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Hamburger Hell: The Flip Side of USDA's Salmonella Testing Program

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**ABSTRACT**

This report examines the integrity and reliability of the U.S. Department of Agriculture's (USDA) Salmonella testing program. These microbial tests are the cornerstone of its Hazard Analysis Critical Control Point (HACCP) program to modernize food safety and transform meat and poultry inspection into a public health program. Microbial testing also serves as the policy rationale for reducing government visual inspection in slaughter and processing plants. Most visibly, it is the foundation for repeated agency statements that Salmonella contamination of government-approved meat and poultry is dropping. Based on an exhaustive, five month review of USDA's own records, obtained under the Freedom of Information Act, we conclude there is no factual basis from the testing program for USDA's reassurances that the food supply has become safer for consumers of ground beef. We examined results from the start of the Salmonella testing program in January 1998 through October 1, 2001. We found that there has been a systematic breakdown in the integrity of the sampling program, to the extent that its results are unable to support conclusions about changes in contamination rates. Whether due to systematic incompetence or bad faith, USDA's "don't look, don't find" policy means it is fundamentally deceiving the public with false reassurances.

Please note that this article was peer reviewed but not double-blind reviewed.

## ARTICLE

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An extended version of this article is available at  
<http://www.citizen.org/documents/salmonellareport.PDF>

*"Who makes meat safe?" [she] asked. The crowd managed a weak,  
'We do.'*

*'That's right,' Murano replied. 'You do. We [USDA] are just there to  
look over your shoulder.'*

*From the back of the room, a voice called out, 'Can't you look away  
once in awhile?'"(1)*

While "don't look, don't find" regulation may be a laughing matter for industry insiders, as this report will show, it is definitely not a laughing matter for consumers. At many large ground beef plants, the USDA is doing a poor job living up to its promises about using a new, scientific, microbial testing program to protect consumers. The scale of food borne illness in the U.S., estimated by the Centers for Disease Control and Prevention to cause 76 million illnesses, 325,000 hospitalizations and 5,000 deaths per year(2), is staggering. A strong microbial testing program could serve as an important tool for reducing food borne illness. But a poorly implemented microbial testing system does not bolster federal food safety programs. And implementing a scientific program in a less than scientific manner is a waste of taxpayer dollars and an abuse of the public's trust.

## HISTORY

In 1993, *E. coli*-contaminated hamburger killed four children and sickened more than 700 people nationwide in the Jack in the Box outbreak(3). The outbreak served as a wake-up call and highlighted the severity of the problem of contaminated food. It also sparked a national debate on more effective and modern methods of government food inspection. Three years later, in 1996, the Clinton Administration finalized the Pathogen Reduction/HACCP (Hazard Analysis Critical Control Point) rule, a modification of requirements for federally inspected meat and poultry slaughtering and processing establishments.

The primary change under HACCP was a shift in government and industry roles based upon the premise that introduction of microbial testing would strengthen meat inspection by making it more science-based. Under HACCP, plant managers must analyze their production system for likely hazards, then identify critical control points where these hazards are likely to occur. Plant employees must then control and monitor the plant's process at these points. With this new system, USDA turned over many inspection tasks traditionally performed by federal inspectors to plant employees. Government inspectors, once the backbone of product safety efforts, are now relegated, primarily, to oversight and auditing roles. Representatives from some consumer organizations viewed the trade-off as acceptable because, for the first time, the USDA introduced routine government microbial testing in meat plants. When implemented, this testing program consisted of a routine government sampling program for *Salmonella*(4).

The stated purpose of the *Salmonella* testing program is not to prevent products contaminated with *Salmonella* from leaving the plant. Rather, its purpose is to use the presence of the pathogen as an indication that the plant is not controlling food safety hazards in their production processes(5). *Salmonella* was "selected [by the agency] as the target organism because it is the most common cause of food borne illness associated with meat and poultry products" and because the agency believed that controlling for *Salmonella* might also result in reductions of other dangerous pathogens that may grow in the gut of farm animals, such as *E. coli* O157H:7(6). These pathogens can get into the food supply when sloppy handling of the hides or intestines of animals at slaughter allows fecal contamination of the meat.

The agency claimed that *Salmonella* sampling would more than make up for diminished frontline government inspection and would make food safer by detecting dangerous microbes that were invisible to inspectors. The agency would ensure food safety by verifying that plant production systems were successfully controlling hazards. The explicit strategy was that when the microbial testing program detected food safety problems at a plant, the agency would mandate that the plant take immediate corrective actions and would review the adequacy of those actions in a timely manner(7).

USDA established *Salmonella* performance standards at the beginning of HACCP, and announced that these standards would become progressively more rigorous, eventually leading to an overall decrease in the pathogens on meat and poultry and, ultimately, a decrease in associated food-borne illnesses. Companies not able to meet the standards would face regulatory

action ranging from written notices requiring corrective action to withdrawal of inspection. If a plant failed three successive tests, the agency would suspend inspection services, effectively shutting the plant down, "until the establishment demonstrates its ability to meet the performance standard."(8)

However, in December 2001, a Texas federal appeals court ruled in Supreme Beef Processors, Inc. v. United States Department of Agriculture(9), that the USDA's *Salmonella* performance standard is unlawful. The court's decision applies only to Texas, Mississippi, and Louisiana. According to USDA's public affairs department, the agency is using the decision to guide its policy nationwide.(10)

Still unclear is exactly how much of the *Salmonella* testing program could be invalidated by the decision that the standard itself is unlawful. The agency has decided not to appeal the decision to the Supreme Court(11), and has stated that while the decision limited its ability to enforce the standard, it did not diminish its authority to use the performance standard as a diagnostic tool(12).

Undersecretary for Food Safety Dr. Elsa Murano has assured the public that "[the agency] will continue to test for *Salmonella*, since this will serve to verify that a [company's food safety] plan is properly controlling food-borne hazards to the greatest extent possible." In fact, although there are currently a number of proposals in Congress to give the agency increased authority to close plants based on failed *Salmonella* tests, Dr. Murano recently told congressional leaders that she was not in favor of basing enforcement decisions solely on microbial test results. Instead, she believes they function best to trigger more extensive physical inspections(13).

Meanwhile, the agency is waiting for pending recommendations from the National Academy of Sciences and the National Advisory Committee on the Microbiological Criteria for Foods on how microbial standards can best be used for public protection(14). The agency is also planning a series of forums to get public comment on this issue.

Obviously, in the wake of the Supreme Beef decision, the future of the *Salmonella* testing program is unclear. Whether or not USDA retains authority to take any enforcement action as a result of testing is a question that must be resolved, most likely by Congress. For the purposes of this report, we will not speculate on the ultimate effect of the decision. What we will do is examine the data generated by the testing program from its inception through October, 2001 - a few months before the Supreme Beef decision - and examine the program's effectiveness. This is useful because it

can inform further discussions about the future of performance standard testing.

## **METHODS**

On October 1, 2001 we submitted a Freedom of Information Act (FOIA) request to the USDA requesting all *Salmonella* testing data collected since the beginning of the testing program in January 1998. The data was received on CD-ROM in December 2001 and covered testing from January 26, 1998 through October 1, 2001.

The ground beef data was then separated from the data on other product categories. Ground beef testing data was chosen for analysis for the following reasons:

Enforcing *Salmonella* standards in ground beef plants was the specific subject of the recent Supreme Beef ruling.

Ground beef testing is the only routine scientific testing done at the largest beef plants that both slaughter cattle and grind beef(15).

Because we wanted to evaluate agency enforcement actions at plants failing to meet the performance standard, we sorted the data by the number of failed "sample sets" for each product type. The category with the most failed sets was ground beef(16), which makes it the largest body of data for evaluation of the agency's enforcement actions.

Data from the agency's random *E. coli* O157:H7 testing program, a program independent from the *Salmonella* testing program, indicates that the percentage of ground beef samples collected at federally inspected production facilities that tested positive for *E. coli* increased from .18% in 1997 to 1.3% in 2000. Even with better testing, an *E. coli* O157:H7 rate exceeding one percent indicates that company safety plans and current agency regulations are not controlling food safety hazards in a way that sufficiently protects consumers(17).

Recent research indicates that consumer demand for beef is steadily increasing(18), and therefore the safety of this product greatly impacts public health.

HACCP was implemented in stages, according to plant size. As plants came under HACCP, they simultaneously became subject to *Salmonella* testing. HACCP was implemented in large plants (those with 500 or more employees) in January 1998; in small plants

(those with 10 to 499 employees) in January 1999; and very small plants (those with fewer than 10 employees or annual sales of less than \$2.5 million) in January 2000. It is very difficult to determine how large a plant is strictly by the initial *Salmonella* testing date, however, because testing at some large plants started late (after 1998) while testing at some small plants started early (before January 1999).

The database we received did not list plant size. Therefore we first estimated a plant's size by the date it started *Salmonella* testing. We confirmed the size of the plants we believed to be large (which are the primary focus of this report) using either the agency's website(19) or information we received from agency officials. When this information conflicted, we relied on the website information because the agency was frequently non-responsive to our questions about plant size and other information pertinent to this report(20). Confusion about plant size may also enter in because plant sizes are not fixed(21). It is possible that some plants may have changed category by gaining or losing employees.

The bulk of this report deals with findings in the 26 ground beef plants we determined to be large. Because the agency implemented HACCP in the large plants first, it has done more testing in each of these plants than in plants that are small or very small. There are, however, many more small and very small plants, so these contribute the majority of tests in later years. Large plants will have a significant impact on public health due to the large volume of ground beef they produce. There is no reliable, publicly available information on the percentage of ground beef produced by large plants(22), or on the total poundage produced by large ground beef plants under HACCP. For calculations in this report, we are using an estimate commonly accepted by those familiar with the ground beef industry that large ground beef plants typically produce 150,000 pounds per shift, two shifts per day, six days per week. Based on this estimate, the 26 large ground beef plants collectively send enough ground beef to market to make nearly 10 billion quarter pound hamburgers each year.

## **PART ONE: THE *SALMONELLA* TESTING PROGRAM ON PAPER VS. IN PRACTICE THE TESTING PROGRAM ON PAPER**

The stated purpose of performance standard testing is to ensure that food consumed by the public is as safe as possible. The agency uses a sampling program to verify that plant systems are controlling food safety hazards. The more frequent the sampling, the more

rapidly the agency should be able to detect problems that threaten public health.

Frequent testing is necessary because the nature of the production systems in meat plants makes them extremely vulnerable to problems that frequently occur without warning - and as a result, food can quickly be turned into a toxic product. Excessive line speeds prevent line employees from detecting contamination. Employee turnover in the large plants often exceeds 100 percent per year. Thus, each new group of unskilled workers must be trained how to eviscerate animals without spilling fecal material on the carcass, as well as how to avoid cross-contaminating meat as it moves down the line. Equipment malfunction or mishandling can also introduce and spread contamination on carcasses. Plants that grind meats are vulnerable to problems with the raw products they receive from their suppliers, as well as sanitation and process problems at their own facility.

When the public debate on microbial testing first began, consumer group representatives advocated daily sampling at each plant. This seemed to be the only way to determine that plants were controlling hazards consistently enough to ensure that the food was actually safe. Some companies that are keenly aware of the deadly consequences of inadequate procedures use even more frequent testing. After the 1993 tragedy, Jack-In-The-Box instituted microbial testing in its plants every 15 minutes of production(23).

The USDA regulates meat and poultry in slaughter and processing facilities. "Slaughter" plants turn live animals into carcasses. All further butchering, grinding and processing of the carcasses is done at processing facilities. The agency's current *Salmonella* regulations apply at slaughter plants for cattle, hogs, chicken and turkeys, and processing plants that grind beef, chicken or turkey, but not to other types of processed meats. While the HACCP Final Rule authorizes the agency to sample carcasses and ground products at plants that produce both(24), the agency focuses testing efforts on ground products at these plants because "*Salmonella* is more likely to be present on raw, ground or comminuted products than on the carcasses from which they are derived..."(25).

Under standard protocol the agency tells federal inspectors in a given plant when to begin taking samples. For ground products, the sample size is approximately half a pound(26). An agency Directive instructs the inspectors to take the sample each day the plant is producing the product and to send the sample to one of the USDA labs for analysis(27). For each product that USDA tests, it has established the number of samples that comprise a complete sample "set." When the lab has analyzed the designated number of

samples, it informs the inspector in the plant to stop sending them. The results of the lab tests are sent to the Food Safety Inspection Service (FSIS) at USDA headquarters in Washington, DC. Only when the sample set is complete, do the government inspector in the plant or plant officials have access to the results.

*Salmonella* standards for each product were based on nationwide industry baseline testing performed before the implementation of HACCP. Baseline prevalence rates were calculated using data from large and small plants only, because very small plants contribute less than one percent of products reaching the market(28). For each product, the agency established the number of samples that make up a set and the number of samples in the set that may legally test positive for the presence of *Salmonella*. The performance standards established by the agency were chosen so that there is an "approximately 80% probability of passing when the establishment is operating...just within the performance standard."(29) The number of allowable positives and the number of samples in the set vary by product. For example, a plant slaughtering steers and heifers meets the standard if no more than one out of 82 samples tests positive for *Salmonella*, whereas a ground turkey plant meets the standard if no more than 29 out of 53 samples tests positive for *Salmonella*. Ground beef plants, covered in this report, are considered to be in compliance if no more than five out of a set of 53 samples test positive for *Salmonella*(30).

If the plant passes the set, it will be tested again whenever the agency schedules it. However, the agency has never made clear how soon after passing a set the plant will be re-tested, thereby neglecting to establish a minimum scope or frequency of testing. This leaves the public health foundation of the testing program incomplete.

If the plant fails the set, an inspector in the plant is instructed to issue a non-compliance report requiring corrective action. Then, the agency will "normally" begin re-testing in approximately 60 days to verify that the changes implemented by the plant have been effective(31). Before the recent Supreme Beef decision prohibited it, agency regulations provided that further failures could lead to a shut down after three successive failed sets,(32) but now these serious lapses in food safety may only trigger an "extensive review" by the agency. (See page 16 for more discussion of the review process.) It is important to note that by the time a set is complete, the product that was tested will have left the plant, and the *Salmonella* testing program has no mandate or expectation that product from plants failing to meet the standard will be recalled.



## **THE TESTING PROGRAM IN PRACTICE**

There are approximately "1,700 establishments producing ground beef under [USDA] inspection"(33). The database received and analyzed for this report has 1,163 complete *Salmonella* testing sample sets from 760 federally inspected plants that produce ground beef. Twenty-six of these plants are large, 734 are small or very small.

Of the 26 large plants, 16 never failed a set (61.5 percent). Of the 10 that failed any sets:

- One plant failed its only set (1/1).
- One plant failed one out of two sets (1/2).
- Three plants failed one out of three sets (1/3).
- One plant failed two out of three sets (2/3).
- One plant failed three out of three sets (3/3).
- Two plants failed one out of four sets (1/4).
- One plant failed two out of four sets (2/4).

Of the 734 small and very small plants, 666 never failed a set (90.7 percent).

Of the 60 small plants that failed any sets:

- Seven plants failed their only set (1/1).
- 15 plants failed one out of two sets (1/2).
- 23 plants failed one out of three sets (1/3).
- Four plants failed two out of two sets (2/2).
- Five plants failed two out of three sets (2/3).
- Three plants failed two out of four sets (2/4).
- One plant failed three out of four sets (3/4).
- One plant failed three out of five sets (3/5).
- One plant failed four out of four sets (4/4).

Of the eight very small plants that failed any sets:

- Two plants failed their only set (1/1).
- Five plants failed one out of two sets (1/2).
- One plant failed two out of two sets (2/2).

### **Testing Frequency**

Agency protocol states that a sample is to be collected every day a plant produces ground beef until 53 samples are collected(34). To determine the extent to which the agency actually samples ground beef each day that it is being produced, we looked only at data from the large plants, because these plants typically produce ground beef five or six days per week. Small and very small plants may only produce the product sporadically. If samples are taken daily, the

agency should easily complete collection of a ground beef sample set at a large plant within 9 to 12 weeks.

Agency testing was completed within a 12-week time frame in less than 40% (39.7%) of the 73 sets completed in the large plants for which we have good data(35). The median set length was 14.1 weeks and the range of set lengths was 10.3 weeks to 126.4 weeks in large plants. Because of the extreme length of a set at a number of plants, the average length of a sample set at large plants was 25.7 weeks.

The data show that prolonged sets often have involved extensive lapses within the sample set, rather than consistent, but less frequent testing. Any number of the typical transient problems involving equipment, supplies or employees could combine to cripple food safety systems during such a lapse, and remain undetected if the plant continues normal production schedules and continues to send product to the market(36).

*In the eight large plants where a set took more than a year, all sampling ceased for periods ranging from nine to nearly 26 months, completely precluding the government from detecting problems during these lapses.*

These long lapses in testing raise another concern. In response to our questions, the agency has repeatedly stated that delays in completing sample sets are most often due to individual circumstances such as sample delivery problems or other unforeseen logistical delays. The data, however, show strong patterns of delay that call such explanations into question. In the eight plants mentioned above, the agency started the sets in 1998 and sampled nearly daily until most of the 53 samples were collected. Then all sampling ceased until the final few samples necessary to complete the set were collected in 1999 or 2000. Based on the agency's responses to our questions, it is not clear if the agency knew of the lapses in testing, or any potential pattern in the timing of these lapses. Regardless of the reason behind it, the agency's failure to prevent these lapses in testing is inexcusable.

### **Postponing a Finding of Failure**

Since a ground beef plant fails the sample set if more than five samples test positive for *Salmonella*, we refer to the date of the sixth positive sample as the "actual failure" date. However, as this section explains, the agency does not declare a set a failure until all samples are collected. We refer to the date that the agency considers a set a failure as the "official failure" date.

The agency mandates that plants take corrective action after failing a set(37), but it unnecessarily postpones determination of failure and thereby prolongs conditions that could threaten public health. Even though a ground beef plant fails if any more than five samples test positive for *Salmonella*, the agency does not consider a set complete and will not address set failure until all 53 samples have been collected. The agency does have an "early warning" system, under which it informs plants as soon as they have accumulated more than half the positives necessary to fail a sample set (three for ground beef). But the agency does not require that the plant take any action to correct the problem after such a warning. After this early warning, until all 53 samples are analyzed, the agency will not:

- inform the plant when it fails the set (with the sixth positive sample);
- require corrective action;
- alert the inspectors in the plant that the plant failed the set; or
- warn the public that the plant may be sending unusually contaminated products to market.

Instead, the USDA does nothing and continues to stamp the products "Inspected and Passed" and the product goes to market.

The delays due to prolonged testing discussed in the previous section are especially significant at failing plants. Out of the 14 failing sample sets at large plants, only four were completed in 12 weeks. In the other 10 failing sets, testing took up to 27 additional weeks. Because of the excessive time to complete the set, and because no corrective action is required until a set is complete, such delays represent a missed opportunity to protect public health.

*The ultimate impact of this delay on consumers is that the agency allowed failing plants to send products to market for a cumulative total of nearly 1000 weeks after actual failures, without informing them of problems or requiring them to take corrective action.*

*During the 121 weeks of delays at large plants alone, the agency knowingly allowed an estimated 218 million pounds of potentially contaminated ground beef to enter the market bearing the USDA seal of approval before it even informed plant managers of the need for corrective actions(38). (Ground beef was also sent to the market during the waiting period that followed these sets.)*

This unnecessary delay when corrective actions are needed most poses a tremendous threat to consumers by postponing elimination of public health hazards, especially at plants where high numbers of positive samples indicate that food safety systems are seriously compromised.

For example, at ConAgra Beef Company (Cactus, Texas), over 16 weeks passed after its sixth positive sample was discovered by the agency and before corrective action was required. At Excel Corporation (Booneville, Arkansas), over 19 weeks passed after its sixth positive sample was discovered by the agency and before corrective action was required. By the time all 53 samples were collected in each set, the ConAgra plant had 25 samples and the Excel plant had 15 samples that had tested positive for *Salmonella*, demonstrating that their food safety controls were seriously compromised throughout the unnecessary period of agency inaction.

### **The Waiting Period Between Sets**

We calculated the length of the period between the end of one sample set and the beginning of the next set. We refer to this period as a "waiting period."

The agency does not define how long the waiting period is after passing sets. Though no testing is being done during a waiting period, ground beef continues to carry the USDA seal of approval.

There were limitations in the data that limited our ability to calculate the average waiting period after passing sets. We requested data from January 1998 through October 2001, but, under agency policy, only received data from sample sets that had been completed in that timeframe. There were numerous plants where at least one set was taken but where no subsequent set has been documented since 1999. While it is possible that no testing of ground beef has occurred at a particular plant since then, it is also possible that the agency had initiated but not completed a set by October 2001 and therefore did not release data from these incomplete sets. It is also possible that the plant has stopped producing ground beef altogether. There were too many cases like this to be individually investigated.

Given those limitations, however, we determined the waiting period after passing sets for plants for which we have records. The waiting period at plants that never failed a set exhibited variability at both large and smaller plants.

*A seven or eight month waiting period for plants that have never failed a set can still pose a threat to public health because good performance does not always continue. This is illustrated by the fact that six of the 10 large plants and 13 of the 60 small plants that failed their second or third set, did so after passing their first set.*

Even at plants that pass consecutive sets, there is no assurance that the conditions during the waiting period between sets were constant. One example is the Excel plant in Fort Morgan, Colorado. Numerous food safety problems were evident at this plant during the test-free waiting period between April 15, 1999 and July 18, 2000(39):

- On September 13, 1999, USDA found *E. coli O157:H7* in beef produced at the plant through its random retail sampling program;
- USDA tests found the same pathogen twice soon after;
- inspectors cited the plant 26 times for fecal contamination;
- USDA suspended inspection at the plant for three days and threatened a second suspension;
- sirloin tips produced at the plant on June 23, 2000 and contaminated with the deadly *E. coli O157:H7* pathogen were linked to an outbreak that sickened over 500 people and killed a little girl in Wisconsin.(40)

Testing of the ground beef was the only *Salmonella* testing done at this entire plant - in either slaughter or processing. Despite the severity of the problems just described that were happening in the slaughter section of the plant starting in April 1999, the agency did not schedule another set to evaluate the plant's food safety controls until July 2000. Virtually all of the beef used by the plant to produce ground beef comes from the slaughter section of this facility.

When a plant fails a sample set, agency policy holds that a follow-up set will usually be initiated within 60 days (approximately 9 weeks). Although the agency does no testing during this period, it continues to place the USDA seal of approval on products leaving the plant.

None of the plant size categories were found to have median waiting periods less than the recommended 60 days, moreover the data show that large plants have been given more time than small or very small plants after a failed set before the agency resumes testing for *Salmonella*. This creates and prolongs an interim honor system when USDA should instead be intensifying government oversight. Again, because of the volume of ground beef sent to market by large plants, it is of particular concern for consumers when the agency delays verification of plant corrective measures at large plants. Under the *Salmonella* testing program, the only way to get such verification is to complete a passing sample set.

### **The Final Delay**

Recently, USDA's Undersecretary for Food Safety Dr. Elsa Murano stated that, in response to a lower court's decision in the Supreme Beef case in 1999, the agency changed its protocol for scheduling a

third sample set(41). This change was formalized in October 2001, when the agency issued a Directive stating that after a plant fails two consecutive *Salmonella* performance standard sets, the agency will no longer begin a follow-up set after 60 days. Instead, it will send in a group of agency officials to assess "whether an establishment is carrying out activities that meet the requirements of the Pathogen Reduction/HACCP regulation."(42) The evaluation is called an "In-Depth Verification (IDV) review." Products continue to carry the USDA seal of approval to market throughout the review.

But unfortunately for consumers, agency policy provides an excuse for not starting the third sample set. According to agency policy, if there is "any doubt" that plant corrective actions after a failure have been effective or any doubt that the plant "is likely to pass the third set," the third *Salmonella* set will not begin. It is only when there is a "high level of confidence that...the next sample set will succeed...[that] the third sample set is initiated."(43) In short, unless the agency is sure the plant will pass, it will not begin a follow-up set. The IDV review team may even use the results of *Salmonella* testing by the plant to determine when the plant is likely to pass the set, essentially granting the plant the chance for off-the-record testing.

Repeatedly, in answer to our questions, officials at the Food Safety Inspection Service's Technical Service Center in Ames, Iowa and at Washington headquarters said there is no time limit to initiate another sample set during an IDV. Both line inspectors and FSIS supervisors who are now whistleblowers have told us that this process has already gone on for almost a year at some plants. It is already clear that IDV reviews will only justify more delays in taking action to prevent potentially dangerous products from entering the marketplace.

### **The Effect of Multiple Delays**

Perhaps the weaknesses of the *Salmonella* testing program are best illustrated by considering how little testing the agency does in a plant when the various delays just described are combined.

We calculated the time between the first sample of a set and the first sample of the following set and are calling this period the "testing cycle." The testing cycle encompasses the time to complete a full sample set and the waiting period after that set. The testing cycle calculation illustrates the cumulative effect of prolonged sample sets and waiting periods discussed previously. The median testing cycle for sample sets at large ground beef plants that have never failed a set is 58.5 weeks(44), and the range was 21.6 weeks to 136.7 weeks. Included in these are five sets for which the testing

cycles took more than two years to complete. (It is important to keep in mind that in one testing cycle for ground beef, only 53 samples are taken.) The cumulative effect of such delays is less than weekly sampling, a significant departure from early FSIS plans for daily testing.(45)

While it is impossible to link long testing cycles directly with public health effects, a long testing cycle necessarily contains long periods with no sampling. It is not safe to assume that good performance continues during test-free periods, whether occurring during passing sets or in the following waiting period. The data show two plants with long testing cycles which passed their first set, but whose subsequent history illustrates why such delays are troubling.

Due to a significant lapse within its first set, as well as the waiting period after that set(46), the IBP plant in Holcomb, Kansas only had eight samples taken between August 1998 and October 2000. The plant went on to effectively fail its second set after only 12 samples were analyzed and finished that set with almost twice the allowable number of positives - 9 (47). Due to a significant lapse within its first set, as well as the waiting period after the set(48), the IBP plant in Emporia, Kansas had only six samples taken between September 1998 and July 2000. The plant went on to effectively fail its second set after only 18 samples were analyzed and finished the set with more than twice the allowable number of positives (11).

For both of these plants, the results indicate that the food safety systems were severely compromised by the time the agency finally began the second set; however, it is now impossible to determine when during the test-free period either plant started posing an inordinate risk to public health.

At failing plants, delays can combine to create serious public health consequences. A review of the sampling summaries from two large plants that failed multiple sets demonstrates how prolonged sets, long lapses between actual and official failure, and long waiting periods between sets combine to prevent the *Salmonella* testing program from being used to effectively protect the public.

The agency first determined that plant systems at a ConAgra plant were inadequate on June, 10 1999. It then took over 16 weeks to complete the set in which the outcome was already known, and over 34 weeks to start a second set, which the plant proceeded to fail within four weeks. But as of October 1, 2001, it had not yet completed a passing sample set that could verify that problems had been corrected.

*Though this plant had the worst record of any large ground beef plant in the database, USDA has continued to stamp their product "Inspected and Passed," with no major interruptions as far as can be determined.(49)*

In the case of an Excel plant, the agency first determined that plant systems were inadequate on May 27, 1999. But as of October 1, 2001, it had not yet completed a passing sample set that could verify that corrective actions were effective.

*Every week that the agency allowed (or continues to allow) these two plants to send ground beef to market without verifying that they have successfully corrected food safety problems, it gave the USDA seal of approval to enough potentially contaminated ground beef to make over 14 million quarter-pound hamburgers.(50) If these two plants operated virtually without interruption between their failures in June 1999 and October 1, 2001, together, they introduced enough potentially dangerous ground beef into the market to make nearly 2 billion quarter-pound hamburgers, all USDA-approved.*

## **PART TWO: ANALYSIS OF USDA'S SALMONELLA TESTING REPORTS**

In Part One, *Salmonella* testing data was analyzed to examine agency implementation of the testing program. In this section the data from large ground beef plants was analyzed to determine what it indicated about improvements in food safety controls in these plants and about the accuracy of agency reports on the program. But unfortunately, the data were so compromised by biases resulting from the poor implementation and design of the program that reliable conclusions about improvements on the basis of the *Salmonella* data cannot be drawn. The USDA, however, has used this same data set to claim major improvements in food safety due to implementation of the HACCP program.

### **THE QUALITY OF AGENCY DATA**

Given the critical role of the testing program in evaluating HACCP's effectiveness, it is reasonable to expect that the program would be carefully planned and administered. From the beginning of HACCP implementation, the results of the *Salmonella* testing program were viewed as the primary and most reliable indicator for the effectiveness of the agency's meat and poultry inspection system.



The agency stated that:

*"Salmonella enforcement strategy will embody an objective, uniform systems approach to ensure that it is administered and applied in a fair, equitable, and common-sense manner. The Agency will carefully monitor and adjust its enforcement program on an ongoing basis to ensure that its enforcement activities reflect these principles while ensuring food safety."(51)*

Part One demonstrated that testing was not administered in a uniform way, resulting in long delays both within and between sets, and documented enough inconsistencies to cast doubt on the randomness of testing results. Randomness is an essential component of any legitimate sampling program. The *Salmonella* program's extreme inconsistencies could have significantly biased data collection under this program, precluding reliable analysis of annual trends or trends between sample sets.

## **THE QUALITY OF AGENCY REPORTS**

The agency has analyzed on-going data from the program on at least eight separate occasions(52). Each time it published at least one report on the findings with accompanying press releases. Initial agency reports stated that results were still considered preliminary and some reports suggest caution in comparing data because of potential bias. Despite this, the agency consistently makes comparisons to pre-HACCP baseline data and with every analysis reports continuing improvement in the industry as a whole. The agency has often cited particular improvements in ground beef as a result of HACCP implementation, based on the results from the *Salmonella* testing program. The validity of these reports is severely compromised by two factors. First, the agency did not control for potential biases in the data due to poor implementation of the program. Second, the agency used analytic methods that introduced additional bias.

Agency reports do not mention the great disparities in sample set length and sampling patterns or the potential departure from a random sampling scheme that these disparities signal. There is no indication that the agency recognized this source of bias or controlled for it.

The agency's analytic methods for interpreting the data add additional bias. The two measures of performance consistently used by the agency in its reports are compliance and prevalence rates. The "compliance rate" indicates the percentage of completed sample sets that passed the performance standard during a given time period. The "prevalence rate" indicates the percentage of samples that tested positive for *Salmonella*.

In all four reports since January 2000, the agency has excluded results from some sample sets from most compliance rate and prevalence rate calculations. These calculations include results only from completed "A" sets, defined as any set which does not follow a failed set.(53) (It should be noted that exclusion of data from sets following failed sets in no way indicates that any of the meat from the sets is prevented from carrying the USDA seal to market.)

When the agency initially used this method in calculations for the report on January 1998 through January 2000 data (hereinafter, "the 1998-2000 report"), it did not mention it in the main report(54) or its accompanying press release.(55) Compliance rates and prevalence rates were presented as if no data had been excluded. The agency did describe the exclusions in the text of the full report but presented the results of calculations with all the data only in the Appendix of that report(56). The inclusive (which did not use the A set method) results are dramatically different. For ground beef, the prevalence rates do not indicate improvement, while the exclusive results which are given show improvement. The baseline prevalence rate for ground beef is 7.5% and this figure is used to demonstrate improvements due to HACCP. In the 1998-2000 report, the large ground beef prevalence rate for sample sets completed in the second year using A sets only, was 5.8 percent. This was the figure used in all public announcements about the testing program. In contrast, the prevalence rate for all sets completed in the second year in these plants, which was presented only in the Appendix of the report, was 7.6 percent. Only by using the A set calculation method could the agency report improvements in the prevalence rate at large ground beef plants in the second year of HACCP.

The agency says that it includes results only from A sets because all others represent biased results and that A set data "provides the most direct comparison to the baseline estimates used to establish the performance standards".(57) However, excluding all but A sets from agency calculations is certain to bias the data because a failing ground beef plant was more than 3 times (3.22) (58) as likely to fail the next set as a passing ground beef plant, in the data we received. The agency has progressively "purified" the data by excluding results from these plants for its reports. For example, in 2000, five of the 27 sets collected in large ground beef plants failed the performance standard. This means that results from the five subsequent sets at those plants would be excluded from subsequent calculations. Assuming that the agency used a similar size sample frame for the next set, nearly 20% of results (5/27 sets) would be excluded from calculations involving the subsequent sets.

There are two more areas of concern with the agency reports - the sampling program's relationship to volume of production and the diluting effect of including large numbers of results from small plants. Unless the percentage of samples from each size category used in agency calculations accurately represents the volume of ground beef those plants contribute to the market, the combined prevalence rate will not reflect the prevalence of *Salmonella* in ground beef on the market. In its reports, the agency has not controlled for this potential bias and yet claims that the "[d]ata released. . .shows that the prevalence of *Salmonella* in raw meat and poultry has decreased..."(59).

In ground beef calculations, the bias due to this inaccuracy has been considerable. For example, in the 1998-2001 report nearly 30 percent (60) of samples used for ground beef prevalence calculations for the 1998-2001 aggregate figure came from very small plants although they produce less than one percent of product on the market.(61)

More importantly, because very small plants did so much better than the large plants in terms of *Salmonella* reductions(62), the fact that they contributed five times(63) the number of samples as large plants to the aggregate figure means that the final prevalence rate presented by the agency (3.4%) is in large part due to "dilution" of the poor large plant data by the more successful small and very small plants as they were added to the program over time.(64) Had the agency excluded the samples from very small plants from the aggregate figure and used the figures for large and small plants only, the prevalence rate would have been 3.9%. This result would be similarly inaccurate, however, unless the percentage of small and large plant samples accurately reflected the volume of product they contribute to the market.

Because of the biases introduced by the agency's analytical methods, the *Salmonella* results touted by agency reports are very unlikely to represent the true condition of ground beef on the market, yet it is the only information available to the public and is even used in Congressional testimony. In September 2000, then-Secretary of Agriculture Glickman used biased figures in his Statement Before the Senate Committee on Agriculture, Nutrition and Forestry.(65) He testified that "[w]ith the Pathogen Reduction and HACCP rule, the prevalence of *Salmonella* on raw products has been substantially reduced," and he reported a 5.0% prevalence on ground beef. This figure was the result of using only "A" sets and including nearly 15 times as many samples from small ground beef plants as from large plants.(66) Neither biasing factor was mentioned to Congress.

### **PART THREE: CONCLUSIONS**

Our analysis of the USDA's *Salmonella* performance standard program led to the following conclusions:

1. While sampling is supposed to happen on a daily basis, it is often happening much less frequently, with long test-free periods prolonging sample sets.

2. The agency misses opportunities to protect consumers due to its policy of completing a sample set before requiring corrective action, even if a plant has already failed and even though delays in set completion are common.

3. Long waiting periods between sample sets create additional and substantial test-free periods.

4. The program was originally designed as a "three strikes and you're out" performance standard. But the agency practice of indefinitely postponing a sample set after two failures creates and prolongs an industry honor system at times when government oversight should intensify.

5. When combined, all the delays in the testing program create long periods when no *Salmonella* testing is performed. Yet meat is stamped "Inspected and Passed" throughout, with no indication to consumers that a plant has not met the standard or has not been tested in months.

6. The poor implementation of the program has resulted in data that are riddled with problems. The poor data, and the questionable analytical methods used to analyze it, call into question the validity of the agency's claims about the program's success at reducing the prevalence of *Salmonella* in ground beef.

Taken together, these conclusions illustrate that the USDA's *Salmonella* performance standard program remains a poor and unproven replacement for the loss of continuous government inspection under HACCP. The infrequent testing rate and the agency's failure to act when testing reveals that plant food safety systems are inadequate, provide little incentive for ground beef producers to improve their systems.

### **PART FOUR: RECOMMENDATIONS**

We recommend that the *Salmonella* testing program be changed by redesigning the testing protocol. A more protective testing program would include:

- Daily testing. This eliminates waiting periods between sets and In Depth Verification reviews.
- Volume-based testing, which would take into account the amount of product sent to market by different size plants. In other words, large plants would be subject to more sampling than small and very small plants.
- Government sampling for other pathogens, at a minimum, *E. coli*.
- A warning system to alert agency officials when the sampling rate falls below daily, which would prompt a government inspector in the plant to report why daily sampling is not happening. These reports should be made public.
- Immediate notification of companies, inspectors, and the public when a plant fails a set by exceeding the allowable number of failures.
- A limit on the period of time in which plants may release product while implementing corrective actions.
- Public release of names of plants failing to meet the standard. This should include prominently displaying on the USDA website the results of failing sets along with associated data such as dates for sample collection and any corrective actions taken.
- The prevalence rate that serves as the performance standard should get lower over time.
- Publication of the testing protocol, with a detailed explanation of how standards were chosen.
- A more transparent explanation of the analysis of compliance and prevalence rates, and the use of consistent analytical methods from report to report. All data should be included, which would eliminate the use of "A sets." Reports should address and correct for potential biases.
- A recalculation of the compliance and prevalence data from the program to date, using all data (without "A sets"). To whatever extent possible, the agency should correct for any bias, and at a minimum, explain and quantify its effect on results.

- As soon as possible, incorporate rapid testing technology into daily government inspection activities.
- Provide whistleblower protection for industry employees whose disclosures are even more significant in the absence of reliable testing data.

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### **Footnotes**

1. "Live from NMA: Murano charts new frontier for food safety." Dan Murphy. 2/22/02. <http://www.meatingplace.com>
2. "Statement for the Record by Stephen M. Ostroff, M.D., Associate Director for Epidemiologic Science, National Center for Infectious Diseases, Centers for Disease Control and Prevention, Department of Health and Human Services, Before the Agriculture, Nutrition and Forestry Committee, U.S. Senate." 9/20/00. <http://www.cdc.gov/washington/legislative/09202000.htm>
3. "Modern Meat." Frontline. 4/18/02. <http://www.pbs.org/wgbh/pages/frontline/shows/meat/etc/script.html>
4. 9 CFR 310.25(b). The other component of the microbial testing program under HACCP is a generic E. coli sampling program conducted by the company and audited by government meat inspectors. Inspectors are only entitled to see a summary chart of results and companies are allowed to do multiple tests and only report passing results. 9 CFR 310.25(a).
5. "Issue Paper: Public Release of Salmonella Testing Results." USDA Food Safety and Inspection Service. 12/15/97. <http://www.fsis.usda.gov/OA/haccp/issue01.htm>
6. "Pathogen Reduction: Hazard Analysis and Critical Control Point (HACCP) Systems; Final Rule." USDA Food Safety and Inspection Service. 7/25/96. [http://www.fsis.usda.gov/oa/fr/haccp\\_rule.htm](http://www.fsis.usda.gov/oa/fr/haccp_rule.htm) (p. 38835).

7. HACCP Final Rule p. 38848-9.
8. HACCP Final Rule p. 38849.
9. 275 F. 3d 432 (5th Cir. 2001)
10. Personal communication. USDA Food Safety and Inspection Service. 5/17/02
11. Personal communication. USDA Food Safety and Inspection Service. 5/17/02
12. "USDA To Continue Testing For Salmonella In Meat Plants." USDA News Release No. 0267.01. 12/18/01.  
<http://www.usda.gov/news/releases/2001/12/0267.htm>
- 13 "Murano doesn't embrace expansion of USDA authority" Food Chemical News Daily. 3/15/02. Vol. 4, No. 176.
14. The agency should have sought out this level of expertise while it was designing the program.
15. The USDA categorizes what is done to meat as either slaughter or processing. "Slaughter" plants work with products until they are cut down to carcasses. After that point, whatever is done to the product is considered processing. The agency's current Salmonella regulations apply at slaughter plants for cattle, hogs, chicken and turkeys, and processing plants that grind beef, chicken or turkey, but not to some other types of processed meats. "Because Salmonella is more likely to be present on raw, ground or comminuted products than on the carcasses from which they are derived, raw, ground, or comminuted product ordinarily will be the focus of [agency] compliance testing in those establishments that both slaughter and produce raw ground product." HACCP Final Rule p. 38848.
16. According to the data we received, the following number of plants for each product failed at least one "sample set" (a set consists of 53 samples. See page 7 for more explanation of the testing program protocol.): Broilers - 40; Cows/Bulls - 8; Steers/Heifers - 1; Turkeys - 5; Market Hogs - 24; Ground Turkey - 3; Ground Chicken - 0; Ground Beef - 62.
17. USDA analyzes ground beef samples randomly collected at federally inspected production facilities, retail stores, and import facilities, as well as samples collected by state personnel at state-inspected plants. The increase in the number of samples testing positive from all sources combined rose from .06% in 1997 to

nearly 1% (.86%) in 2000. "Microbiological Results for Raw Ground Beef Products Analyzed for *Escherichia coli* O157:H7." USDA Food Safety and Inspection Service.

<http://www.fsis.usda.gov/OPHS/ecoltest/index.htm>

While much of this increase may be due to the adoption of increasingly sensitive testing methods, we cannot determine that this alone accounts for the increase.

18. "Consumer appetite for beef remains strong, year-end data shows." Bryan Salvage. 2/13/02. <http://www.meatingplace.com>

19. <http://www.fsis.usda.gov/ofofaim/faimmain.htm>.

20. We were told that that all information given to us by any department at the agency must first be cleared through the public affairs department.

21. The agency acknowledges that this could have happened also between a pre-HACCP testing phase and the beginning of HACCP. "Pathogen Reduction/HACCP Salmonella Performance Testing." USDA Food Safety and Inspection Service. 9/28/98. <http://www.fsis.usda.gov/OPHS/salmstd.htm>

22. Personal communication. USDA Economic Research Service. 4/16/02.

23. "Modern Meat" Frontline. 4/18/02. <http://www.pbs.org/wgbh/pages/frontline/shows/meat/etc/script.html>

24. 9 CFR 310.25(b)(2)

25. HACCP Final Rule p. 38848.

26. HACCP Final Rule p. 38917.

27. "Directive 10,011.1: Enforcement Instructions for the Salmonella Performance Standards." USDA Food Safety and Inspection Service. 9/9/98. <http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/10011-1.pdf> (Attachment 1).

28. Loren Lange, Assistant Deputy Administrator, Office of Public Health and Science, Food Safety and Inspection Service, presentation at FSIS' "Pathogen Reduction: A Scientific Dialogue." 5/7/02. Washington, DC.

29. HACCP Final Rule p. 38847.



30. 9 CFR 310.25(b)(1).

31. "Directive 10,011.1: Enforcement Instructions for the Salmonella Performance Standards." USDA Food Safety and Inspection Service. 9/9/98.

<http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/10011-1.pdf> (VI.D.4). The length of the waiting period is subject to agency discretion and may be affected by actions taken by the plant.

32. "Failure by the establishment [to take appropriate corrective actions], or failure to meet the standard on the third consecutive series of FSIS-conducted tests for that product . . . will cause FSIS to suspend inspection services." 9CFR 310.25(b)(3)(iii).

33. "Microbiological Results for Raw Ground Beef Products Analyzed for *Escherichia coli* O157:H7." USDA Food Safety and Inspection Service. <http://www.fsis.usda.gov/OPHS/ecoltest/index.htm>

34. "Directive 10,011.1: Enforcement Instructions for the Salmonella Performance Standards." USDA Food Safety and Inspection Service. 9/9/98.

<http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/10011-1.pdf>

35. Although we have data for 76 complete sample sets at 26 large ground beef plants, data for three of the first sets was erroneous because the end date of the set was later than the sampling dates for subsequent sets. Data from a few small plants had this same problem. In February 2002, agency officials confirmed that these end dates must be erroneous, but did not respond to repeated calls for correct sampling dates.

36. We asked USDA's public affairs department if any of the large plants with delays longer than nine months had significant breaks in production during the time of the lapses in testing, and were told that the Food Safety and Inspection Service does not keep track of this type of information. We then asked government inspectors in the appropriate regions, who reported that they did not know of any significant breaks at these plants.

37. Regulations require plants to "take immediate action to meet the standard," after the first failure, and to "reassess its HACCP plan for that product and take appropriate corrective actions," after the second failure. 9 CFR 310.25 (b)(3)(I) and (ii)

38. 150,000 pounds/shift x 2 shifts/day x 6 days/week x 121 weeks  
= 217.8 million pounds

39. The agency collected samples comparatively frequently and consistently from March 1998 through June 1998. It collected the last three samples in April, 1999 to complete the first Salmonella set. It began the testing for the second set in July 2000.
40. "An Outbreak Waiting to Happen: Beef-Inspection Failures Let In a Deadly Microbe." Joby Warrick. 4/19/01. Washington Post.
41. Remarks at Consumer Federation of America's "National Food Policy Conference." 4/22/02. Washington, DC.
42. "Directive 5500.1: Conducting Targeted In-Depth Verification Reviews." USDA Food Safety and Inspection Service. 10/11/01. <http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/5500.1.pdf>
43. "Directive 5500.1: Conducting Targeted In-Depth Verification Reviews." USDA Food Safety and Inspection Service. 10/11/01. <http://www.fsis.usda.gov/OPPDE/rdad/FSISDirectives/5500.1.pdf>
44. Although there are few plants that have had numerous sets, it appears that the testing cycle length may be increasing for later sets.  
HACCP Final Rule p.38837
45. During the 27 month lapse, the agency collected eight samples. The agency completed 45 samples for the first set by July 8, 1998. To complete the set, it took three samples in November 1999, three samples in May 2000 and two samples in June 2000. It started the second set on October 11, 2000.
46. Additionally, after a consumer discovered glass in ground beef from this plant, 10,000 pounds of the ground beef produced during the test-free period were recalled. "Recall Information Center." USDA Food Safety and Inspection Service. [http://www.fsis.usda.gov/OA/recalls/rec\\_intr.htm](http://www.fsis.usda.gov/OA/recalls/rec_intr.htm)
47. Had there instead been invisible pathogens in the ground beef, the consumer would have had no way of knowing not to consume the product, perhaps resulting in serious consequences.
48. During the nearly 24-month lapse, the agency collected seven samples. The agency completed 47 samples for the first set by August 4, 1998. To complete the set, it took three samples in November 1999, and three samples in November 1999. It started the second set on July 19, 2000.
49. According to agency Quarterly Enforcement Reports, the agency put the plant under suspension on Friday June 16, 1999. It is

possible, but agency reports do not specify, if this was because the agency collected the sixth positive on June 10, 1999. The agency may instead have discovered and been responding to another failure of a food safety control. In any case, the interruption was short-lived because that suspension was put in abeyance by Monday June 19, 1999, and the plant was back in operation.

50. 150,000 pounds/shift x 2 shifts/day x 6 days/week x 2 plants x 4 quarter-pound hamburgers/pound = 14.4 million quarter-pound hamburgers.

51. HACCP Final Rule p. 38849.

52. "Pathogen Reduction/HACCP Salmonella Performance Testing." USDA Food Safety and Inspection Service. 9/28/98.  
<http://www.fsis.usda.gov/OPHS/salmstd.htm> "Second Progress Report on Salmonella Testing for Raw Meat and Poultry Products." USDA Food Safety and Inspection Service. 1/21/99.  
<http://www.fsis.usda.gov/OA/background/salmback.htm>  
"One-Year Progress Report on Salmonella Testing for Raw Meat and Poultry Products." USDA Food Safety and Inspection Service. 3/9/99. <http://www.fsis.usda.gov/OA/background/salmtest3.htm>  
"Progress Report on Salmonella Testing of Raw Meat and Poultry Products." USDA Food Safety and Inspection Service. 10/99. <http://www.fsis.usda.gov/OA/background/salmtest4.htm>  
"Progress Report on Salmonella Testing of Raw Meat and Poultry Products." USDA Food Safety and Inspection Service. 3/00. <http://www.fsis.usda.gov/OA/background/salmtest5.htm>  
"Interim Progress Report on Salmonella Testing of Raw Meat and Poultry Products." USDA Food Safety and Inspection Service. <http://www.fsis.usda.gov/OPHS/haccp/salmraw.htm>  
"Progress Report on Salmonella Testing of Raw Meat and Poultry Products, 1998-2000." USDA Food Safety and Inspection Service. <http://www.fsis.usda.gov/ophs/haccp/salmdata2.htm>  
"Progress Report on Salmonella Testing of Raw Meat and Poultry Products, 1998-2001." USDA Food Safety and Inspection Service. <http://www.fsis.usda.gov/OPHS/haccp/salm4year.htm>

53. "Progress Report on Salmonella Testing of Raw Meat and Poultry Products, 1998-2001." p.1.

54. "Progress Report on Salmonella Testing of Raw Meat and Poultry Products."

55. "FSIS Reports Continued Decline Of Salmonella." USDA News Release. 3/21/00.  
<http://www.fsis.usda.gov/OA/news/2000/salmrel2.htm>

56. "HACCP Implementation: Salmonella Compliance Test Results, January 26, 1998 to January 24, 2000." USDA Food Safety and Inspection Service.

<http://www.fsis.usda.gov/OPHS/haccp/salcomp.pdf>

57. "Interim Progress Report on Salmonella Testing of Raw meat and Poultry Products."

58. This was determined by using the formula B/A, where A = the number of failing sets that followed a passing set (25)/the number of passing sets that had a subsequent set (326) and B= the number of failing sets that followed a failed set (19)/the number of failing sets that had a subsequent set (77)

59. "USDA Data Show a Reduction of Salmonella in Raw Meat and Poultry." USDA News Release No. 0154.02. 4/18/02.

<http://www.usda.gov/news/releases/2002/04/0154.htm>

60. 22,209 of the 74,758 samples (29.7%) used for the 1998-2001 aggregate prevalence figure (combining results from large, small and very small ground beef plants) were from very small ground beef plants. "Progress Report on Salmonella Testing of Raw Meat and Poultry Products, 1998-2001."

61. Loren Lange, Assistant Deputy Administrator, Office of Public Health and Science, Food Safety and Inspection Service, presentation at FSIS' "Pathogen Reduction: A Scientific Dialogue." 5/7/02. Washington, DC. Lange stated that very small plants were not even included in baseline testing because they are such a small percentage of production.

62. The very small ground beef plants had a much lower prevalence rate (2.4% for 1998-2001) than the large plants (5.2% for 1998-2001). "Progress Report. . . 1998-2001."

<http://www.fsis.usda.gov/OPHS/haccp/salm4year.htm>.

63. Large plants contributed 3,954 samples compared to the 22,209 samples contributed by the very small plants. "Progress Report on Salmonella Testing of Raw Meat and Poultry Products, 1998-2001."

64. In contrast, among broiler plants, it is the large plants that consistently have lower prevalence rates. For the 1998-2001 aggregate figures, the prevalence rate for Salmonella was much higher for the very small plants (34.7%) than for small (13.7%) or large (9.2%) plants. It is worth noting that, in broilers, where the very small plants did so poorly, they were not over-represented by the percentage of samples from their class used for aggregate

results - only 1.4% of the samples for the 1998-2001 aggregate prevalence rate for broilers came from very small plants.

65. [http://www.fsis.usda.gov/oa/congress/test\\_glickman.htm](http://www.fsis.usda.gov/oa/congress/test_glickman.htm)

66. 583 samples were included from large plants, with a prevalence rate of 9.1%. There were 8427 total samples.

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