and publishes the annual *Outbreak Alert!* report which analyzes those outbreaks. Separately we have tracked outbreaks linked to antibiotic-resistant pathogens, going back to 1973, which is published in our white paper entitled *Antibiotic Resistance in Foodborne Pathogens*.

III. LEGAL BASIS FOR DECLARING ABR *SALMONELLA* AN ADULTERANT

Under the meat and poultry inspection acts, USDA is required to protect consumers: "It is essential in the public interest that the health and welfare of consumers be protected by assuring that meat and meat food products distributed to them are wholesome, not adulterated, and

properly marked, labeled, and packaged.”¹⁹ This directive compels the agency to recognize ABR *Salmonella* as an adulterant.

In denying the CSPI 2011 petition, USDA failed to address the key issue of whether ABR *Salmonella* is an “added substance” that may render meat or poultry injurious to health. Instead, the agency focused its response on requesting additional information it would like to consider before rendering a decision on whether ABR *Salmonella* is an adulterant.

Importantly, the agency did not discuss the public health data submitted by CSPI, including the outbreaks linked to ABR *Salmonella*, or reflect on its own direct experience managing outbreaks linked to ABR *Salmonella* in meat and poultry that have occurred since the 2011 petition was originally filed. The evidence that these four *Salmonella* strains are linked to outbreaks demonstrates their public health significance. This evidence is proof-positive that the “substance” ABR *Salmonella* may render meat or poultry injurious to health.

The FMIA and PPIA definitions²⁰ of adulteration incorporate two independent standards, one addressing added substances and the second applying if the substance occurs naturally. Depending on how the substance is characterized, the standards for determining harm to consumers change as well: For added substances, the law allows FSIS to act if the substance “may render” the food injurious to health; while for natural substances, the standard covers food that is “ordinarily injurious to health.”

While FSIS does not yet classify *Salmonella* in raw meat as an adulterant, it has done so on a case-by-case basis. However, ABR *Salmonella* has unique characteristics that justify stricter and

¹⁹ Federal Meat Inspection Act 21 U.S.C. § 602 (2014).

²⁰ Both the FMIA and the PPIA definitions, found at 21 U.S.C. §§ 601(m)(1) and 453(g)(1) state in pertinent part that a carcass, part thereof, meat, or meat food product, or poultry product is adulterated "if it bears or contains any poisonous or deleterious substance which may render it injurious to health but in case the substance is not an added substance, such article shall not be considered adulterated under this clause if the quantity of such substance in or on such article does not ordinarily render it injurious to health."

more uniform treatment.²¹ The chief characteristic is that the risk of illness to consumers increases as a result of human intervention—namely, the administration of antibiotics in meat and poultry production that increases the presence of ABR *Salmonella* on regulated meat and poultry. (See Factual Basis, below.) The fact that ABR *Salmonella* infections in patients are less susceptible to existing antibiotics creates a greater risk of injury to human health and lends further support to finding these pathogens to be adulterants.

A. ABR *Salmonella* is an “Added Substance” that “May Render” Meat or Poultry Injurious to Health

ABR *Salmonella* is an added substance within the meaning of 21 U.S.C. § 601(m)(1) (meat products, as cited below) and 21 U.S.C. § 453(g)(1) (covering poultry products). Therefore, to declare it an adulterant under the law, FSIS must only find that it contains a poisonous or deleterious substance that “may render” the food injurious to health.

ABR *Salmonella* is an added substance in meat and poultry because its increasing prevalence is directly attributable to human actions: i.e. the use of antibiotics in animal production. The use of antibiotics in farm animals selects for the genetic varieties of *Salmonella* and other contaminants that are resistant. While some proportion of “wild-type” *Salmonella* may carry resistant genes, the use of the antibiotics distorts the overall population of bacteria, rendering ABR *Salmonella* far more common on meat and poultry products.²² Further evidence that *Salmonella* is present in retail meat is documented by the National Antimicrobial Resistance Monitoring System (NARMS), which found that the number of *Salmonella* isolates gathered from retail meat that were resistant to one or more antibiotics has steadily risen since 2002.²³ (See Factual Basis, below.)

²¹ Press Release, FSIS, FSIS Releases Comprehensive Plan to Reduce Salmonella (Dec. 4, 2013) (“The U.S. Department of Agriculture’s (USDA) Food Safety and Inspection Service (FSIS) today released its Salmonella Action Plan that outlines the steps it will take to address the most pressing problem it faces--Salmonella in meat and poultry products. An estimated 1.3 million illnesses can be attributed to Salmonella every year.”)

²² Maria Sjölund-Karlsson, et al., *Antimicrobial Susceptibility to Azithromycin among Salmonella enterica Isolates from the United States*, 55 *Antimicrobial Agents and Chemotherapy* 3985 (2011).

²³ NARMS 2011 Retail Report (hereinafter “NARMS 2011”)

Where a portion of a substance is derived from “acts of man,” courts have interpreted the added substances to cover the entirety of the substance in the food:

“Since the ‘may render injurious’ standard was to facilitate regulation of food adulterated by the acts of man, we think that it should apply to all of a toxic substance present in the food when any of the substance is shown to have been introduced by man.”²⁴

Thus ABR *Salmonella* is correctly classified as an adulterant under the first part of the adulteration definition that addresses added substances. Since 1916, courts have interpreted the term “added” to mean that a substance is added to food if its presence in the food is due to some action by a person.²⁵ The definition of added substances has been applied to intentional applications of man-made additives, as well as unintentional applications such as bacteria in oysters that was sourced to sewage, and chemicals in fish linked to human-caused pollution.²⁶

To find adulteration, FSIS must only determine if a poisonous or deleterious substance is “artificially introduced or attributable in some degree to the acts of man.”²⁷ Scientists have shown that resistant strains of ABR *Salmonella* increase in prevalence because in industrial agriculture, producers use antibiotics extensively in livestock production to promote growth and treat or prevent disease.²⁸ This is comparable to the facts in *United States v. Anderson Seafoods, Inc.*, where the court found the link between mercury dumped with other pollutants into rivers that washed into the ocean—where it was methylated by bacteria, taken up by plankton that were eaten by fish, that were in turn eaten by larger fish, concentrating the mercury to hazardous levels before it entered the human food supply—sufficient to rule that FDA could regulate mercury as an

²⁴ *United States v. Anderson Seafoods, Inc.*, 622 F.2d 157 (5th Cir., 1980)

²⁵ *United States v. Forty Barrels*, 241 U.S. 265, 283 (1916).

²⁶ *Forty Barrels*, 241 U.S. at 283; *Merck & Co., Inc. v. Kidd*, 242 F.2d 592, 595 (6th Cir., 1957)(citing *United States v. Sprague*, 208 F. 419 (E.D.N.Y., 1913)); *Anderson Seafoods, Inc.*, 622 F.2d at 157.

²⁷ *Anderson Seafoods, Inc.*, 622 F.2d at 160.

²⁸ Scott A. McEwen & Paula J. Fedorka-Cray, *Antimicrobial Use and Resistance in Animals*, 34 *Clinical Infectious Diseases*, Supplement 3 S93 (2002) (hereinafter “McEwen 2002”); G. Gellin, et al., *Antibiotic Resistance of Gram-Negative Enteric Bacteria from Pigs in Three Herds with Different Histories of Antibiotic Exposure*, 55 *Applied and Environmental Microbiology* 2287 (Sept. 1989), available at <http://aem.asm.org/cgi/reprint/55/9/2287.pdf> (last accessed Sept. 29, 2014).

“added” adulterant in seafood.²⁹ It did not matter that some mercury occurred naturally in the environment because an act of man was responsible for increasing and concentrating the substance in fish used as human food.³⁰ Similarly, the use of antibiotics in farm animals has been shown to increase the prevalence of antibiotic-resistant bacteria in meat produced from those animals.³¹

B. FSIS 2014 Response to the CSPI 2011 Petition

FSIS largely failed to respond to the legal argument presented to the agency on the point that ABR *Salmonella* is an added substance. The agency said,

“At the outset, we note that the petition does not define ‘antibiotic resistance’ or specify the number or types of antibiotics that the *Salmonella* strains identified in the petition would need to be resistant to in order to qualify as adulterants. . . . This information is important to our evaluation of your request because the petition asserts that only certain strains of *Salmonella* should be treated differently from other strains of *Salmonella*. Therefore, understanding the characteristics of the strains that significantly increase the risk to human health is essential for developing the appropriate risk management strategies.”

CSPI outlined in the factual basis for its 2011 petition the reason for the selection of the specific ABR *Salmonella* strains, specifically that they were associated with disease outbreaks and were present in retail meat products. Thus, the evidence of human illness, which has only grown stronger since 2011, is sufficient to form the basis of an agency determination of adulteration. The history of outbreaks and the presence of ABR *Salmonella* in retail meats provides proof of adulteration, even in the absence of a complete understanding of the number or types of antibiotics or the “characteristics of the strains.” The fact that FSIS has also requested recalls of these ABR *Salmonella* strains on numerous occasions provides additional support that the agency is

²⁹ *Anderson Seafoods*, 662 F.2d at 162.

³⁰ *Anderson Seafoods*, 662 F.2d at 161-162.

³¹ McEwen 2002.

S.M. Donabedian, et al., *Molecular Characterization of Gentamicin-resistant Enterococci in the United States: Evidence of Spread from Animals to Humans Through Food*, 41 J. Clinical Microbiol. 1109 (2003); D. Siegel, et al., *Continuous Non-Therapeutic Use of Antibacterial Drugs in Feed and Drug Resistance of the Gram-Negative Enteric Flora of Food-Producing Animals*, 6 American Society for Microbiology 697 (Dec. 1974).

already treating them as adulterants on a case-by-case basis and CSPI renews its request that FSIS make its policy consistent across the board, in order to protect consumers.

Since 2011, both the CDC and the President’s Council on Science and Technology Policy have highlighted the urgency of addressing the problem of antimicrobial resistance.³² CSPI believes FSIS has both the authority and the responsibility to act on this petition and declare all four strains or any individual strains adulterants without regard to a “resistance profile.” Nonetheless, strains that show resistance to one or more critically or highly important antibiotics as defined by the World Health Organization (WHO)³³ could provide a reasonable risk management benchmark.

While CSPI provides further evidence in the Appendix as requested by FSIS in its denial, CSPI disputes that more scientific information is essential to the legal determination before the agency. Under the cited case law, it is not relevant that a certain proportion of ABR *Salmonella* is naturally present, if any other part of that substance is present on meat or poultry as a result of human activity, e.g. the use of antibiotics in animal production. *United States v. Anderson Seafoods, Inc.*, 622 F.2d 157 (5th Cir., 1980) supports this reading of the statute in interpreting added substance: “In sum, we hold that where some portion of a toxin present in food has been introduced by man, the entirety of that substance present in the food will be treated as an added substance and so considered under the ‘may render injurious to health’ standard of the Act.”³⁴

³² CDC, Antibiotic Resistance Threats in the United States, 2013, available at <http://www.cdc.gov/drugresistance/threat-report-2013/>; Report to the President on Combating Antibiotic Resistance, Executive Office of the President’s Council of Advisors on Science and Technology, September 2014, available at

http://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_carb_report_sept2014.pdf.

³³ WHO, Critically Important Antimicrobials for Human Medicine: 3rd Revision (2001), available at http://apps.who.int/iris/bitstream/10665/77376/1/9789241504485_eng.pdf (last accessed Sept. 29, 2014).

³⁴ *Anderson Seafoods*, 622 F.2d at 161.

Although decided under a provision of the Food, Drug, and Cosmetic Act, courts give the same meaning to the definition of added substance in the FMIA and PPIA.³⁵

C. ABR *Salmonella* Meets the “May Render Injurious” Standard

A finding of adulteration is triggered when the added substance “may render [food] injurious to health.” Courts have interpreted the term “may render [food] injurious to health” in the statute as meaning there is a reasonable possibility of injury to the consumer.³⁶ That determination relies on a reasonable consideration of the facts.³⁷ It also does not mean the substance must cause injury, only that it has the capability of causing injury.³⁸

Although the *Anderson Seafoods* holding does not require that the adverse health effect be distinct from other illnesses, ABR *Salmonella* poses an additional risk of injury to consumers because it is more resistant to traditional treatment.³⁹ Patients stricken with antibiotic-resistant illnesses often suffer longer and more extreme forms of illness, increased likelihood of hospitalizations and serious side effects from alternative drugs needed to treat them.⁴⁰ Further proof is provided by the outbreak data cited in this petition. This additional risk meets the statutory definition as increasing the potential of injury to consumers. It also adds urgency to FSIS making a determination that ABR *Salmonella* is an adulterant.

³⁵ See, *Kenney v. Glickman*, 96 F.3d 1118, 1121 (8th Cir., 1996) (stating definitions of adulterated under FMIA and PPIA are almost identical); *United States v. 2,116 Boxes of Boned Beef*, 516 F. Supp. 321, 329 (D. Kan., 1981) (“The definition of adulteration in the Federal Meat Inspection Act, 21 U.S.C. § 601(m)(1), is identical to that included in the Federal Food, Drug and Cosmetic Act, 21 U.S.C. § 342(a)(1).”) (citing *Anderson Seafoods*).

³⁶ *Anderson Seafoods*, 622 F.2d at 159; *Berger v. United States*, 200 F.2d 818, 821 (8th Cir. 1952).

³⁷ *United States v. Lexington Mill & Elevator Co.*, 232 U.S. 399, 411 (1914).

³⁸ *Lexington Mill & Elevator*, 232 U.S. 399.

³⁹ Scott D. Holmberg, et al., *Drug-Resistant Salmonella from Animals Fed Antimicrobials*, 311 New England J. Med. 617 (Sept. 1984) (hereinafter “Holmberg 1984”).

Jonathan G. Frye, & Charlene R. Jackson, *Genetic Mechanisms of Antimicrobial Resistance Identified in Salmonella enterica, Escherichia coli, and Enterococcus spp. Isolated from US Food Animals*, *Frontiers in Microbiology* 4 (2013); Alessandra Carattoli, *Plasmid-mediated Antimicrobial Resistance in Salmonella enterica*, 5 *Current Issues Molecular Biol.* 113 (2003).

⁴⁰ F.J. Angulo, et al., *Evidence of an Association Between Use of Anti-microbial Agents in Food Animals and Anti-microbial Resistance Among Bacteria Isolated from Humans and the Human Health Consequences of Such Resistance*, 51 *J. Veterinary Med., Series B*, 374 (2004).

Even in dismissing the CSPI 2011 petition, the agency provided an analysis of existing studies that documented an association of increased severity of illness with ABR *Salmonella*.⁴¹ The agency cited six articles suggesting an association of increased severity of illness with ABR *Salmonella* and identified three more studies supporting the statement that “[p]ublic health officials report increased bloodstream infections and hospitalizations for multi-drug-resistant *Salmonella* Typhimurium.”⁴²

In the FSIS response to the 2011 petition, the agency said that *Salmonella* is not considered an adulterant of raw meat and poultry products “because ordinary cooking and preparation of these products is generally sufficient to destroy the pathogens.” While the increasing number and impact of outbreaks belies this assertion, in any case such evidence is not legally required for the agency to find that ABR *Salmonella* is an “added substance” that “may render” the meat or poultry “injurious to health.” Nonetheless, in order to be helpful in advancing the agency’s thinking, CSPI has provided an appendix with numerous studies addressing the agency’s questions on consumer handling, cooking practices, virulence, infectious dose, and heat resistance.

IV. FACTUAL BASIS FOR DECLARING ABR *SALMONELLA* AN ADULTERANT

As discussed above, adulteration under §§ 601(m)(1) and 453(g)(1) exists if an added poisonous or deleterious substance may render food injurious to health. This section contains the

⁴¹ M. Barza, *Potential Mechanisms of Increased Disease in Humans from Antimicrobial Resistance in Food Animals*, 34 *Clinical Infect. Disease* (Supplement 3) S123 (2002); K. Travers & M. Marza, *Morbidity of Infections Caused by antimicrobial-resistant Bacteria*, 34 *Clinical Infect. Disease* (Supplement 3) S131 (2002); A.D. Anderson, et al., *Public Health Consequences of Use of Antimicrobial Agents in Food Animals in the U.S.*, 9 *Microbial Drug Resistance* 373 (2003); L.J. Martin, et al., *Increased Burden of Illness Associated with Antimicrobial-resistant Salmonella enterica Serotype Typhimurium Infections*, 189 *J. Infect. Disease* 377 (2004); K. Molbak, *Human Health Consequences of Antimicrobial Drug-resistant Salmonella and Other Foodborne Pathogens* 41 *Clinical Infect. Disease* 1613 (2005); A.L. Krueger, et al., *Clinical Outcomes of Nalidixic Acid, Ceftriaxone, and Multidrug-Resistant Nontyphoidal Salmonella Infections Compared with Pansusceptible Infections in FoodNet Sites, 2006-2008*, 11 *Foodborne Pathogens and Disease* 335 (2014).

⁴² Jay K. Varma, et al., *Antimicrobial-resistant Nontyphoidal Salmonella is Associated with Excess Bloodstream Infections and Hospitalizations*, 191 *J. of Infect. Diseases* 554 (2005); Jay K. Varma, et al., *Hospitalization and Antimicrobial Resistance in Salmonella Outbreaks, 1984–2002*, 11 *Emerg Infect Disease* 943 (2005); Suzanne M. Solghan, et al., *Multidrug-Resistant Nontyphoidal Salmonella in New York State's Foodborne Diseases Active Surveillance Network Counties*, 7 *Foodborne Pathogens and Disease* 167 (Feb. 2010).

factual basis that supports, indeed compels, the agency to find ABR *Salmonella* an adulterant because it is both added and renders food injurious to health.

Research has shown that since the 1970s, non-therapeutic usage of antibiotics in animal agriculture, which is a human activity, selects for increased antibiotic resistance among all bacteria—pathogens and non-pathogens—on farms and in livestock.⁴³ Research has also shown since the 1980s that those on-farm antibiotic-resistant bacteria can sicken consumers through the food supply.⁴⁴ Since that time, evidence showing that antibiotic use by humans on farms is driving increased resistance to antibiotics in pathogens in the food supply has only grown stronger; including *Salmonella* spp. and *Salmonella* Serovars Heidelberg, Newport, Hadar, and Typhimurium. The agency has sufficient scientific data to grant this petition, and CSPI asks that it do so without further delay.

A. Human Actions Contribute to Antibiotic Resistance

In 2009 through 2011, the volume of antibiotics used in human medicine that were administered to food animals consistently exceeded 20 million pounds, including many antibiotics critically important to human medicine.⁴⁵ Many studies have demonstrated the causal link between antibiotic usage—particularly nontherapeutic use—in animal agriculture and the development of antibiotic resistance among bacteria, foodborne pathogens included.⁴⁶ It is a fundamental principle of bacterial biology that any environment saturated with low levels of antibiotics will select for resistance among bacteria inhabiting that environment,⁴⁷ as such saturation results in ecologic imbalance that encourages the survival of ABR bacteria and hinders the survival of

⁴³D. Siegel, et al., *Continuous Non-therapeutic Use of Antibacterial Drugs in Feed and Drug Resistance of the Gram-negative Enteric Flora of Food-producing Animals*, 6 *Antimicrobial agents and chemotherapy* 697 (1974).

⁴⁴ Scott D. Holmberg, et al., *Animal-to-Man Transmission of Antimicrobial-resistant Salmonella: Investigations of US Outbreaks, 1971-1983*, 225 *Science* 833 (1984).

⁴⁵ DeWaal 2013.

⁴⁶ Holmberg 1984.

⁴⁷ Bonnie M. Marshall, & Stuart B. Levy, *Food Animals and Antimicrobials: Impacts on Human Health*, 24 *Clinical microbiology reviews* 718 (2011) (hereinafter “Marshall 2011”); P.D. Fey, et al., *Ceftriaxone-resistant Salmonella Infection Acquired by a Child from Cattle*, 342 *New England J. Med.* 1242 (2000).

antibiotic susceptible bacteria.⁴⁸ The administration of nontherapeutic antibiotics in animal agriculture (continuous low-dose treatment of flocks or herds in particular), is responsible for resistance to those antibiotics used on-farm and to others, including broad classes of antibiotics, antibiotics never used on-farm or administered to animals, which contributes to the development of multi-drug resistance.⁴⁹

The National Antimicrobial Resistance Monitoring System (NARMS) monitors isolates of *Salmonella* spp. collected from retail meats, and classifies them by serotype and antibiotic resistance profiles. NARMS data provides additional evidence of the impact of continued use of antibiotics in food animals. Since 2002, the percentage of *Salmonella* isolates collected from meat and poultry at retail that are susceptible to all antibiotics (pansusceptible) has steadily declined, and the number of isolates that are resistant to one or more antibiotics has steadily risen.⁵⁰ In retail chicken alone, between 2002 and 2011 the percentage of pansusceptible *Salmonella* has fallen from 52 percent to 26 percent, while the number of isolates resistant to five or more classes of antibiotics has risen

⁴⁸ Stuart B. Levy & Bonnie M. Marshall, *Antibacterial Resistance Worldwide: Causes, Challenges and Responses*, 10 Nature Med. S122 (2004).

⁴⁹ Marshall 2011; T. W. Alexander, et al., *Farm-to-Fork Characterization of Escherichia coli Associated with Feedlot Cattle with a Known History of Antimicrobial Use*, 137 Internat'l J. Food Microbiol. 4405 (2010); M.S. Diarra, et al., *Impact of Feed Supplementation with Antimicrobial Agents on Growth Performance of Broiler Chickens, Clostridium Perfringens and Enterococcus Counts, and Antibiotic Resistance Phenotypes and Distribution of Antimicrobial Resistance Determinants in Escherichia coli Isolates*, 73 Appl. Environ. Microbiol. 6566 (2007); H.D. Emborg, et al., *Relations Between the Occurrence of Resistance to Antimicrobial Growth Promoters among Enterococcus Faecium Isolated from Broilers and Broiler Meat*, 84 Internat'l J. Food Microbiol. 273 (2003); H.D. Emborg, et al., *Tetracycline Consumption and Occurrence of Tetracycline Resistance in Salmonella Typhimurium Phage Types from Danish Pigs*, 13 Microb. Drug Resist. 289 (2007); G.D. Inglis, et al., *Effects of Subtherapeutic Administration of Antimicrobial Agents to Beef Cattle on the Prevalence of Antimicrobial Resistance in Campylobacter Jejuni and Campylobacter Hyointestinalis*, 71 Appl. Environ. Microbiol. 3872 (2005); T.L. Lauderdale, et al., *Effect of Banning Vancomycin Analogue Avoparcin on Vancomycin-resistant Enterococci in Chicken Farms in Taiwan*, 9 Environ. Microbiol. 819 (2007); S.B. Levy, G.B. FitzGerald, & A.B. Macone, *Changes in Intestinal Flora of Farm Personnel after Introduction of a Tetracycline-Supplemented Feed on a Farm*, 295 New England J. Med. 583 (1976); R. Sharma, et al., *Diversity and Distribution of Commensal Fecal Escherichia coli Bacteria in Beef Cattle Administered Selected Subtherapeutic Antimicrobials in a Feedlot Setting*, 74 Appl. Environ. Microbiol. 6178 (2008); H. Sorum, *Antimicrobial Drug Resistance in Fish Pathogens, Antimicrobial Resistance in Bacteria of Animal Origin* (F. M. Aarestrup (ed.)), ASM Press, Washington, DC, pp213-238 (2006); Csaba Varga, et al., *Associations Between Reported On-Farm Antimicrobial Use Practices and Observed Antimicrobial Resistance in Generic Fecal Escherichia coli Isolated from Alberta Finishing Swine Farms*, 88 Preventive Veterinary Med. 185 (2009); Csaba Varga, et al., *Associations Among Antimicrobial Use and Antimicrobial Resistance of Salmonella spp. Isolates from 60 Alberta Finishing Swine Farms*, 6 Foodborne Pathog. Dis. 23 (2009); X.Y. Zhang, et al., *Resistance Patterns and Detection of aac(3)-IV Gene in Apramycin-resistant Escherichia coli Isolated from Farm Animals and Farm Workers in Northeastern of China*, 87 Research in Veterinary Sci. 449 (2009).

⁵⁰ NARMS 2011.

from 3.3 percent to 28 percent.⁵¹ While pork showed a modest increase in pansusceptible *Salmonella* over the 10 year period, the trend since 2008 has been toward declining numbers of isolates that are susceptible to all antibiotics.⁵²

B. Outbreaks Document the Public Health Impact of ABR Pathogens

ABR *Salmonella* has a significant impact on public health, as it causes more severe illness, has an increased rate of hospitalization, is more difficult to treat, and has observed higher rates of death.⁵³ Data obtained from foodborne illness outbreak investigations is a key tool to understand the distribution of pathogens among different foods.⁵⁴ CSPI collects and analyzes records of ABR foodborne outbreaks that provide a compelling scientific basis for this petition. Notably, because antibiotic-resistance pathogen profiles are not reported through the normal mechanisms of outbreak reporting, the available data severely understates the actual number of outbreaks linked to ABR pathogens and only contains partial reports on hospitalizations and deaths associated with those outbreaks.⁵⁵

Recognition of resistant pathogens in the nation's food supply is growing. In CSPI's review of 58 documented outbreaks linked to antibiotic-resistant bacteria since the 1970s, 50 percent (29 out of 58) occurred in the last decade. A total of 21,375 people were sickened from these 58 outbreaks, resulting in 3,401 hospitalizations and 27 deaths.⁵⁶

⁵¹ NARMS 2011.

⁵² NARMS 2011.

⁵³ J.K. Varma, et al., *Hospitalization and Antimicrobial Resistance in Salmonella Outbreaks, 1984-2002*, 11 *Emerging Infect. Diseases* 943 (2005).

⁵⁴ Brendan R. Jackson, et al., *Outbreak-Associated Salmonella Enterica Serotypes and Food Commodities, United States, 1998–2008*, 19 *Emerging Infect. Diseases* 1239 (2013).

⁵⁵ CDC estimates that for every documented case of *Salmonella*, an additional 29.3 *Salmonella* cases may be undiagnosed; E. Scallan, et al., *Foodborne Illness Acquired in the United States—Major Pathogens*, 17 *Emerg Infect Diseases* 7 (2011), available at <http://www.cdc.gov/EID/content/17/1/7.htm> (last accessed Sept. 30, 2014).

⁵⁶ This includes one large *Salmonella* Typhimurium outbreak caused by milk in 1985 in which 16,659 were sickened, 2,777 were hospitalized, and 18 died. Petitioners recognize that regulation and oversight of pathogens in milk is not under the authority of USDA, but we include this data to illustrate the potential magnitude of harm.

Of the 58 documented ABR outbreaks, 50 were linked to strains of *Salmonella*. CSPI identified a total of 19 outbreaks related to all strains of ABR *Salmonella* in FSIS-regulated products: 10 in beef, one in pork, and eight in poultry including three in ground turkey. Cases of salmonellosis associated with these 19 meat and poultry outbreaks were linked to 2,358 illnesses, 424 hospitalizations, and 8 deaths.⁵⁷ Given the breadth of products involved, CSPI has moved from narrowly defining the products covered in this petition to asking that USDA consider declaring ABR *Salmonella* as adulterants in any meat or poultry product.

An antibiotic resistance pattern was reported for 55 of those 58 outbreaks.⁵⁸ The responsible bacteria displayed resistance to a total of 23 different antibiotics and the entire sulfonamide class of antibiotics. Of those 23 antibiotics, 12 are classified by the WHO as “critically important” to human medicine and eight as “highly important” to human medicine. Further information on the resistance patterns found in retail meats is included below.

C. *Salmonella* Present on Some Retail Meats is Antibiotic Resistant

Salmonella spp. is commonly found on meat and poultry products that consumers purchase. USDA data shows the prevalence of *Salmonella* spp. on meat and poultry products after processing for the years 1998-2013 ranged from 1.6 to 18 percent: 3.9 percent of young chicken products, 1.6 percent of ground beef, 18.0 percent of ground chicken, 15.0 percent of ground turkey, and 2.3 percent of intact turkey products.⁵⁹ If a product doesn’t contain *Salmonella*, it would not be affected by any declaration that might result from this petition.

For the minority of products that do carry *Salmonella*, additional information on the pathogens and the resistance patterns found on retail meat and poultry is available from the

⁵⁷ This includes three outbreaks from other strains of ABR *Salmonella*, not included in this petition, which together caused 139 illnesses, 56 hospitalizations, and one death. The strains were Agona (2004), Havana (1987), and Istanbul (2005).

⁵⁸ An antibiotic-resistance pattern refers to the specific drug or class of drugs to which the bacteria displays resistance.

⁵⁹ USDA, *Progress Report on Salmonella and Campylobacter Testing of Raw Meat and Poultry Products, CY 1998-2013*. (2013) available at <http://www.fsis.usda.gov/wps/wcm/connect/885647f4-2568-48bf-ac5c-4a0d8279f435/Progress-Report-Salmonella-Campylobacter-CY2013.pdf?MOD=AJPERES>, (last accessed Sept. 30, 2014).

NARMS database. Of 357 *Salmonella* isolates from retail meat or poultry analyzed by NARMS in 2011, the four strains covered by this petition made up less than 50 percent: *S. Typhimurium* isolates represented 23 percent, *S. Heidelberg* represented 11 percent, and *S. Hadar* represented 9 percent, while *S. Newport* was not found (0 percent). (*S. Newport* was present in 2010 as described below.)

An issue of particular concern for public health is the number of ABR *Salmonella* that are resistant to Critically Important Antimicrobials (CIA) and Highly Important Antimicrobials (HIA). The WHO classifies an antibiotic as CIA if it is the sole, or one of limited therapy, to treat serious human disease and it is used to treat diseases caused by organisms that may be transmitted via non-human sources or diseases caused by organisms that may acquire resistance genes from non-human sources. WHO classifies an antibiotic as HIA if it is the sole, or one of limited therapy, to treat serious human disease or it is used to treat diseases caused by organisms that may be transmitted via non-human sources or diseases caused by organisms that may acquire resistance genes from non-human sources.⁶⁰

Of the *S. Heidelberg* isolates collected from meat and poultry at retail, 30 out of 40 were resistant to one or more antibiotics. Eleven isolates were collected from chicken at retail, 28 from ground turkey, and one from pork chops.

- Among the 11 isolates of *S. Heidelberg* collected from chicken at retail, one isolate displayed antibiotic resistance and possessed resistance to both streptomycin and tetracycline. Streptomycin is classified as CIA and tetracycline is classified as HIA.
- Of the 28 isolates of *S. Heidelberg* collected from ground turkey, 28 displayed antibiotic resistance: 15 isolates possessed resistance to 2-3 classes of antibiotics, seven isolates possessing resistance to 4-5 classes of antibiotics, and 6 isolates had resistance to 6-7 antibiotics. Of notable concern, 22 isolates were resistant to gentamicin (CIA), 26 to streptomycin (CIA), 11 to amoxicillin/clavulanic acid (CIA), 27 to ampicillin (CIA), 26 to tetracycline (HIA), 11 to ceftriaxone (CIA), 11 to ceftiofur (CIA), and 10 to ceftiofur (CIA), and 10 to ceftiofur (CIA), and 10 to ceftiofur (CIA).

⁶⁰ WHO, *WHO List of Critically Important Antimicrobials for Human Medicine (CIA)*, (2011) available at http://www.who.int/foodborne_disease/resistance/cia/en/ (last accessed Sept. 26, 2014).

- The one isolate collected from pork chops displayed resistance to kanamycin (CIA), streptomycin (CIA), and tetracycline (HIA).⁶¹

Of the *S. Hadar* isolates collected from meat and poultry at retail, 32 out of 32 were resistant to one or more antibiotics. One isolate was collected from chicken at retail, 23 were collected from ground turkey, and eight were collected from pork chops.

- The isolate from chicken was resistant to streptomycin (CIA), ampicillin (CIA), and tetracycline (HIA).
- Of the 23 isolates collected from ground turkey, all 23 were resistant to streptomycin (CIA) and tetracycline (HIA), 14 isolates were resistant to ampicillin (CIA), four isolates were resistant to ceftriaxone (CIA), three isolates were resistant to ceftiofur (CIA), three were resistant to amoxicillin/clavulanic acid (CIA), four were resistant to kanamycin (CIA), and five were resistant to gentamicin (CIA).
- Of the eight isolates collected from pork chops, all eight exhibited resistance to streptomycin (CIA) and ampicillin (CIA) and one was resistant to tetracycline (HIA).⁶²

Of the *S. Typhimurium* isolates collected from meat and poultry at retail, 75 of 81 were resistant to one or more antibiotics. Sixty-six isolates were collected from chicken meat, eight from ground turkey, and seven from pork chops.

- Of the 66 isolates collected from chicken, 61 were resistant to tetracycline (HIA), 44 were resistant to ampicillin (CIA), 62 were resistant to sulfisoxazole (HIA), 36 were resistant to ceftiofur (CIA), 36 were resistant to amoxicillin/clavulanic acid (CIA), 16 were resistant to streptomycin (CIA), 16 were resistant to kanamycin (CIA), and two were resistant to gentamicin (CIA).
- Of the 28 isolates collected from ground turkey, two were resistant to gentamicin (CIA), four were resistant to streptomycin (CIA), five were resistant to amoxicillin/clavulanic acid (CIA), four were resistant to ceftiofur (CIA), four were resistant to ceftriaxone (CIA), five were resistant to sulfisoxazole (HIA), and seven were resistant to ampicillin (CIA) and tetracycline (HIA).

⁶¹ NARMS 2011.

⁶² NARMS 2011.

- Of the seven isolates collected from pork chops, five were resistant to streptomycin (CIA), five were resistant to sulfisoxazole (HIA), two were resistant to ampicillin (CIA), and four were resistant to tetracycline (HIA).⁶³

Though *S. Newport* was not found in NARMS 2011 retail meat monitoring, four isolates reported in 2010 displayed similar multi-drug resistant characteristics to those found in the three serotypes above. Two isolates were collected from ground turkey and two from ground beef.

- Of the two isolates collected from ground turkey, one was resistant to gentamicin (CIA), streptomycin (CIA) and sulfisoxazole (HIA).
- Of the two isolates collected from ground beef, two were resistant to streptomycin (CIA), sulfisoxazole (HIA), chloramphenicol (HIA) and tetracycline (HIA). One isolate displayed additional resistance to kanamycin (CIA), amoxicillin/clavulanic acid (CIA), cefoxitin (HIA), ceftiofur (CIA), ceftriaxone (CIA) and ampicillin (CIA).⁶⁴

D. Antibiotic-Resistant *Salmonella* Found on Meats at Retail Presents a Public Health Risk

Given the large number of ABR *Salmonella* found on retail meats that showed resistance to critically and highly important antibiotics for human medicine, those strains present a clear and direct threat to public health. The observed resistance to amoxicillin/clavulanic acid is particularly dangerous, as this antibiotic is a member of the beta-lactam/beta-lactamase drug class, one of the key drug classes used to treat *Salmonella* infections. According to a 2013 study, 12.3 percent of the 57 *S. Heidelberg* isolates collected at retail through NARMS in 2008 contained genes conferring resistance to beta-lactamase drugs.⁶⁵ Those drugs including cephalosporins, the front-line drugs used to treat invasive *Salmonella* infections. The study states, “This is of concern, as Heidelberg is more likely to cause invasive disease that requires hospitalization,” and continues “isolates of [*S. Heidelberg*] detected among animal and retail meat samples from both Canada and the United States [suggest] that these sources may be reservoirs for cephalosporin resistance.” This finding is

⁶³ NARMS 2011.

⁶⁴ NARMS 2010 Retail Meat Report.

⁶⁵ Maria Sjölund-Karlsson, et al. *Occurrence of β -Lactamase Genes Among Non-Typhi Salmonella enterica Isolated from Humans, Food Animals, and Retail Meats in the United States and Canada*, 19 Microbial Drug Resistance 191 (2013).

further supported by recent work on extended-spectrum cephalosporin resistance genes and plasmids.⁶⁶

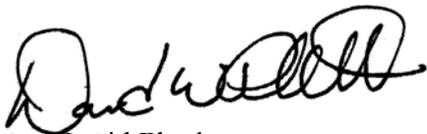
V. CONCLUSION

In light of the evidence establishing ABR *Salmonella* as a serious health risk to consumers, the agency must act quickly and decisively to declare these strains adulterants, so that the agency can prevent the sale of contaminated meat and poultry. Moreover, FSIS should adopt preventive testing programs to spare consumers of meat and poultry the increased physical harm (including potential death) and expense through early identification of adulterated products and timely recalls. The agency has both the authority and the legal and scientific basis to issue an interpretive rule, and we urge the agency to do so.

VI. CERTIFICATION

The undersigned certifies that to the best of their knowledge and belief this petition includes all information and views on which the petition relies and that it includes representative data and information known to the petitioner that are unfavorable to the petition.

Respectfully submitted,



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Senior Staff Attorney



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⁶⁶ Jason P. Folster, et al. *Characterization of Extended-Spectrum Cephalosporin-Resistant Salmonella enterica Serovar Heidelberg Isolated from Humans in the United States*, 7 *Foodborne Pathogens and Disease* 181 (2010).

APPENDIX

FACTUAL BASIS FOR FINDING ABR *SALMONELLA* ORDINARILY RENDERS FOOD INJURIOUS TO HEALTH

CSPI petitioned in 2011 for a declaration that four strains of ABR *Salmonella* are adulterants based on their status as added substances, but noted, too, that even if ABR *Salmonella* were analyzed as a naturally occurring substance, they would nonetheless be adulterants.⁶⁷ In its denial letter, FSIS highlighted certain factors it considers in finding a substance is an adulterant. While we believe FSIS can respond favorably to the petition on the basis of the public health data outlined in the petition, this appendix responds to the agency’s request for additional information that is more relevant to an analysis of “ordinarily injurious to health.”

In its denial letter, the agency identified the following as necessary information for finding ABR *Salmonella* an adulterant—

- I. Data on consumer preparation and cooking practices for meat and poultry, and consumer views of what is meant by properly cooked.
- II. Information on whether ABR *Salmonella* has a higher heat resistance than susceptible strains.
- III. Data on the actual number of *Salmonella* per serving in different known food products responsible for outbreaks in order to provide FSIS with an understanding of the actual infectious dose.
- IV. Information on virulence.
 - Information on whether ABR *Salmonella* is more virulent than susceptible strains.
 - Studies documenting that ABR and virulence genes “always occur together” for specific serotypes of *Salmonella*.

⁶⁷ As noted elsewhere in this petition the two standards are: a food is adulterated if it bears on contains (1) an added poisonous or deleterious substance which may render it injurious to health or (2) a naturally occurring poisonous or deleterious substance in an amount sufficient to render it injurious to health in ordinary use under ordinary conditions. 21 U.S.C. §§ 601(m)(1) and 453(g)(1) (2013); See, *Millet Pit & Seed Co., Inc. v. United States*, 436 F.Supp. 84, 87 (E.D. Tenn., 1977).

Several of these elements were previously used by the agency in finding the six STEC strains to be adulterants.⁶⁸ While CSPI believes each of these questions is scientifically important and would add to the body of evidence that ABR *Salmonella* is in fact an adulterant, addressing those questions is not a legal requirement in light of the public health evidence described in the petition that ties ABR *Salmonella* in meat and poultry to human illness.

The following studies and analysis address each of these issues, providing a basis for FSIS to grant our petition and thereby improve the safety of the meat and poultry supply by reducing the burden of ABR diseases on consumers.

A. Studies on Consumer Preparation and Cooking Practices

In denying the CSPI 2011 petition, FSIS stated:

“Most foodborne pathogens, including *Salmonella*, are not considered adulterants of raw meat or poultry products because ordinary cooking and preparation of these products is generally sufficient to destroy the pathogens. ...FSIS is aware that some consumers consider ground beef to be properly cooked rare, medium-rare, or medium. However, we are not aware of any data to suggest that consumers consider ground poultry, ground pork, or ground lamb to be properly cooked when rare, medium-rare, or medium.”

FSIS did not provide any scientific support for the assertion that ordinary cooking and preparation practices are sufficient to destroy *Salmonella* on many types of meat and poultry. In fact, numerous studies confirm that consumer behaviors and practices when handling and cooking raw meat and poultry products do not adequately control for bacteria or pathogens present on or in the meat.⁶⁹ Many consumers are misinformed concerning the proper practices for safe meat

⁶⁸ For example, in 1999, FSIS issued a policy that stated, “* * * [g]iven the low infectious dose of [E. coli O157:H7] associated with foodborne disease outbreaks and the very severe consequences of an [E. coli O157:H7] infection, the Agency believes that the status under the FMIA of beef products contaminated with [E. coli O157:H7] must depend on whether there is adequate assurance that subsequent handling of the product will result in food that is not contaminated when consumed.” Beef Products Contaminated With *Escherichia Coli* O157:H7, 64 Fed. Reg. 2,803 (Jan. 19, 1999)(Cited also in Shiga Toxin-Producing *Escherichia coli* in Certain Raw Beef Products, 76 Fed. Reg. at 58,158).

⁶⁹ C. Hoelzi, et al., *Observational Trial of Safe Food-handling Behavior During Food Preparation Using the Example of Campylobacter spp.*, 76 J. Food Protection 482 (2013); Aarieke E.I. de Jong, et al. *Extreme Heat Resistance of Food Borne Pathogens Campylobacter jejuni, Escherichia coli, and Salmonella Typhimurium on Chicken Breast Fillet during Cooking*, Internat'l J. of Microbiology (2012) (hereinafter “de Jong 2012”); Fine Cooking, *The Science of Grilling Burgers* at

and poultry handling and preparation, resulting in improperly prepared meat and poultry, cross contamination of pathogens across food products, and inadequate protection from pathogens present on raw meat and poultry products.⁷⁰

As CSPI has expanded the focus of the petition from ground product to all meat and poultry, the remainder of this discussion will address cooking practices for many types of meat and poultry. First, however, it is important to consider past findings of the agency in making adulterant declarations.

When FSIS announced that *E. coli* O157:H7 was an adulterant on ground beef in 1994, it justified that action, in part, by asserting that “ground beef... has traditionally been cooked by many people in a manner that does not destroy the organism.”⁷¹ It did this without reference to studies that quantified how “many people” undercooked ground beef, nor studies that supported the agency’s belief that undercooking was a traditional practice. Surveys in 1996 found that less than 4 percent of hamburgers were eaten with red or pink centers, and less than 8 percent of the population cooked or ordered hamburgers rare, medium-rare, medium-red, or medium-pink.⁷²

<http://www.finecooking.com/articles/how-to-grill-burgers.aspx?pg=0> (last accessed Sept. 30, 2014); E.V. Taylor, et al., *Ground Beef Consumption Patterns in the United States*, *FoodNet*, 2006 through 2007, J. Food Protection 341 (2011); C.M. Bruhn, *Chicken Preparation in the Home: An Observational Study*, 35 Food Protection Trends 318(2014) (hereinafter “Bruhn 2014”). See also, Maria Godoy, *Julia Child was Wrong: Don’t Wash Your Raw Chicken, Folks*, National Public Radio, Aug. 23, 2013, available at <http://www.npr.org/blogs/thesalt/2013/08/27/213578553/julia-child-was-wrong-don-t-wash-your-raw-chicken-folks> (last accessed Sept. 30, 2014) (hereinafter “Godoy 2013”).

⁷⁰ Sumeet R. Patil, et al., *Consumer Food-Safety Knowledge, Practices and Demographic Differences: Findings from a Meta-Analysis*, 68 J. Food Protection 1884 (2005) (hereinafter “Patil 2005”); Aarieke E.I. de Jong, et al., *Cross-Contamination in the Kitchen: Effect of Hygiene Measures*, 105 J. Applied Microbiology 615 (2008) (hereinafter “de Jong 2008”); C. Hoelzi, et al., *Observational Trial of Safe Food-Handling Behavior During Food Preparation Using the Example of Campylobacter spp.*, 76 J. Food Protection 482 (2013) (hereinafter “Hoelzi 2013”); P.A. Kendall, et al., *Observation vs. Self-Report: Validation of a Consumer Food-Behavior Questionnaire*, 67 J. Food Protection 2578 (2004) (hereinafter “Kendall 2004”); A.E. Johnson, et al., *Food-Safety Knowledge and Practice Among Elderly People Living at Home*, 52 J. Epidemiol Community Health 745 (1998) (hereinafter “Johnson 1998”); K.V. Kennedy, et al., *Food-Safety Knowledge of Consumers and the Microbiological and Temperature Status of their Refrigerators*, 68 J. Food Protection 1421 (2005) (hereinafter “Kennedy 2005”); Amy Lando, et al., 2006 FDA/FSIS Food Safety Survey Topline Frequency Report, available at <http://www.fda.gov/food/foodscienceresearch/consumerbehaviorresearch/ucm080374.htm> (last accessed Sept. 30, 2014) (hereinafter “Lando 2006”); H.S. Phang, et al. *Burger Preparation: What Consumers Say and Do in Their Home*, 74 J. Food Protection 1708 (2011) (hereinafter “Phang 2011”).

⁷¹ Taylor 1994.

⁷² Katherine Ralston, et al., *Consumer Food Safety Behavior: A Case Study in Hamburger Cooking and Ordering*, USDA Economic Research Service (Nov. 2001) (hereinafter “Ralston 2001”).

The largest relevant number to describe “many people” was 24 percent of adult respondents who reported cooking hamburgers in the home rare, medium-rare, or medium (described as pink center) in the 1993 FDA/FSIS Food Safety Survey.⁷³ This shows that previous declarations were supported when between 4 and 24 percent of consumers expressed a specific preference or practice.

In the 2014 FSIS response to CSPI, the agency also requested “data on consumer preparation and cooking practices for ground poultry, ground pork, or ground lamb, or consumer views of what is considered properly cooked ground poultry, pork, or lamb.” Studies clearly show that consumer practices frequently result in undercooked food. The agency’s continued reliance on the 40 year old decision in *American Public Health Association v. Butz* that *Salmonella* is not an adulterant because meat and poultry is prepared in the home by housewives who know to properly cook it has been thoroughly disproved through contemporary surveys.⁷⁴ The agency is ignoring the abundant number of studies, recipes and advice (some of which are cited below) that demonstrate home cooks engage in numerous behaviors that could lead to pathogen spread, growth and undercooking of meat and poultry dishes. Rather than relying on a judicial utterance made 40 years ago,⁷⁵ the agency should look at actual cooking and handling practices as the factor most critical to addressing the agency’s question. Here are findings from a number of studies reporting on modern consumer behavior.

1. Consumers do not know the proper methods for food storage, handling, or hand washing

- To understand the overall status of safe food handling, an analysis by S.R. Patil and colleagues in 2005 examined 20 studies on specific food handling behaviors and found:

⁷³ Ralston 2001.

⁷⁴ General Accounting Office, *Salmonella in Raw Meat and Poultry: An Assessment of the Problem*, 25, July 22, 1974.

⁷⁵ For another court’s take on the *American Public Health Ass’n v. Butz* holding see, *Seabrook International Foods, Inc. v Harris* 501 F. Supp. 1086, 1092 (D.D.C., 1980) stating that the housewives comment was “plainly dictum which did not reflect consideration of any factual basis or legal analysis of the adulteration provision”.

- Men were more likely to undercook foods and fail to follow practices to prevent cross contamination;
- Higher income consumers were less knowledgeable about hygiene and had poorer cross contamination avoidance practices;
- Knowledge about food safety doesn't necessarily translate into safe food handling practices.⁷⁶
- In another study by A.E. de Jong, the hands of 73 percent to 100 percent of consumers who reported washing their hands after touching chicken were found to still be contaminated with *Campylobacter jejuni*.⁷⁷
- C. Hoelzi and colleagues⁷⁸ found 100 percent of consumers in their observational study washed the cutting board with soap or changed the board after contact with raw chicken.
- Kindall found that while 78 percent of graduate students said they would wash the board under these circumstances, only 8 percent actually did, and others rinsed with water rather than actually washing.⁷⁹
- An analysis of cleaning effectiveness found that pathogens were reduced after washing with soap and mechanical scrubbing, but some pathogens remained and were transferred from the board to the next food item.
- Consumers did not know the recommended refrigerator temperature, and some home refrigerators were found to be above the recommended 32-41F.⁸⁰

2. Consumer cooking does not provide an adequate kill step

- Consumers do not routinely use thermometers to cook meat to the recommended temperatures.⁸¹
- Hoelzi's study found only 3 percent of participants used a thermometer to check the doneness of chicken.⁸² Most determined that chicken was cooked by visually inspecting the surface (78 percent), the interior (28 percent), or tasting (10 percent).

We specifically draw the agency's attention to a recent observational study of cooking and handling practices for raw chicken, a product that consumers generally know is likely to carry

⁷⁶ Patil 2005.

⁷⁷ de Jong 2008.

⁷⁸ Hoelzi 2013.

⁷⁹ Kendall 2004.

⁸⁰ Johnson 1998; Kennedy 2005; Lando 2006; Phang 2011.

⁸¹ Godoy 2013.

⁸² Hoelzi 2013.

pathogens like *Salmonella*. This study observed 120 consumers in their own homes preparing chicken. Here are the most relevant findings:⁸³

Background on study participants

- 60 percent of households had members at increased risk for foodborne illness (elderly, children).
- 48 percent of participants indicated they had a food-handler certificate/previous restaurant experience.
- 10 percent had food safety training in high school or other academic setting.
- 95 percent had heard of people becoming ill from eating chicken.
- 94 percent had heard of *Salmonella*.
- 48 percent believed a family member had experienced a foodborne illness.
- Only 21 percent believed their family could become ill from home-prepared chicken.
- Only 9 percent of those with a history of illness believed it came from their own kitchen/picnic.

Chilling and hand washing

- 56 percent of respondents did not know the recommended refrigerator temperature.
- Only 26 percent correctly responded with temperatures between 32F and 40F.
- 44 percent placed chicken on the top shelf in their refrigerator, 21 percent in the middle, 1 percent in the door.
- 64 percent of meal preparers did not wash their hands before starting meal preparation.
- 38 percent did not wash their hands after handling raw chicken.
- 47 percent washed their chicken.

⁸³ Bruhn 2014.

- There was no correlation between having a food handler’s certificate and washing hands before beginning meal preparation, washing after handling chicken, or washing the chicken.

Cooking temperatures

- 48 percent said they owned a cooking thermometer, however only 53 percent said they knew the temperature to cook chicken; only 29 percent responded with the correct temperature.
- Consumers expressed surprise that their kitchen thermometers should—or could—be calibrated.
- 40 percent of “finished” chicken was under 165F.⁸⁴

CSPI did not identify comprehensive studies of consumer practices in their kitchens for all types of meat and poultry. But the practices documented by the cited studies have relevance to all meat and poultry, especially with respect to refrigerator temperatures, hand washing, cross contamination, and cooking practices, including the use of a thermometer. The percent of consumers that engaged in these practices far exceeded the 4 to 24 percent who reported they would order or prepare their ground beef as rare or medium-rare.

In the absence of formal surveys on consumer cooking preferences, CSPI found evidence that some consumers prefer ground pork, lamb, and pork-chicken mixtures cooked rare to medium-rare. A cursory search of the internet turns up rare to medium-rare cooking times in pork, lamb, and chicken recipes, many of them appearing on the websites of respected sources. For example, a recipe for a ground pork and lamb hamburger that appeared in the *New York Times* recommends cooking it rare to medium-rare, the Food Network website instructs consumers to cook ground pork hamburgers to medium-rare, and the Epicurious website includes a recipe for Mexican Pork and Chicken Burgers that calls for grilling the hamburger over medium heat for 3 to

⁸⁴ This sample of food preparers differed from those in the study by Kendall and colleagues who reported that consumers who did not use a thermometer adequately cooked their food.

4 minutes per side, a time associated with rare to medium-rare cooking.⁸⁵ These recipes reach a large audience and may influence cooking behavior in the home. Furthermore, while some recipes note the risk of *Salmonella* poisoning, most do not or else minimize the danger.

B. Studies on the Heat Resistance of ABR *Salmonella*

CSPI has not identified studies showing that ABR *Salmonella* is more heat resistant than non-ABR *Salmonella*. We believe the studies cited above on consumer habits demonstrate that heat resistance is not relevant if, as documented in the Bruhn study, 40 percent of “finished” chicken did not achieve the temperature necessary to deactivate *Salmonella*. Such a finding means that *Salmonella* may well survive “ordinary” cooking practices.

One study the agency should consider analyzed *Salmonella* Typhimurium’s survivability on chicken and found “[C]hicken meat, challenge temperature, or heating rates and cold storage have their effect on the heat resistance of . . . *S. typhimurium*, . . . They survive for longer periods of time than expected,” and concluded: “[L]imited cooking does not necessarily eliminate all bacteria present on the surface of poultry meat.”⁸⁶

In addition, the fact that *Salmonella* survives cooking under ordinary cooking conditions must be given great weight by FSIS in granting this petition, comparable to that given the 4 to 24

⁸⁵ Mark Bittman, *For the Love of a Good Burger*, N.Y. Times, May 23, 2007 at <http://www.nytimes.com/2007/05/23/dining/23mini.html?pagewanted=all> (urging that ground pork and lamb hamburgers be cooked rare to medium-rare); Food Network, *Mini Pork Cheeseburgers*, (2014) at <http://www.foodnetwork.com/recipes/mini-pork-cheeseburgers-recipe.html> (instructing people to cook ground pork burgers medium-rare); Epicurious, *Mexican Pork and Chicken Burgers*, Sept. 13, 2008, at <http://www.epicurious.com/recipes/member/views/MEXICAN-PORK-AND-CHICKEN-BURGERS-1278284> (recommending hamburger made with chicken and pork mix be grilled at medium heat for 3 to 4 minutes on a side). Other recipes may be found at N.Y. Times, *Recipe: Garlicky Pork Burger*, May 23, 2007, at <http://www.nytimes.com/2007/05/23/dining/232mrex.html?adxnln=1&ref=dining&adxnlnx=1409865269-hTkpYYESHxkFnRsMzuqi9g> (recommending ground pork hamburger be grilled 5 minutes on a side or until medium); N.Y. Times, *Recipe: Inside-Out Lamb Cheeseburgers*, May 23, 2007, at <http://www.nytimes.com/2007/05/23/dining/233mrex.html?ref=dining> (recommending ground lamb hamburger be grilled 4 minutes on a side for medium-rare); Caroline Russock, *Cook the Book: Lamb Burger*, Serious Eats Nov. 12, 2009, at <http://www.serious-eats.com/recipes/2009/11/lamb-burger-recipe.html> (describing a 70/30 lamb to pork hamburger cooked medium-rare as “amazing”); and Daniel Bruce, *Pork Burgers with Sage*, Food & Wine, Sept. 2009, at <http://www.foodandwine.com/recipes/pork-burgers-with-sage> (recommending ground pork hamburger be grilled over moderately hot flame for 6 minutes per side until browned on the outside and barely pink inside.) (All websites last accessed Sept. 4, 2014).

⁸⁶ de Jong 2012.

percent of consumers who reported a preference or practice in cooking their ground beef to rare or medium-rare. This is especially important, given studies discussed below showing consumers face poorer health outcomes from ABR *Salmonella* infections.

C. Factors Related to FSIS' Decision on *E. coli* in Ground Beef that Support ABR *Salmonella*'s Status as an Adulterant

FSIS distinguished its decision to declare seven serotypes of *E. coli* are adulterants in raw, non-intact beef products by pointing to other factors such as association with the serious illness conditions of hemorrhagic colitis (bloody stools) and hemolytic uremic syndrome. We agree that these are serious complications meriting the designation of the seven STEC strains as adulterants. However, it is unclear why the agency believes that these conditions merit stronger action on *E. coli* than on pathogenic strains of *Salmonella* that can have equally dire health consequences and are associated with a number of acute, long-term, and life threatening health impacts. These impacts are especially relevant to this petition's request because ABR *Salmonella* carries the additional factor of making these conditions more difficult to treat.

Salmonella infections can lead to Aortitis (inflammation of the aorta), Cholecystitis (inflammation of the large intestine), Endocarditis (infection of the inside lining of the heart chambers and heart valves), Epididymo-orchitis (inflammation of one or both of the testicles), Meningitis (inflammation/infection of the membranes covering the brain and spinal cord), Myocarditis (inflammation of the heart muscle), Osteomyelitis (infection of bone or bone marrow), Pancreatitis (inflammation/infection of the pancreas), Reactive arthritis, Splenic abscesses (a high level of pus in the spleen caused by a bacterial infection), and Septic arthritis in sickle-cell anemic persons (inflammation of a joint caused by a bacterial infection; also known as infectious

arthritis).⁸⁷ Additionally, *Salmonella* is associated with more than a quarter of the estimated 1,351 deaths each year from known foodborne pathogens.⁸⁸ We believe the agency well understands the health risks are serious for any foodborne disease, and that these consequences are made more serious if treatment is rendered ineffective by characteristics of the pathogen that result from antibiotic resistance.⁸⁹

In addition to physical health impacts, *Salmonella* illnesses impose a severe financial burden on consumers and society, some of which could be mitigated by declaring ABR *Salmonella* an adulterant. Even without diminished options for treatment, the monetized cost of each *Salmonella* case is estimated at \$4,000.⁹⁰ Another measure places costs per case at \$11,000 measured as lost quality of life for the victim.⁹¹ Additional or prolonged hospitalizations due to an ABR *Salmonella* infection would multiply these costs. And, whereas *E. coli* O157:H7 and non-O157 STECs are estimated to cause 20 deaths annually, *Salmonella* is estimated to take the lives of 378 people annually. In 2013, the CDC estimated that specific types of drug resistant non-typhoidal *Salmonella*⁹² cause 100,000 illnesses and 40 deaths annually.

Salmonella's monetized impact on public health led the Emerging Pathogens Institute (EPI) to rank it as the number one pathogen of concern in terms of annual disease burden.⁹³ The same EPI study ranked *Salmonella* in poultry fourth (221,045 illnesses/4,159 hospitalizations/81 deaths),

⁸⁷ Tanya Roberts, Barbara Kowalczyk & Patricia Buck, *The Long-Term Health Outcomes of Selected Foodborne Pathogens*, Center for Foodborne Illness Research & Prevention (2009) available at http://www.foodborneillness.org/cfi-library/CFI_LTHO_PSP_report_Nov2009_050812.pdf (last accessed Sept. 30, 2014).

⁸⁸ Elaine Scallan, et al., *Foodborne Illness Acquired in the United States—Major Pathogens*, 17 *Emerg. Infectious Diseases* 7, 12 (2011).

⁸⁹ Jay K. Varma, et al., *Hospitalization and Antimicrobial Resistance in Salmonella Outbreaks, 1984-2002*, 11 *Emerg. Infectious Diseases* 943 (2005).

⁹⁰ Robert L. Scharff, *Economic Burden from Health Losses Due to Foodborne Illness in the United States*, 75 *J. of Food Protection* 123 (2012) (the monetized costs of a *Salmonella* infection is about half the productivity loss for an *E. coli* O157:H7 infection, but \$1,000 higher on quality of life in Scharff's analysis) (hereinafter "Scharff 2012").

⁹¹ Scharff 2012.

⁹² Defined as ceftriaxone, ciprofloxacin or 5 or more drug classes. *Antibiotic Threats in the United States, 2013*, CDC.

⁹³ Michael B. Batz, et al., *Ranking the Risks: The 10 Pathogen-Food Combinations with the Greatest Burden on Public Health*, University of Florida, Emerging Pathogens Institute, 2011 (*E. coli* O157:H7 ranks 6th and non-O157 STECs rank 13th on the scale used by the study) (hereinafter "Batz 2011").

Salmonella in beef 12th (65,716 illnesses/1,237 hospitalizations/24 deaths), and *Salmonella* in pork 13th (65,716 illnesses/1,237 hospitalizations/24 deaths) among 50 top pathogen-food combinations.⁹⁴ Based on this information, *Salmonella* in meat and poultry costs consumers in excess of \$1.4 billion in medical expenses and lost productivity and some portion of this significant burden could be reduced by declaring ABR *Salmonella* an adulterant.

D. Studies on the Infectious Dose of ABR *Salmonella*

As FSIS notes in its denial letter, infectious dose is dependent on a variety of factors. For that reason, an evaluation of infectious dose should consider not only factors leading to infection, but also morbidity and mortality.⁹⁵ Some studies have said that only one viable *Salmonella* bacterium reaching the small intestine is capable of causing infection.⁹⁶ Host factors, therefore, such as low gastric acid and reduced immunity that are associated with the very young and the elderly, increase the risk of infection, and at that point, dose-dependence gives way to virulence characteristics that the agency should consider.⁹⁷

Infective dose studies demonstrate that ABR *Salmonella* has a lower dose-response than susceptible *Salmonella*. Animal studies show that antibiotic resistance characteristics lower the infective dose required and extend treatment periods.⁹⁸ Prior exposure to antibiotics, a common situation, can affect dose-response, as demonstrated by one study that found the infective dose for mice fell from 10⁸ organisms to fewer than 10 when the mice were treated with streptomycin.⁹⁹ It

⁹⁴ Batz 2011 (Number of illnesses, hospitalizations and deaths are estimates).

⁹⁵ Robert L. Buchanan, et al., *Microbial Risk Assessment: Dose-response Relations and Risk Characterization*, 58 Internat'l J. of Food Microbiology, 159 (2000) (hereinafter "Buchanan 2000").

⁹⁶ Melody Greenwood & W.L. Hooper, *Chocolate Bars Contaminated with Salmonella Napoli: An Infectivity Study*, 286 British Medical J. 1394; FDA, *Bad Bug Book* 2nd Edition; Buchanan 2000.

⁹⁷ Buchanan 2000.

⁹⁸ Jennifer G. Wright, et al., *Multidrug-resistant Salmonella Typhimurium in Four Animal Facilities*, 11 Emerg. Infectious Diseases 1235, 1239 (2005).

⁹⁹ Marjorie Bohnhoff & Phillip Miller, *Enhanced Susceptibility to Salmonella Infection in Streptomycin-Treated Mice*, 111 J. Infectious Diseases 117 (Sep.-Oct. 1962).

is suggested that the linkage between virulence and antibiotic resistance may also lower the infective dose.¹⁰⁰

FSIS requested data on the actual number of *Salmonella* per serving in different known food products responsible for outbreaks. However, the agency is aware that *Salmonella* is rarely enumerated in food vehicles associated with outbreaks, forcing researchers to estimate infective doses.¹⁰¹ Where *Salmonella* have been enumerated, the infective dose is consistently lower than is found in volunteer studies. This is likely because volunteer studies are conducted on healthy adult males while salmonellosis is most serious in the very young and elderly.¹⁰² Therefore, FSIS should rely on other indicators such as morbidity and mortality factors and antibiotic resistance factors that lower the infective dose for ABR *Salmonella* rather than delaying essential action to reduce the risk and burden on consumers from ABR *Salmonella*.

E. Studies on Virulence; Studies Documenting a Link between ABR and Virulence Genes

In its denial of CSPI's initial petition, the agency cited limitations to the studies linking virulence and the antibiotic-resistant status of *Salmonella*. FSIS's analysis is incomplete however. While identification of a specific virulence factor was important in declaring six STECs adulterants because of an absence of strong evidence that those pathogens were causing illnesses and outbreaks, the same is not true for ABR *Salmonella*. In addition to the outbreak data cited in the petition, numerous studies have found ABR *Salmonella* associated with higher hospitalization rates and poorer health outcomes.¹⁰³ These and other studies provide evidence that antibiotic resistance

¹⁰⁰ M. Barza, *Potential Mechanisms of Increased Disease in Humans from Antimicrobial Resistance in Food Animals*, 34 *Clinical Infect. Disease* (Suppl. 3) S123 (2002) (hereinafter "Barza 2002").

¹⁰¹ N. Bemrah, et al., *Quantitative Risk Assessment of Human Salmonellosis from the Consumption of a Turkey Product in Collective Catering Establishments*, 80 *Internat'l J. of Food Microbiology* 17 at 28 (2003) (hereinafter "Bemrah 2003").

¹⁰² Bemrah 2003.

¹⁰³ J.K. Varma, et al., *Antimicrobial-Resistant Nontyphoidal Salmonella is Associated with Excess Bloodstream Infections and Hospitalizations*, 191 *J. Infectious Diseases* 554 (2005) (hereinafter "Varma (2) 2005"); J.K. Varma, et al., *Hospitalizations and Antimicrobial Resistance in Salmonella Outbreaks*, 11 *Emerg Infectious Diseases* 943 (2005); S.M. Solgham, et al., *Multidrug-Resistant Nontyphoidal Salmonella in New York State's Foodborne Diseases Active Surveillance Network Counties*, 7

is an enabling component in the ability of pathogenic *Salmonella* serotypes to cause severe disease, increased hospitalization, more treatment complications, and more deaths.¹⁰⁴ Although the antibiotic-resistant attribute in itself does not heighten *Salmonella*'s pathogenicity, in a modern medical and healthcare setting, such as that in the United States, the antibiotic resistance of a pathogenic *Salmonella* does directly contribute to the increased morbidity and mortality of a *Salmonella* infection. In doing so, it directly falls under the Columbia University School of Public Health definition of virulence.

“The proportion of persons with clinical disease, who after becoming infected, become severely ill or die.”¹⁰⁵

It also falls within the definition used by the University of California Los Angeles, School of Public Health.

“The degree of pathogenicity of an infectious agent, indicated by case-fatality rates and/or the ability of the agent to invade and damage tissues of the host.”¹⁰⁶

Further evidence of a pathogen's antibiotic resistance-status as a component of that pathogen's virulence is well documented in the literature,¹⁰⁷ and is well supported by the public health record.¹⁰⁸

Foodborne Pathogenic Diseases 1 (2010); R.A. Devasia, et al., *Antimicrobial Use and Outcomes in Patients with Multidrug-Resistant and Pansusceptible Salmonella Newport Infections*, 2002-2003, 11 *Microbial Drug Resistance* 371 (2005).

¹⁰⁴ Barza 2002; K. Travers & M. Barza, *Morbidity of Infections Caused by Antimicrobial-resistant Bacteria*, 34 *Clinical Infectious Diseases* (Suppl. 3) S131 (2002); A.D. Anderson, et al., *Public Health Consequences of Use of Antimicrobial Agents in Food Animals in the U.S.*, 9 *Microbiol Drug Resistance* 373 (2003); L.J. Martin, et al., *Increased Burden of Illness Associated with Antimicrobial-resistant Salmonella enterica Serotype Typhimurium Infections*. 189 *J. Infectious Diseases* 377 (2004); K. Molbak, *Human Health Consequences of Antimicrobial Drug-resistant Salmonella and Other foodborne Pathogens*, 41 *Clinical Infectious Diseases* 1613 (2005); A.L. Krueger, et al., *Clinical Outcomes of Nalidixic Acid, Ceftriaxone, and Multidrug-Resistant Nontyphoidal Salmonella Infections Compared with Pansusceptible Infections in FoodNet Sites, 2006-2008*, 11 *Foodborne Pathogens and Disease* 335 (2014).

¹⁰⁵ Glossary of Epidemiology Terms. Columbia University, available at <http://www.cs.columbia.edu/digigov/LEXING/CDCEPI/gloss.html> (last accessed Sept. 30, 2014).

¹⁰⁶ Definitions, University of California Los Angeles School of Public Health, available at http://www.ph.ucla.edu/epi/bioter/anthapha_def_a.html (last accessed Sept. 30, 2014).

¹⁰⁷ Varma (2) 2005; Jennifer E. Stevenson, et al., *Increase in Nalidixic Acid Resistance among Non-Typhi Salmonella enterica Isolates in the United States from 1996 to 2003*, 51 *Antimicrobial Agents and Chemotherapy* 195 (2007); Maria Sjölund-Karlsson, et al., *Emergence of Plasmid-Mediated Quinolone Resistance among Non-Typhi Salmonella enterica Isolates from Humans in the United States*, 53 *Antimicrobial Agents and Chemotherapy* 2142 (2009); B.R. Jackson, et al., *Outbreak-associated Salmonella enterica Serotypes and Food Commodities, United States, 1998-2008*, 19 *Emerg. Infectious Diseases* 1239 (2013);

While *Salmonella* ssp. is a pathogen that poses a compelling public health burden on consumers that FSIS should address in the future, the evidence presented in this petition fully answers the questions posed by FSIS in its denial letter, and should be used to conclude that ABR *Salmonella* is not addressed by “ordinary cooking and preparation,” exposes consumers to an increased risk of severe illness and hospitalization, and has characteristics that make it more virulent than pansusceptible *Salmonella*. These factors require FSIS to develop a unique risk management strategy that goes beyond those which are currently employed for other types of *Salmonella*, including a declaration that the four strains of ABR *Salmonella* described in this petition are adulterants.¹⁰⁹

Jay K. Varma, et al., *Hospitalization and Antimicrobial Resistance in Salmonella Outbreaks, 1984-2002*, 11 *Emerging Infectious Diseases* 943 (2005).

¹⁰⁸ Jason P. Folster, et al., *Characterization of Multidrug-Resistant Salmonella enterica Serovar Heidelberg from a Ground Turkey-Associated Outbreak in the United States in 2011*, 56 *Antimicrobial Agents and Chemotherapy* 3465 (2012); CDC, *Outbreak of Salmonella Heidelberg Infections Linked to a Single Poultry Producer—13 States, 2012-2013*, 62 *MMWR* 553 (2013); CDC, *Multistate Outbreak of Multidrug-Resistant Salmonella Heidelberg Infections Linked to Foster Farms Brand Chicken (Final Update)* (2014) at <http://www.cdc.gov/salmonella/heidelberg-10-13/index.html> (last accessed September 30, 2014); CDC, *Multistate Outbreak of Salmonella Heidelberg Infections Linked to Chicken (Final Update)* (2013) at <http://www.cdc.gov/salmonella/heidelberg-02-13/index.html> (last accessed Sept. 30, 2014); Marshall 2011; L.J. Martin, et al., *Increased Burden of Illness Associated with Antimicrobial-Resistant Salmonella enterica Serotype Typhimurium Infections*, 189 *J. Infectious Diseases* 377 (2004); K. Travers & M. Barza, *Morbidity of Infections Caused by Antimicrobial-resistant Bacteria*, 34 *Clinical Infectious Diseases* (Supp. 3) S131 (2002); Simon J.G. Otto, et al., *Estimating the Number of Human Cases of Ceftriaxone-Resistant Salmonella enterica Serovar Heidelberg in Quebec and Ontario, Canada*, *Clinical Infectious Diseases* (online) (2014); M. Hoffman, et al., *Genome Sequences of Five Salmonella enterica Serovar Heidelberg Isolates Associated with a 2011 Multistate Outbreak in the United States*, 194 *J. Bacteriology* 3274 (2012); John A. Crump, et al., *Antimicrobial Resistance Among Invasive Nontyphoidal Salmonella enterica in the United States, National Antimicrobial Resistance Monitoring System, 1996-2007*, *Antimicrobial Agents and Chemotherapy* (online); K. Molbak, *Human Health Consequences of Antimicrobial Drug-Resistant Salmonella and Other Foodborne Pathogens*, 41 *Clinical Infectious Diseases* 1613 (2005); DeWaal 2013.

¹⁰⁹ FSIS ended its response to CSPI with a discussion of Codex standards. However, the agency’s primary responsibility is to enforce U.S. law, which is the subject of this petition.