ANNEX F

Levels of *Salmonella* spp. in Egg Products

CONTENTS

INTRODUCTION

Eggs are manufactured into egg products, such as liquid, dried, powdered, frozen, or reduced cholesterol products. These products may be contaminated with *Salmonella* spp. if made from contaminated eggs. This annex describes the data and methods used to model the distribution of levels of S*almonella* spp. contamination in egg products. This annex also serves as a draft report of the survey findings; a final, separate report will be issued when the serotype information has been analyzed.

EGG PRODUCT BASELINE SURVEY

Sample Design

All federally inspected plants that produced raw liquid egg products were eligible for sample selection. From this population of plants, separate frames were developed for each of three raw, liquid egg products: whole, whites, and yolks. A plant could be included in more than one frame if it produced more than one of these products. Sampling frames were updated on a quarterly basis throughout the study; however, during the course of the survey, there were no added plants. The resulting frames varied in number of plants by quarter and by product. The numbers of plants in the frames were 70 whole egg plants, 50 egg yolk plants, and 40 egg white plants. Each quarter, 117 (9 per week for 13 weeks) sample requests for each product were allocated to the plants. This was done by cycling through the list of plants of the appropriate sampling frame. That is, if there were 50 plants in the sampling frame, and 117 samples were to be requested, then each plant would be allocated two sample requests, and 17 plants would be allocated three requests. Sample allocation for the next quarter would then resume at the point in the frame where the previous quarter's allocation had been completed. Not all samples requested could be collected because the plant might not have been producing at the time of the request. For the first few months of the survey, it was noticed that the numbers of samples being analyzed were below expectations, so the number of samples allocated per week was increased. After the requests were allocated to the plants, specific weeks for sample collection were randomly assigned such that no plant received two requests for the same product in the same week. Over the duration of the study, for a given product, approximately the same number of sample requests would be allocated to each plant, achieving a nearly balanced allocation over the seasons of the year. Samples were assigned randomly to the laboratory in a manner that assured equal numbers of samples per lab each week. When the samples arrived at the laboratory, the temperature and the integrity of the containers were checked. If the temperature was too low or if there were signs of loss of integrity of containers, the sample was discarded.

The history of the eggs or of the liquid products derived from broken eggs. For example, whether or not the liquid product was produced within the plant, received from another plant, or returned from retail, produced and stored in the plant before pasteurizing - could affect the levels of *Salmonella* in the liquid product before pasteurization. Consequently, FSIS classified samples of liquid product into one of 5 "risk" categories depending upon sampled liquid product history.

Samples were collected from Monday through Thursday of the designated week. The type of sample (whole, white, or yolk) to be collected was designated on the collection form but the risk category of the sample was to be determined by the Inspector in Charge, with priority to be given to products in order of the risk category (defined below). That is, products of the highest risk category (lowest number) were given the highest priority, products of the next highest risk category were given the next highest priority, and so forth. The sample was taken prior to any substance being added to the liquid egg product, as close in time to pasteurization as possible. For each sample request, using aseptic techniques, 100 ml of liquid egg product were placed in each of 2 cups (for a total of 200 ml) and shipped by FedEx overnight service, on the same day of collection, to the designated FSIS laboratory (one of three). If the sample needed to be collected through a valve, then the valve was opened before collection to let sufficient liquid pass from the nozzle/spout so that the sample represented product that was in the tank, not the valve.

Most probable number (MPN) analyses

Levels of *Salmonella* spp. in collected samples were measured using a 3-tube, 6-dilution most probable number (MPN) procedure. MPN is a method of inferring the level of viable cells in a sample from results of a series of qualitative tests of subsamples of different volumes (or sample dilutions). The tested materials are incubated in tubes, and typically, the numbers of tests for each dilution or volume are the same. Thus, for example, a 3-tube, 3-dilution MPN determination is based on three different volumes of samples (e. g., 10 ml, 1 ml, 0.1 ml) with 3 tubes per dilution. The MPN is the level (number of colony forming units (cfu's) of *Salmonella* per ml) that maximizes the likelihood of the pattern of results that were obtained from the tests, assuming that the distribution of the number of cfu's is uniform throughout the sample, the subsampled volume for each tube is a small portion of the total sample volume, and the likelihood of detecting a positive result in the presence of viable cells is 100% for all tests. In statistical terminology, this estimate is referred to as the maximum likelihood estimate (MLE). If the recovery were expected to be 66% instead of 100%, a reasonable approximation of the MPN would be to multiply by 1.5 the MPN for an assumed 100% recovery.

For this survey, 6 dilutions were typically used to achieve sample volumes of 10 ml, 1 ml, 0.1 ml, 0.01 ml, 0.001 ml, and 0.0001 ml, with 3 tubes per dilution. If the obtained pattern was anomalous, then the sample was discarded. For example, a sample result with pattern 030 000 (MPN result of 0.094) was discarded[a], while one with pattern 222 000 (MPN = 0.348) was not. If all 18 results were positive, then another set of analyses was performed, with higher dilutions (lower volumes, e. g., 0.00001 ml and 0.000001 ml). For this survey, this event occurred only a few times, and once, mistakenly, the sample was not analyzed a second time at higher dilutions - consequently, the MPN result of >11,000 was reported.

[a] The decision to discard this result was made after some graphs were made. There was virutally no visual effect of including the sample result. The stated conclusions in the text are made for the case when the sample result was excluded, except where noted.

According to normal FSIS reporting procedure, the MPN value reported would be the one determined from the second set of analyses. However, FSIS realizes that using the results from the second set of analyses may create a bias, because the material used in the second set of analyses had been stored, refrigerated, for 3 or more days, which could result in a decrease or (less likely) increase in the number of viable *Salmonella* cells. Thus, for the risk assessment, the second result was not used. Since probabilities of outcomes for all possible levels are needed to estimate the distribution of *Salmonella* spp. levels, the reported MPN values themselves were not used, but rather the pattern of results – that is, the number of positive results for each dilution - that were obtained were used, as described below.

Information collected

Besides MPN data, FSIS collected information concerning the type of product - whole, white or yolk "risk" category, and other information concerning the production process used for the collected sample, including age of eggs; age of liquid product; temperature of bulk product at the time of sampling; volume of holding tanks; and location of sampling.

The five risk categories for egg products are defined based on how product arrived at the plant: (i) bulk shipments from another plant, not previously heat treated, without additives, and processed separately; (ii) liquid product from shell eggs received from another plant; (iii) liquid product from shell eggs returned from retail market for processing; (iv) liquid products stored in the plant; and (v) products from the plant's current production.

For dried egg products, the levels of *Salmonella* are assumed appropriate factors of the levels in the liquid product, reflecting the loss of moisture in the drying process. In the Egg Pasteurization Manual,[1] the percentages of water in egg products are given as 87.6% for egg white, 73.7% for whole eggs, and 51.1-55.6% for egg yolks. Further, the density of albumen and yolk is approximately 1.035 g/ml.[2;3] These factors were used to convert between levels per ml of liquid product and levels per gram of dried product.

Estimating Distribution of *Salmonella* Levels

While, from a statistical perspective, estimating a distribution from survey data has many of the same features as estimating a distribution from data collected from a controlled scientific study, the nature of the inference is quite different. In a scientific experiment, the conditions are controlled and the conclusions, or derived distributions, provide an estimate of the conditional possibilities, where the researcher determines the conditions. Because conditions can be varied in a controlled fashion, the conclusions are stated with "all things being equal" or similar modifier. The better control one achieves, the more specific and thus more confident one can be regarding those conclusions. In effect, the populations being studied are being controlled and thus defined by the experimenter to derive a general scientific relationship or law that can be related to a theory, either constructing, reinforcing, or challenging one. Thus, from such studies, the assumptions that the data, x, represent realizations from a distribution, f, that can be described with only a few parameters, θ, is eminently reasonable, insofar as there is assumed some type of regularity or commonality of the factors that influence the results that reflect the phenomena being studied.

The data collected from surveys, in comparison, of course, cannot be assumed realizations of processes that have a few common factors that influence results. Consequently, the assumption of a distribution function defined by a few parameters is, on the surface, problematic. Rather, the purpose of surveys is to collect samples that, in some well-defined fashion, represent the variety within the population, P, being studied, and to describe the distribution of some variable, and most often, related to some feature of P, as it is at the time of sampling. At different times, the features may change. It is important to note that as the actions of members of the population or the composition of entities within the population change, so (as expected) would the population distribution change. Thus, percentiles estimated from these types of data would not necessarily apply for the future.

MPN results reflect unknown processes and contingent events. In effect, each result, X, represents a process determined by actions (A) of perhaps, many people; stochastic events of certain natural processes (S); and measurement errors (E). Thus, X, symbolically, can be decomposed as a sum of terms reflecting the influence of the processes A, S, and E. In this vision, A represents controllable factors of the total process that creates X; S, which depends upon A, represents that random, uncontrolled factors that influence the value of X; and E is the measurement error, which for this discussion can be assumed to have an expected value of zero (ignoring in this discussion the bias inherent in the MPN estimation). In effect, each result X represents can be written as,

$$X = X(A) + \eta(S(A)) + E = Y(A) + E \qquad \text{(F1)}$$

where $\eta(S(A))$ represents the error associated with the variations of the uncontrolled factors associated with the actions, A.

Examples of actions might be the processing of eggs from free-range chickens or the temperature and time between collection of eggs after laying. S are stochastic events of certain natural processes and E are measurement errors. Of course, the distribution of X over the population is not the desired one, since it is influenced by the error term, E. Because the error distribution is known, at least in theory, the likelihood of the realization X can be written as

$$L_A(X) = \int \varepsilon(X \mid Y(A))dG_A(Y(A)) \qquad \text{(F2)}$$

where $\varepsilon(X|Y)$ is the (known) likelihood of obtaining an MPN value of X given a true level of Y, and $G_A(Y)$ is the (unknown) cumulative distribution function (cdf) of $Y(A)$, conditional on A. The error $\eta(S(A))$ is assumed to represent error that arises from random variation of contingent or stochastic processes. Thus, as with a controlled experiment, it may be reasonable to assume that $G_A(Y)$ can be described by a few parameters, so that, if repeated measurements under condition A were made, then it would be possible, through Equation F2, to determine the distribution, $G_A(Y)$, through maximum likelihood or method of moments.

Thus, in studies such as this one, auxiliary information is collected, which might be used to define factors that influence the results, and thus, can serve as proxies for A. For example, additional variables can be used to define post-stratification cells, such that, within each cell, the results can be assumed to arise from a common *A*. If the distributions within the post-strata are determined, then, since the probabilities of sample selection are known, the distribution over the surveyed population can, in theory, be estimated.

The small numbers of samples (less than 1,000) are unlikely to represent all the different types of handling or processing combinations that might affect the distribution. FSIS collected extra information on factors thought to affect the levels of *Salmonella* in liquid egg products. These factors certainly do not define very well all the possible actions that might influence the distribution. However, these variables are thought to be able to serve as post-stratification variables and thus help explain some of the variability among the results from the egg product survey.

Thus, there are two features involved with estimating the distribution of $Y(A)$ over the surveyed population: 1) identifying post-stratification variables which capture important factors that influence results and can serve as proxies for sets of actions, *A*, of the surveyed population; and 2) determining the portions of the population that sets of actions that exist within the studied population represent.

For the latter feature, the standard theory of survey estimation requires dividing each result, *X*, by its inverse probability of selection, $q(X)$. Since FSIS is interested in the distribution of *Salmonella* levels over the produced product, the amount of product produced under action *A* is needed. In effect, this means identifying a volume of product, $V(X)$, associated with each sample result, *X*. The unbiased estimate for the population mean, μ is thus,

$$\mu = \frac{\sum_{k=1}^{n} \frac{V_k(X_k)X_k}{q_k(X_k)}}{\sum_{k=1}^{n} \frac{V_k(X_k)}{q_k(X_k)}} \tag{F3}$$

where *n* is the number of samples, and *k* is an index for a sample. Let the coefficient of X_k in the above estimator be w_k, it being understood that this is, or could be, a function of random variables. The coefficients can be thought of as an estimate of the proportion of the population represented by the k^{th} sample. The estimate of the population mean, μ, is thus the sum of the products $w_k X_k$, where $\Sigma w_k = 1$.

Of primary interest, though, is the cdf, $\Im$, that can be estimated using the w_k as follows. For a given *x*, let $\delta_k(x) = \delta(X_k \neq x)$, the Kronecker delta function, which equals unity if the argument is true, and otherwise zero. Then the MPN values are sorted from lowest to highest, so that w_n represents the weight for the highest MPN value. Then

$$\Im(x) = \sum_{k=1}^{n} w_k \delta_k(x) \tag{F4}$$

is the estimated distribution of X over the population, P. However, the unconditional distribution over $Y(A)$, F, is the desired one. Moreover, percentiles beyond the range of the data (for those greater than 1- w_n) cannot be estimated in a simple, direct procedure. Indirect procedures involving generalizing the shape of the estimated cdf, particularly at the higher percentile tail, are needed, which would permit making estimates of percentiles beyond the range of the data.

Alternatively, if the conditional (on A) cdf, G_A, were known, and the proportion of the population associated with each A, w_A, were known (estimated from

$$w_A = \sum_{k \in A} w_k \qquad \text{(F5)}$$

where the sum extends over all those observations that are associated with action set A) then F is determined as,

$$F(x) = \sum_{A \in P} w_A G_A(x) \qquad \text{(F6)}$$

where the sum is over action sets A that exist within the population, P. To estimate the weights, w_A, usual survey procedures would be used. This would involve adjustments for non-response and possible benchmarking or ratio adjustments using known information of the population being studied. Biases, thus, could be kept at a minimum. Therefore, an advantage of using Equation F6 is that it permits straightforward estimates of the higher percentiles, beyond the range of the data.

ANALYSIS OF DATA

A total of 1,034 egg product samples were analyzed. Based on MPN results from these 1,034 samples, 74% were positive; 26% were greater than 24 MPN; 15% were greater than 100 MPN, and 2% were greater than 1,000 MPN. Of the 21 MPN results greater than 1,000, 3 were from egg white, 6 from egg yolk, and 12 from whole egg. The 8 highest results are given in Table F1, along with other information collected for the samples, including a randomly assigned plant number identifier.

TABLE F1 HIGHEST REPORTED MPN VALUES. FOR RESULTS OBTAINED WHEN TWO SETS OF ANALYSES WERE PERFORMED, THE MPN FROM THE FIRST SET IS GIVEN IN PARENTHESES (COLUMN 1).

Highest MPN values (MPN/ml)	Product	Risk Class	Max. age of eggs (d)	Max. age of liquid (h)	Lab #	Plant Id #	Date (m/yr)
(>11,000) 24,000	Yolk	2		4	1302	35	06/02
(>11,000) 24,000	Yolk	2	15	24	1302	67	08/02
(>11,000) 24,000	White	2	10	8	1302	67	10/02
>11,000	Whole	5	14	2	1302	67	10/01
9,330	Whole	2	15	5	1302	67	04/02
9,330	Yolk	2	20	4	602	67	07/02
4620	Whole	5	6	1.5	2902	13	08/02
4270	Yolk	2	10	6	1302	67	12/02

If the true level of *Salmonella* in a sample were 155,000 cfu/ml, there would be about a 1% chance of observing an MPN result equal to or less than 24,000 MPN/ml, using a 3-tube, 3-dilution MPN table with appropriate dilutions. It is possible, then, that the true level of *Salmonella*, in at least one of these samples with a reported MPN of 24,000, was greater than 10^5 cells/ml. In addition, because of the absence of 100% recovery and possible clustering effects, the actual number of *Salmonella* cells per ml could be higher than this value. FSIS is identifying serotypes in positive sample; thus, while not conclusive, the results of these analyses might provide an indication of possible sources of contamination. If SE serotypes are found more often associated with samples with high MPN results, then this might indicate that the high levels are due to internal contamination of eggs.

Some factors correlated with MPN levels

Analyses of variances were performed using PC-SAS®, release 8.0, PROC GLM procedure.

Seasonality

Table F2 presents the fractions of the MPN results that were positive, greater than 24 MPN/ml, and greater than 100 MPN/ml, by month of survey and product type. It can be seen that the MPN levels for the whole and yolk egg products are generally higher than those for the white egg products. The fractions of samples greater than 24 and 100 MPN/ml are lowest for the egg white product; however, the fraction of positive samples is lowest for the yolk product. Note also that the numbers of samples for the first few months of the survey are lower than those of later months.

TABLE F2 FRACTION OF MPN RESULTS >0, >25 AND >100 MPN/ML BY SAMPLING DATE.

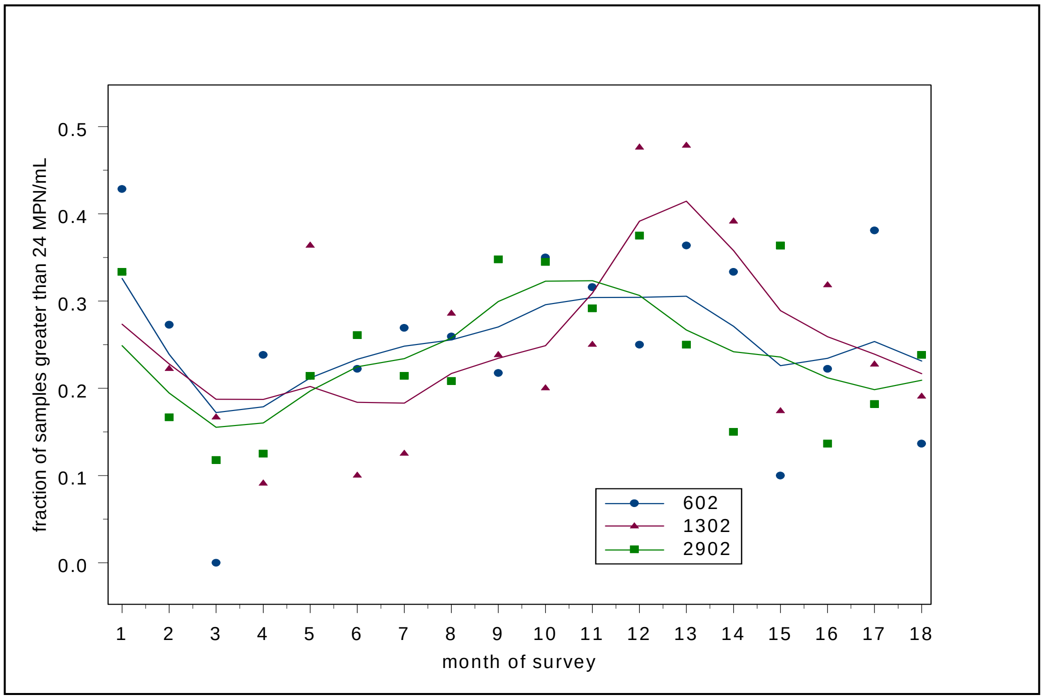
		Product Type											
		White				Whole				Yolk			
Yr.	Mo.	*N*	>0 Frac	>24 Frac	>100 Frac	*N*	>0 Frac	>24 Frac	>100 Frac	*N*	>0 Frac	>24 Frac	>100 Frac
2001	10	9	0.778	0.333	0.333	6	1.000	0.500	0.333	7	0.429	0.286	0.143
	11	12	0.583	0.083	0.083	12	0.833	0.417	0.167	8	0.375	0.125	0.000
	12	13	0.692	0.000	0.000	14	0.857	0.214	0.071	11	0.455	0.091	0.000
2002	1	16	0.563	0.000	0.000	22	0.864	0.318	0.227	10	0.500	0.100	0.100
	2	11	0.727	0.091	0.000	16	0.750	0.375	0.313	12	0.750	0.250	0.167
	3	25	0.640	0.160	0.120	20	0.700	0.250	0.100	16	0.875	0.188	0.063
	4	25	0.560	0.080	0.040	28	0.821	0.179	0.143	17	0.824	0.471	0.294
	5	25	0.720	0.200	0.120	25	0.880	0.280	0.160	22	0.682	0.273	0.136
	6	19	0.737	0.158	0.105	23	0.783	0.348	0.174	25	0.800	0.280	0.160
	7	19	0.737	0.211	0.158	20	0.650	0.250	0.100	25	0.680	0.440	0.280
	8	18	0.778	0.167	0.111	25	0.920	0.400	0.280	24	0.708	0.250	0.125
	9	22	0.955	0.409	0.182	23	0.826	0.217	0.174	19	0.895	0.526	0.263
	10	22	0.909	0.318	0.091	30	0.833	0.367	0.233	21	0.762	0.381	0.238
	11	21	0.762	0.238	0.095	19	0.842	0.368	0.316	21	0.714	0.286	0.095
	12	18	0.667	0.222	0.056	27	0.815	0.148	0.111	20	0.650	0.300	0.250
2003	1	21	0.810	0.190	0.095	23	0.739	0.304	0.087	18	0.667	0.167	0.000
	2	23	0.739	0.217	0.130	19	0.737	0.316	0.158	23	0.609	0.261	0.217
	3	21	0.810	0.190	0.095	23	0.652	0.261	0.174	20	0.300	0.100	0.050
All		341	0.736	0.188	0.100	375	0.800	0.293	0.179	319	0.674	0.282	0.157

The fractions are, in general, lower for the first 5 or so months of the survey for the white and yolk egg products, whereas for the whole egg product, there does not appear to be a significant pattern. For the egg white product, there is clear demarcation of fractions between the first 7 months of the survey (October 2002 – April 2003) and the remaining 8 months; for the yolk product, there is a clear difference for the fractions of positive samples between the first 4 months and the remaining months and for the fractions of results greater than 24 and greater than 100 MPN/ml between the first 6 months and the remaining months.

Laboratory effect

In Table F1, 6 of the highest 8 MPN values were from samples from a single plant, and 6 were from a single laboratory. The question that needs to be answered is whether there was a significant laboratory effect on the results of the survey. Many factors might contribute to laboratory effects, including differences in reagents, environments, equipment, or analysts. These effects should not be large at any given time, and should, over the period of the survey, average out, so to speak. The three FSIS laboratories were randomly assigned samples in an attempt to assure an equal number of samples per laboratory per week, but with no particular attention being paid to the numbers of samples being assigned to any one plant from one laboratory.

Figures F1a and b present the fractions of samples with MPN >24 and 100 by month of survey, for the 3 laboratories. The smoothed curves for the three laboratories are similar, with only a deviation for laboratory 1302 for September to November 2002 for MPN > 24 (lesser so for MPN >100). For these months, 199 samples were analyzed: 60 by laboratory 602, 67 by laboratory 1302, and 72 by laboratory 2902. Analysis of variance and logistic regression for the fraction of MPN greater than 24, with laboratory as a fixed factor indicated a lab effect with *P*-value = 0.07, but when comparing laboratory 1302 versus the other two labs, the significance level was approximately 0.025. However, the significance level using Scheffe's test (for the ANOVA), accounting for the multiplicity of comparisons being considered, was about 0.09 (based on *F*-statistic with 2 and 196 degrees of freedom).



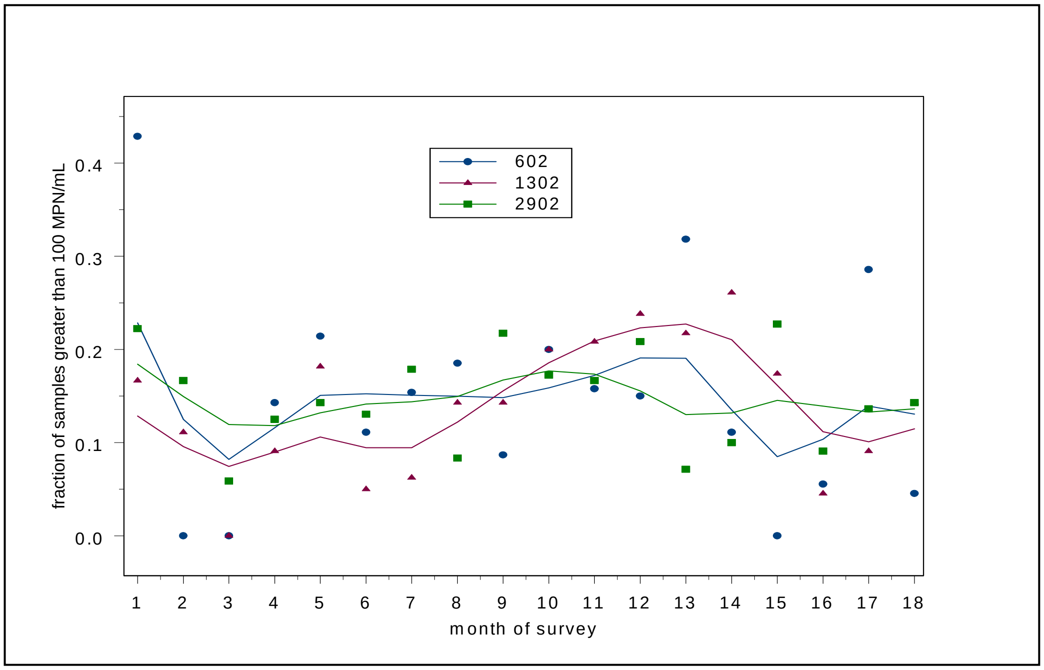


FIGURE F1A-B FRACTION SAMPLES MPN >24 AND >100 BY MONTH AND LABORATORY (KEY). SMOOTH LINE BASED ON NORMAL KERNEL WITH BAND OF 3 MONTHS .

Table F4 provides summaries of the fractions of positive samples and the means of $\log_{10}$(MPN) by laboratory, time of sampling, and type of product. The mean of the $\log_{10}$(MPN) over all samples for laboratory 1302 is 0.83, which is between the means for the other two laboratories. The least square means for the percentage of positive MPN results, estimated from the ANOVA model (adjusted means when assuming a balanced distribution of samples over the factors plant, type of product, and time of sampling), for the three laboratories are 70% (laboratory 602), 71% (laboratory 1302), and 74% (laboratory 2902). The least square means of the $\log_{10}$(MPN) for MPN positive results are 0.87 (laboratory 602), 0.66 (laboratory 1302), and 0.70 (laboratory 2902); and the least square means for the percentage of MPN results greater than 24 are 22% (laboratory 602), 21% (laboratory 1302), and 23% (laboratory 2902). These results suggests the possibility of systematic laboratory differences for samples with low MPN levels, where laboratory 602 is less likely to obtain positive MPN results for low level samples, and laboratory 2902 is more likely to do so. However, the differences appear small; there were no significant laboratory effects in the ANOVA. Selected percentiles of the sample distribution $\log_{10}$(MPN) results, by laboratory, are given in Table 5.

TABLE F4 FRACTIONS OF POSITIVE SAMPLES AND THE MEANS OF LOG_{10}(MPN) BY LABORATORY, TIME OF SAMPLING, AND TYPE OF PRODUCT.

		Time: Early			Time: Late			Time: All		
		MPN >0		Log_{10} (MPN)	MPN >0		Log_{10} (MPN)	MPN >0		Log_{10} (MPN)
Type	Lab.	***N***	**Frac**	**Mean**	***N***	**Frac**	**Mean**	***N***	**Frac**	**Mean**
White	602	36	0.58	0.684	61	0.74	0.570	97	0.68	0.607
	1302	35	0.71	0.331	83	0.80	0.721	118	0.77	0.614
	2902	40	0.60	0.306	86	0.81	0.632	126	0.75	0.549
	All	111	0.63	0.428	230	0.79	0.649	341	0.74	0.588
Whole	602	44	0.82	1.179	89	0.79	1.044	133	0.80	1.090
	1302	32	0.81	1.043	75	0.83	0.957	107	0.82	0.982
	2902	42	0.81	0.800	93	0.77	0.951	135	0.79	0.902
	All	118	0.81	1.008	257	0.79	0.984	375	0.80	0.992
Yolk	602	26	0.58	1.138	80	0.66	1.280	106	0.64	1.249
	1302	18	0.61	0.124	78	0.65	1.099	96	0.65	0.926
	2902	37	0.73	1.084	80	0.73	0.754	117	0.73	0.859
	All	81	0.65	0.900	238	0.68	1.035	319	0.67	1.002
All	602	106	0.68	1.026	230	0.73	0.992	336	0.71	1.002
	1302	85	0.73	0.593	236	0.76	0.910	321	0.75	0.829
	2902	119	0.71	0.751	259	0.77	0.782	378	0.75	0.773
	All	310	0.71	0.796	725	0.75	0.888	1035	0.74	0.862

TABLE F5 SELECTED PERCENTILES OF THE SAMPLE DISTRIBUTION LOG_{10}(MPN) RESULTS, BY LABORATORY.

Laboratory	No. Samples	Fraction Positive MPN	Median Log_{10}(MPN)	75^{th} Percentile Log_{10}(MPN)	90^{th} Percentile Log_{10}(MPN)	95^{th} Percentile Log_{10}(MPN)
602	336	0.71	0.36	1.63	2.36	2.63
1302	321	0.75	-0.03	1.63	2.38	2.97
2902	378	0.75	0.02	1.36	2.36	2.63

The 90^{th} percentiles are nearly the same for all laboratories, and the highest percentile shown above is largest for laboratory 1302, due in part to the large number of samples analyzed by this laboratory from the "worst" plant (67[b]). Of the 28 samples from this plant, 15 were analyzed by laboratory 1302, 7 by laboratory 602, and 6 by laboratory 2902. On the other hand, of the 31 samples from the "best" plant (where 2 of 31 samples were MPN positive), 7 were analyzed by laboratory 1302, 10 by laboratory 2902, and 14 by laboratory 2902 (which had the 2 positive samples with MPN values reported to be 0.43 and 2.31). During the 3-month period September to November 2002, 5 samples from Plant 67 were analyzed, 4 by laboratory 1302. The MPN value from the one sample not analyzed by lab 1302 was 427. The 4 MPN values obtained by lab 1302 from this plant were (by date of collection) 7.4, >11,000 (the highest egg white MPN value in the survey), 2,400, and 2,400 (the last two samples being collected on the same day). The laboratory also analyzed a third sample (egg white) collected on the same data as the last two samples and obtained a value of 0.036. This allowed us to eliminate entertaining the possibility of a systematic lab effect for samples collected on that day.

One peculiar set of results was obtained from laboratory 1302 for a three-month period in which the results were on the average higher than those of other laboratories. However, this event was likely happenstance, a sort of pattern that can readily occur during a long survey. We were unable to attribute it to any sort of systematic error. We conclude that there were not systematic laboratory effects in the survey.

Plant effects

There are analytical results from 70 plants where the numbers of samples per plant range from 2 to 33, and, with the exception of the highest 3 numbers (30, 31, and 33), are approximately uniformly distributed over the plants. That there might be plant effects can be seen by examining the highest MPN results in Table 1, where 6 of the 8 were from one plant (plant 67). Summary data for all plants are given in Table 6. About 50% of the plants had 80% or more samples with positive MPN results. For plant 67, all but one of 28 results were positive; 60% of the results were greater than 100 MPN/ml, and 36% of the results were greater than 1,000 MPN/ml. For comparison, plant 4 had two positive results (0.43 and 2.31 MPN/ml) out of 31 samples. The sampled products from both plants were predominantly risk category 2, and both plants had

[b] It is coincidence that the "worst " plant was randomly assigned an ID number of 67, the highest measured number of *Salmonella* in an egg was 67 cfu /ml, and the number of samples analyzed by laboratory 1302 during these three months was 67. The likelihood of this happening (a common number for all three events) if the queston were considered before the study would have been assumed to be extremely low.

samples of the three product types. One clear difference among the samples for the two plants was the age of the liquid product sampled; for the "best" plant, the ages were recorded as 2 hours for all the samples, whereas for the "worst" plant, the ages generally were higher, between 0.5 hours and 24 hours (one of the two highest MPN results (24,000 MPN/ml) was for the 24-hour-aged sample). However, even the MPN results for liquid samples that were recorded at 0.5 and 2 hours-old in this plant were high: 42.7 MPN/ml and >11,000 MPN/ml, respectively. Therefore, age of liquid product itself does not explain the high results for this plant.

Analyses of variances yielded highly significant plant effects (*P*-value <0.0001) in all analyses, with the following independent variables: plant; type and risk category of product; time of sampling; laboratory; and with interaction of these, and dependent variables: $\log_{10}$(MPN); and indicator variables of whether the MPN exceeded 0, 24, or 100. The consequence of the plant effect is that volume of production may be an important factor for estimating the distribution of the *Salmonella* levels in the product before pasteurization.

TABLE F6 SUMMARY OF DATA FROM FSIS EGG PROCESSING PLANT SURVEY.

Plant ID	No. Samples	Fraction MPN >0	Fraction MPN >24	Fraction MPN >100	Fraction MPN>1000	Geometric Mean of Positive MPN	Mean Risk
26	2	0.00	0.00	0.00	0.00		3.00
4	31	0.06	0.00	0.00	0.00	0.99	1.97
41	6	0.17	0.17	0.00	0.00	42.70	4.00
13	7	0.29	0.29	0.14	0.14	444.16	5.00
69	17	0.29	0.12	0.06	0.00	8.16	2.00
53	13	0.31	0.08	0.08	0.00	10.36	2.23
66	7	0.43	0.00	0.00	0.00	0.05	5.00
48	14	0.43	0.21	0.21	0.07	40.69	2.79
11	18	0.44	0.11	0.11	0.06	1.49	3.22
28	18	0.44	0.11	0.06	0.06	8.28	4.72
40	22	0.50	0.00	0.00	0.00	0.16	5.00
51	28	0.50	0.14	0.07	0.00	2.14	2.61
8	22	0.50	0.14	0.00	0.00	2.41	3.95
49	2	0.50	0.00	0.00	0.00	23.10	1.00
68	12	0.58	0.25	0.17	0.00	6.64	2.00
2	26	0.62	0.12	0.08	0.00	4.14	2.00
10	16	0.63	0.00	0.00	0.00	1.52	4.25
52	8	0.63	0.13	0.00	0.00	5.99	5.00
14	6	0.67	0.00	0.00	0.00	1.53	5.00
17	6	0.67	0.17	0.17	0.17	4.31	2.00
46	6	0.67	0.17	0.17	0.00	26.11	3.83
64	22	0.68	0.27	0.14	0.00	5.88	2.14
7	23	0.70	0.09	0.04	0.00	2.17	1.96
15	10	0.70	0.10	0.10	0.00	2.42	2.00
22	10	0.70	0.30	0.10	0.00	8.05	2.30
55	28	0.71	0.07	0.04	0.00	1.39	4.54
25	21	0.71	0.33	0.24	0.00	9.50	2.43
5	23	0.74	0.13	0.04	0.00	1.09	2.91
39	4	0.75	0.25	0.00	0.00	2.00	2.50
44	4	0.75	0.25	0.25	0.00	7.89	2.00
57	17	0.76	0.24	0.06	0.00	3.94	2.65

50	22	0.77	0.14	0.09	0.00	2.56	4.05
35	22	0.77	0.32	0.23	0.05	8.51	2.00
6	14	0.79	0.29	0.29	0.00	6.59	2.00
16	10	0.80	0.10	0.10	0.00	0.75	4.50
43	5	0.80	0.20	0.20	0.00	2.17	4.00
37	25	0.80	0.28	0.08	0.00	3.92	1.24
56	15	0.80	0.27	0.20	0.07	10.84	3.33
27	5	0.80	0.60	0.20	0.00	62.11	4.60
18	27	0.81	0.33	0.15	0.04	11.21	2.70
24	6	0.83	0.33	0.17	0.00	12.66	1.00
47	18	0.83	0.28	0.06	0.00	14.18	2.11
32	13	0.85	0.31	0.23	0.00	6.13	1.92
36	33	0.85	0.15	0.09	0.00	5.88	3.12
20	7	0.86	0.29	0.14	0.00	5.85	1.71
60	7	0.86	0.14	0.14	0.14	10.58	2.29
29	30	0.87	0.17	0.00	0.00	1.92	5.00
70	17	0.88	0.18	0.06	0.00	3.01	2.47
21	9	0.89	0.00	0.00	0.00	0.43	4.44
34	9	0.89	0.44	0.22	0.00	11.27	4.67
61	18	0.89	0.39	0.33	0.00	14.98	2.00
12	28	0.89	0.32	0.11	0.00	9.74	1.64
54	24	0.92	0.42	0.25	0.00	18.42	4.46
3	13	0.92	0.31	0.08	0.00	17.93	3.85
58	15	0.93	0.47	0.33	0.00	37.81	4.80
1	25	0.96	0.28	0.20	0.00	4.33	3.80
67	28	0.96	0.71	0.61	0.36	160.01	2.32
42	3	1.00	0.33	0.00	0.00	0.38	5.00
62	3	1.00	0.00	0.00	0.00	0.79	5.00
33	5	1.00	0.00	0.00	0.00	1.84	1.00
30	3	1.00	0.00	0.00	0.00	6.90	2.33
63	5	1.00	0.40	0.20	0.00	13.75	1.00
59	9	1.00	0.22	0.11	0.00	15.12	1.00
38	15	1.00	0.47	0.13	0.00	16.99	3.00
65	14	1.00	0.64	0.43	0.00	26.37	1.64
9	25	1.00	0.48	0.32	0.00	26.63	5.00
19	11	1.00	0.64	0.27	0.09	33.06	1.36
23	16	1.00	0.63	0.44	0.06	44.11	3.31
71	27	1.00	0.70	0.41	0.00	57.57	4.11
31	4	1.00	0.50	0.25	0.00	82.56	1.00
Total	1034	0.74	0.26	0.15	0.02	0.87	3.05

Risk Category

Besides type of product, samples were categorized with respect to processing history. There were 5 "risk" categories of product, as explained above. Table F7 provides the fraction of MPN positive results and MPN results >100, by risk category, type of product, and time of sample (where early = 2001 and the first four months of 2002 and later = the remainder). It is seen that the higher fractions of MPN >100 belong to risk categories 1 and 2. Because product from these risk categories was shipped from one plant to another, there may have been some additional growth of *Salmonella*. For samples from risk category 1, the fractions of positive samples are the highest. Ignoring samples for risk category 3 (due to the small number of them), samples of risk category 2 showed the smallest number of positives. The relatively low fraction of positive MPN and relatively high fraction of large MPN results for samples in risk category 2 can be explained in part from the above discussion for plants: the "best" and "worst" plants had samples identified as risk 2 product; and for plant 69, 6 of 17 risk category 2 samples were positive; and for plant 53, only 1 of 8 risk category 2 samples were positive.

Another point of interest is that the differences between the early and late periods of the survey are evident for the risk category 2, egg white and yolk product, for both fractions given in Table 7, and for risk category 1 product for the fraction of MPN >100. The KS test for a non-uniform pattern was significant at the 0.01 level for the egg white product for positive MPN and MPN >24. However, in analysis of variances, combining the risk 1 through 3 category samples into one super risk class (*srisk* = 1), and the other samples into another super risk class (*srisk* = 2), the *srisk* variable was not significant (at better than the 0.10 level) for any model attempted that included plant and type of product factors. That is, when the indicators of positive MPN, MPN >24, MPN >100, and the $\log_{10}$(MPN) were the dependent variables, and plant, type of product, time of sampling, *srisk*, and interactions of these, were the independent variables, the *srisk* variable by itself or interacting with other terms were not significant (type III significance). Plant, type of product, and the interaction of type of product were significant in all models, and in some models, the time of sampling was significant. The "significance" of the risk category is seen when ignoring all effects except *srisk* and type, in which case both variables are significant, but with the type of product effect more so. Table F8 gives the least square means for the dependent variables from the model, ignoring the plant effect, with type of product and *srisk* as main effects (the interaction terms were not significant).

TABLE F7 FRACTIONS OF MPN POSITIVE AND >100 BY TYPE, RISK CATEGORY AND PERIOD OF SAMPLE COLLECTION. EARLY = 2001 AND 2002 UP TO APRIL 30. LATE = MAY 2002 THROUGH MARCH 2003.

			White			**Whole**			**Yolk**			**All**	
		MPN >0 N	**MPN >0 Frac**	**MPN >100 Frac**	**MPN >0 N**	**MPN >0 Frac**	**MPN >100 Frac**	**MPN >0 N**	**MPN >0 Frac**	**MPN >100 Frac**	**MPN >0 N**	**MPN >0 Frac**	**MPN >100 Frac**
<u>Risk</u>													
	Early												
1	1	12	0.67	0.00	13	1	0.08	11	1	0.18	36	0.89	0.08
	2	33	0.91	0.06	48	0.90	0.23	43	0.81	0.23	124	0.87	0.19
	All	45	0.84	0.04	61	0.92	0.20	54	0.85	0.22	160	0.88	0.16
	Early												
2	1	40	0.48	0.05	43	0.70	0.21	31	0.48	0.13	114	0.56	0.13
	2	85	0.76	0.13	93	0.76	0.24	95	0.57	0.18	273	0.70	0.18
	All	125	0.67	0.10	136	0.74	0.23	126	0.55	0.17	387	0.66	0.17
	Early												
3	1	1	1.00	1.00	2	1	0.50	-	-	-	3	1	0.67
	2	4	0.50	0.25	4	0.25	0.00	4	0.50	0	12	0.42	0.08
	All	5	0.60	0.40	6	0.50	0.17	4	0.50	0	15	0.53	0.20
	Early												
4	1	24	0.75	0.04	26	0.96	0.23	7	0.86	0.14	57	0.86	0.14
	2	49	0.84	0.08	43	0.86	0.14	41	0.78	0.17	133	0.83	0.13
	All	73	0.81	0.81	69	0.90	0.17	48	0.79	0.17	190	0.84	0.13

	Early												
5	1	34	0.71	0.12	34	0.76	0.12	32	0.66	0.09	100	0.71	0.11
	2	59	0.73	0.14	69	0.75	0.10	55	0.71	0.11	183	0.73	0.11
	All	93	0.72	0.13	103	0.76	0.11	87	0.69	0.10	283	0.72	0.11
All		341	0.74	0.10	375	0.80	0.18	319	0.67	0.16	1035	0.74	0.15

TABLE F8 LEAST SQUARE MEANS BASED ON GLM MAIN EFFECTS MODEL WITH RISK CATEGORY AND TYPE OF PRODUCT AS INDEPENDENT VARIABLES (IGNORING PLANT EFFECTS).

	Fraction of Samples with:			
	MPN +	**MPN >24**	**MPN >100**	**Log_{10}(MPN)**
Product Type				
White	0.737	0.187	0.099	0.588
Whole	0.802	0.292	0.177	0.985
Yolk	0.678	0.280	0.153	0.993
Risk Category				
1, 2, and 3	0.713	0.265	0.165	0.952
4 and 5	0.765	0.242	0.121	0.759

The fraction of positive samples, MPN >24, and MPN >100 are not as different between the 2 super risk categories as they are among the 3 product types. The primary difference for the type of products is between the egg white product and the others for the measured levels for positive samples. For example, the average $\log_{10}$(MPN) for the eggwhite positive samples is approximately 0.4 $\log_{10}$ lower than the averages for the samples of other two types of products.

Age of egg and liquid product effects

One difference between the "best" and the "worst" plants identified above was the age of liquid product before pasteurization. It would be expected that egg age and liquid product would have an effect on *Salmonella* levels. One aspect of the data that confounds the analysis is that recorded ages represent maxima; many plants use eggs from different sources in unknown amounts. In addition, the true effect of these variables cannot be determined from survey data because of the possible confounding of other factors associated with actions by the plants and farms, as well as other unknown random or contingent factors. Nevertheless, over many observations, differences associated with the ages of the eggs and liquid product might be seen.

There were 266 samples for which the ages of the eggs were not recorded and 146 samples for which the age of the liquid product was not recorded. One missing value for the liquid egg product came from plant 4, in which the other 30 samples were reported as being 2 hours old for liquid product; thus, for the missing value, a value of 2 hours was assigned. Tables Fa and F9b provide the fractions of MPN values >24, and the means of the $\log_{10}$(MPN) for samples by the maximum age of the eggs used and by the maximum age of the liquid product used, for the 2 super risk categories of product. The results show that younger eggs and liquid product have a greater likelihood of lower MPN levels before pasteurization. Specifically, samples from eggs ≤ 1 day old and liquid product ≤3 hours old had lower than average MPN values. Samples were classified as whether the ages of the eggs were ≤1 day, or whether the age of the liquid was ≤3 hours. If <30% of the plants data regarding age of eggs or liquid product were missing and the age classifications were the same for the non-missing data, then the common age classification was imputed for the missing data.

Tables F10a and F10b provide fractions of MPN >24, for whole and yolk egg product, and whether ages of eggs and liquid product satisfy the above conditions. The results show a greater difference associated with the age of the liquid product being >3 hours old than is associated with the age of the egg being >1 day old. This, of course, is not a surprising finding since *Salmonella* grows more rapidly in yolk product than in albumen. Differences observed for whole and yolk product samples were not observed for egg white product samples.

TABLE F9A FRACTIONS OF MPN VALUES >24, AND THE MEANS OF THE LOG_{10}(MPN) FOR POSITIVE MPN SAMPLES, BY MAXIMUM AGE OF EGG.

	Risk Category								
	1 – 3			4 – 5			All		
	MPN >24		Log_{10} (MPN)	MPN >24		Log_{10} (MPN)	MPN >24		Log_{10} (MPN)
	N	**Mean**	**Mean**	***N***	**Mean**	**Mean**	***N***	**Mean**	**Mean**
Egg Age (Day)									
0	2	0.000	1.00	-	-	-	2	0.000	1.00
1	13	0.308	0.65	99	0.071	0.00	112	0.098	0.10
2 – 3	33	0.364	1.27	81	0.284	0.91	114	0.307	1.00
4 – 6	79	0.215	0.92	87	0.448	1.32	166	0.337	1.16
7 – 10	75	0.293	1.17	85	0.259	0.90	160	0.275	1.01
11 – 13	28	0.214	0.80	21	0.143	0.51	49	0.184	0.65
14 – 20	54	0.352	1.39	38	0.237	0.52	92	0.304	1.00
>20	50	0.240	0.86	24	0.208	0.88	74	0.230	0.87
All	334	0.275	1.06	435	0.248	0.77	769	0.260	0.88

TABLE F9B FRACTIONS OF MPN VALUES >24, AND THE MEANS OF THE LOG_{10}(MPN) FOR POSITIVE MPN SAMPLES, BY MAXIMUM AGE OF EGG.

	Risk Category								
	1 – 3			4 – 5			All		
	MPN >24		Log_{10} (MPN)	MPN >24		Log_{10} (MPN)	MPN >24		Log_{10} (MPN)
	N	**Mean**	**Mean**	***N***	**Mean**	**Mean**	***N***	**Mean**	**Mean**
Max Age (Hour)									
0 – 1	39	0.103	0.42	19	0.158	0.58	28	0.121	0.47
2 – 3	116	0.121	0.46	73	0.233	0.79	189	0.164	0.62
4 – 12	102	0.412	1.37	58	0.276	0.78	160	0.363	1.16
13 – 24	82	0.354	1.27	140	0.314	0.95	222	0.329	1.06
25 – 36	46	0.435	1.29	50	0.180	0.77	96	0.302	1.03
37 – 48	27	0.407	0.95	26	0.269	0.91	53	0.340	0.93
49 – 72	40	0.275	0.93	32	0.219	0.32	72	0.250	0.65
73 – 96	30	0.233	0.72	20	0.150	0.45	50	0.200	0.63
97 – 120	17	0.176	0.70	17	0.235	0.52	34	0.206	0.61
121 – 144	12	0.083	0.23	13	0.000	0.08	25	0.040	0.15
145 – 168	8	0.375	0.90	2	0.500	2.63	10	0.400	1.11
>169	13	0.154	0.56	8	0.000	0.09	21	0.095	0.40
All	532	0.276	0.98	458	0.242	0.75	990	0.261	0.87

TABLE F10A AND F10B FRACTIONS OF MPN >24 AND 100, FOR WHOLE AND YOLK EGG PRODUCT, AND WHETHER AGES OF EGGS AND LIQUID PRODUCT SATISFY THE SPECIFIED CONDITIONS.

		Liquid Age													
		0-3 h						>3 h							
		Risk Category						Risk Category							
		1-3		4-5		All		1-3		4-5		All		All	
		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24	
Egg Age	Risk Category	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean
0-1 d	1-3	1	0.00	-	-	1	0.00	7	0.29	-	-	7	0.29	8	0.25
	4-5	-	-	15	0.07	15	0.07	-	-	25	0.08	25	0.08	40	0.08
	All	1	0.00	15	0.07	16	0.06	7	0.29	25	0.08	32	0.13	48	0.10
>1 d	1-3	40	0.20	-	-	40	0.20	77	0.38	-	-	77	0.38	117	0.32
	4-5	-	-	34	0.29	34	0.29	-	-	91	0.33	91	0.33	125	0.32
	All	40	0.20	34	0.29	74	0.24	77	0.38	91	0.33	168	0.35	242	0.32
All		41	0.20	49	0.22	90	0.21	84	0.37	116	0.28	200	0.32	290	0.28

		Liquid Age													
		0-3 h						>3 h							
		Risk Category						Risk Category							
		1-3		4-5		All		1-3		4-5		All		All	
		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24		MPN >24	
Egg Age	Risk Category	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean	*N*	Mean
0-1 d	1-3	2	0.00	-	0.00	2	0.00	5	0.40	-	-	5	0.40	7	0.29
	4-5	-	-	5	0.00	5	0.00	-	-	28	0.07	28	0.07	33	0.06
	All	2	0.00	5	-	7	0.00	5	0.40	28	0.07	33	0.12	40	0.10
>1 d	1-3	50	0.04	-	-	50	0.04	58	0.40	-	-	58	0.40	108	0.23
	4-5	-	-	15	0.13	15	0.13	-	-	79	0.46	79	0.46	94	0.40
	All	50	0.04	15	0.13	65	0.06	58	0.40	79	0.46	137	0.43	202	0.31
All		52	0.04	20	0.10	72	0.06	63	0.40	107	0.36	170	0.37	242	0.28

The above analyses indicate age of liquid product is correlated with MPN levels, particularly for yolk and whole egg product. Figure F2 is a plot of the $\log_{10}$(MPN) versus ln(1 + age of liquid product) by product type. For the purposes of the plot, when MPN was non-detect, a value of –2 was assigned.

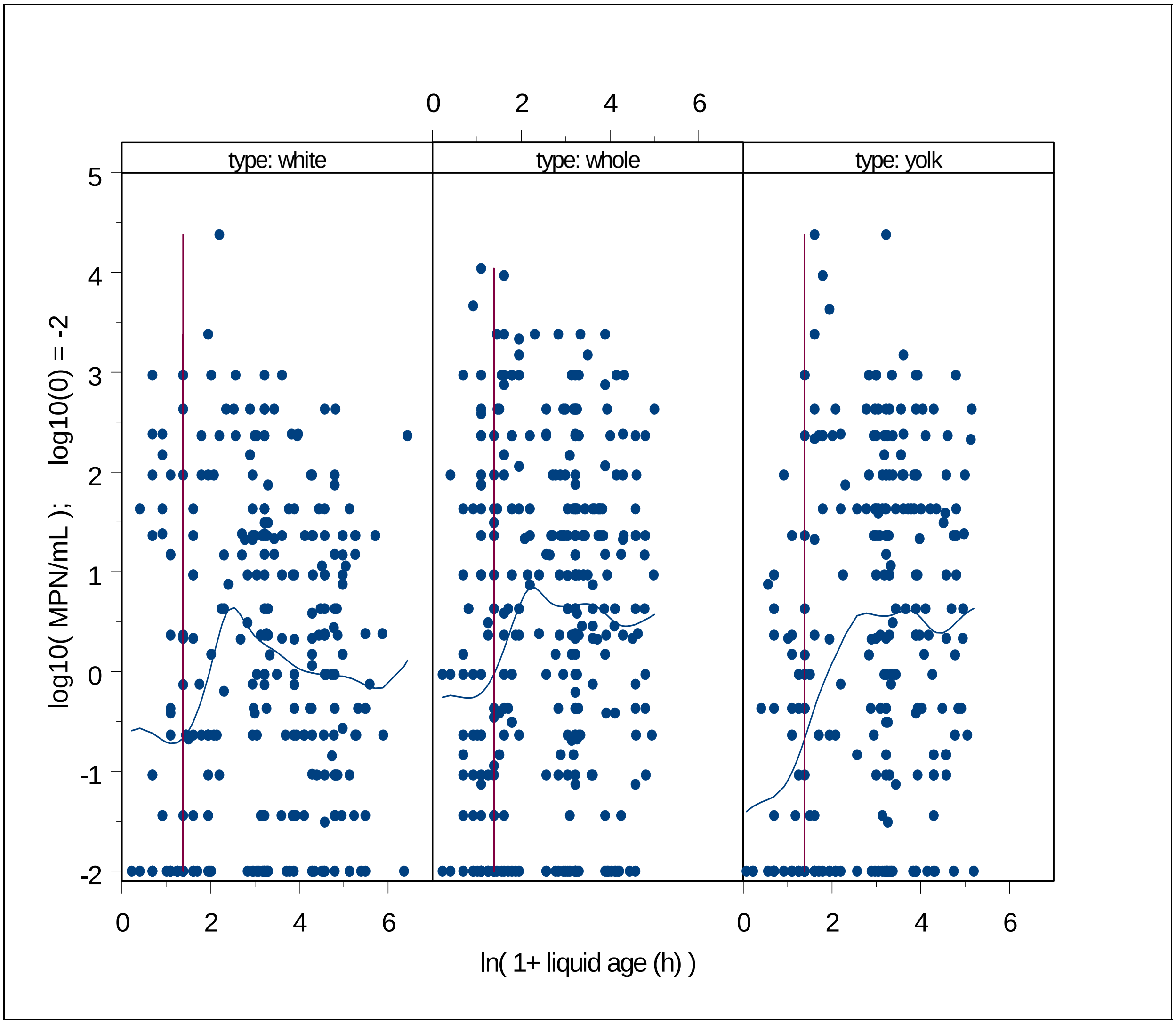


FIGURE F2 PLOT OF THE $\log_{10}$(MPN) VERSUS LN(1 + AGE OF LIQUID PRODUCT) BY PRODUCT TYPE. MPN NON-DETECT IS SHOWN AS A VALUE OF –2. THE VERTICAL LINE IS AT 3 HOURS AND THE OTHER SOLID LINE IS A SMOOTHED LINE USING A NORMAL KERNEL WITH BANDWIDTH 1, OF THE $\log_{10}$(MPN) VERSUS LN(1 + AGE), PRODUCED BY THE S-PLOT PROCEDURE.

The relationship of MPN with liquid product age beyond three hours is not as pronounced as within the first few hours. The lack of an observed relationship beyond a certain number of hours does not imply that age is not important for relatively large ages, but rather that there may be other factors that need to be taken into account for explaining the data.

Sample location – valve effect

In an effort to ensure that egg product samples represented product at the time immediately before pasteurization, if samples had to be collected from valves or spigots, collectors were instructed to "let sufficient liquid pass from the nozzle to ensure that the sample represents product that is in the tank, not in the valve." We were concerned that samples taken from valves or spigots would be contaminated by a build up of bacteria within them.

Among the 1,035 samples, 30 did not include information about the location of sample collection; 160 did not include the words valve or spigot in their sample location descriptions; and the remaining 845 had at least one of these words in their sample location descriptions. Most of the samples that were not collected from a valve came from risk category 1 product. Many of the missing values were from plants for which almost all other samples had information. Thus, imputed values for missing data were made if all samples with known information from a plant, either from risk category 1 or from the other risk categories, as appropriate, had the same classification. After the imputations, there were 13 samples for which information was missing, 161 that were designated not to have been collected from a valve, and 861 samples that were designated to have been collected from a valve.

Because of the plant effect, for determining the significance of a "valve" effect, the plant variable needs to be accounted for in the analysis. The summaries in Table 11 are results for risk category 1 product from plants that had samples collected from (i) valves and (ii) not valves. Differences of the fractions of positive MPN, MPN >100, and MPN >1,000, and means of the $\log_{10}$(MPN) between valve and non-valve sample results (valve – nonvalve) are small or are negative, and are not statistically significant (through analyses of variance with plant as a fixed effect). The most notable differences are for the: (i) 'MPN >1,000' samples, where for the risk categories 2-5, whole egg products, only samples collected from valves had MPN results >1,000; however, of the 83 'risk categories 2-5, whole products' samples collected from valves, 4 (4.8%) had MPN values >1,000. With only 31 samples within this group that were not collected from a valve, it is not possible to infer a significant effect; and (ii) MPN >100 samples, where for the risk categories 2-5, yolk egg products, only samples collected from valves had MPN results >100; however, of the 95 'risk categories 2-5, yolk products' samples collected from valves, 9 (9.47%) had MPN values greater than 1,000. With only 14 samples within this group that were not collected from a valve, it is not possible to infer a conclusion of a significant effect. Even combining the two combinations, the significance of the valve effect, based on 9 + 4 = 13 'positive' results from 178 samples collected from valves, versus no 'positive' results from 44 samples not collected from valves, results in Fisher's exact test significance at the 0.05 level, which is not definitive evidence of a valve effect.

To explore the relationship of MPN levels and valves, two additional analyses were performed: (i) an analysis of the relationship of the maximum MPN within a plant and the incidence variable, "Valve," defined as equal to 1 when the sample was from a valve, and zero otherwise "Valve"; and (ii) an analysis of the within-plant correlations of the MPN and the variable "Valve." Both analyses did not produce significant evidence suggesting a systematic valve effect. The details of these analyses are presented in Attachment 1 to this annex.

The lack of a detectable systematic valve effect does not preclude valve effects occurring sporadically for some plants. Attachment 1 presents a summary of the high MPN values by plant, regarding whether they were from samples collected through valves. Three plants that had samples both collected from valves and non-valves, with ID numbers 5, 12, and 60, in particular, can be seen to have had high MPN values associated with valves. For plant 5, with 23 samples of which 15 were from valves, the 6 samples with the highest MPN results, ranging from 147 to 2.4 MPN/ml, were collected from valves (which, by the hypergeometric distribution has a 0.05 probability, thus reflecting the probability that there would be at least a run of 6 of the highest MPN results being from samples collected from valves), while there were also 4 samples from valves that had a non-detect MPN. For plant 12, with 28 samples of which 9 were from valves, the 2 samples with the highest MPN results, 427 and 24 MPN/ml, were collected from valves, and 3 of the top 4 MPN values were from samples collected from valves. And for plant 60, with 7 samples of which 3 were from valves, the 2 samples with the highest MPN results, 2,400 and 14.9 MPN/ml, were collected from valves, while 1 sample collected from a valve had a non-detect MPN.

In conclusion, only a small percentage of samples were not collected through valves, and thus it is difficult to conclude that samples collected from valves, given everything else being equal, would typically have higher *Salmonella* levels than those that were not. Some exceptions might exist. Since there does not appear to be a clear systematic valve-effect (Table F11), all data were used in the following analysis.

TABLE F11 FRACTION (FRAC) OF MPN RESULTS >0, 100, AND 1,000, AND THE AVERAGE OF THE LOG_{10}(MPN) FOR POSITIVE MPN VALUES. FOR EACH ROW, RESULTS ARE FROM SAMPLES THAT WERE COLLECTED IN PLANTS FOR WHICH BOTH VALVE AND NON-VALVE SAMPLES WERE OBTAINED.

		Type									
		White					Whole				
	MPN Value		**>0**	**>100**	**>1000**	**Log_{10}**		**>0**	**>100**	**>1000**	**Log_{10}**
Risk Category	Valve	*N*	Frac	Frac	Frac	Frac	*N*	Frac	Frac	Frac	Frac
	No	9	0.89	0.11	0.00	0.70	26	0.92	0.23	0.04	1.01
1	Yes	13	1.00	0.08	0.00	0.79	12	1.00	0.33	0.00	1.18
	No	12	0.92	0.25	0.00	1.36	31	0.61	0.13	0.00	0.90
2-5	Yes	112	0.56	0.04	0.00	0.33	83	0.73	0.16	0.05	0.92

		Type									
		Yolk					All				
	MPN Value		**>0**	**>100**	**>1000**	**Log_{10}**		**>0**	**>100**	**>1000**	**Log_{10}**
Risk Category	Valve	*N*	Frac	Frac	Frac	Frac	*N*	Frac	Frac	Frac	Frac
	No	20	0.85	0.25	0.00	1.01	55	0.89	0.22	0.02	0.96
1	Yes	18	0.89	0.17	0.00	1.21	43	0.95	0.19	0.00	1.07
	No	14	0.50	0.00	0.00	1.03	57	0.65	0.12	0.00	1.06
2-5	Yes	95	0.55	0.09	0.00	0.86	290	0.61	0.09	0.01	0.69

Estimation Procedures

Construction of sample weights

The above analyses suggest plant and type of product are the "most" significant factors. Time of sampling, age of eggs and liquid product, and risk category also affect the results, but clearly, the most important variable is the plant, as seen by examining results for plants 4 and 67. Ideally, A-sets could be defined for each plant; however, the numbers of samples for each plant are too small to expect reliable estimates of the distribution of *Salmonella* levels. For equation F6, it is not practical to determine distributions for each plant separately. Thus, Equation F6 is used, combining all the data over the plants. If a good fit is achieved using a simple distribution, reasonable estimates of percentiles within the range of the data would be provided. Equation F6 will be considered for each of the product types by super risk categories, designated by the variable, *srisk*, where *srisk* = 1 for samples from risk categories 1, 2, and 3, and *srisk* = 2 for the other samples. Observations are weighted taking into consideration the production volume of the plants for the type of product, and the time of sampling.

FSIS collected production volume information from each plant, for every month over the life of the survey. The collected information included production volume for white, whole, and yolk products, by whether the product was received by the plant, or whether it was processed originally within the plant. However, there was a difficulty in interpreting the production volume numbers. Often times the production volume for incoming product was not reported or reported as zero while samples from risk categories 1, 2 or 3 were collected from plants; and, much fewer times, the production volume for in-plant product was not reported or reported as zero while samples from risk categories 4 or 5 were collected from plants. Weighted estimates of the distributions, consequently, are made only when combining all results within a product type. These estimated distributions are used in the risk assessment.

Recall (Table F2) that the numbers of monthly samples were slightly less than average for the first few months of the survey, and the percentages of positive samples for white and yolk product categories tended to be lower than their respective category averages for the first few months of the survey. To help mitigate possible biases that might arise because of these trends, sample results were weighted differentially by time of period for the white and yolk egg product categories. Weights for each sample result for these two categories were computed for the first 5 months or the last 13 months of the survey, as appropriate for the sample. The weight for a result from a sample collected from an establishment (k), within the first 5 months of the survey (j =1) or the last 13 months of the survey (j = 2) is proportional to: V_{kj}/n_{kj}, where V_{kj} is the total production volume and n_{kj} is the number of samples for the k^{th} establishment within the j^{th} period, for the white or yolk product category, as appropriate. If, for a given plant, there were no samples for a period, and for all samples of whole egg product, the weight for that plant's samples was determined by using the total plant's production divided by the total number of samples.

For sample results for whole product, no weight adjustment for the different periods of the survey was needed since there does not appear to be a trend to the degree that trends occurred for the other product categories; thus, the weights for results within the whole product category are proportional to the production divided by the number of samples for the particular establishment. To estimate the distribution $\Im$ using Equation F6, the error distribution from Equation F2 of the MPN measurements need be specified.

More detailed account of the use of the results obtained from the MPN procedure

To compute an MLE of parameter values defined in Equation F6, for each reported MPN value, the pattern of the 18 results associated with the 6-dilution, 3-tube MPN procedure needs to be determined. For the analysis presented in this report, the following procedure was used for assigning a pattern to the reported MPN result. The reported MPN value corresponds to a pattern of positive results for a 3-tube, 3-dilution MPN, *abc*, where *a* represents the number of positives in the lowest dilution (largest volume of sample); *b* represents the next lowest dilution; and *c* represents the highest. For dilutions higher than that of the *c* result, a value of 0 was assigned; for dilutions lower than that of the *a* result, a value of 3 was assigned. For example, an assumed pattern could be 33*a bc*0, or *abc* 000, or 333 *abc*, and so forth. If all tubes were negative, then a non-detect was reported, corresponding to a pattern of 000 000. The highest reported result was 24,000 MPN/ml (twice) and there was one reported value of 23,100 MPN/ml. These results from second sets of analyses and the one reported as >>11,000 MPN/ml, however, were assigned a pattern 333 333. Thus, an MPN value corresponds to a unique 6-tuple vector.

Let $P_0(V, r) = e^{-rV}$ be the probability of a negative result in a tube containing a volume V of sample material, assuming a "true" level of r uniformly distributed throughout the sample; V_j, j = 1, 2, ..., 6, be the volumes of the sample material in the 6 dilutions used for determining the MPN value; and x_j, j = 1, 2, ...,6 be the number of positive tubes from among the n_j tubes of volume V_j. The assumption for P_0 is reasonable, since the highest volume in a given tube of sample tested was 10 ml and the total sample consisted of 200 ml. Assume x corresponds to the vector $x = (x_1,..., x_6)$ and that $\gamma(x|r)$ is the probability of obtaining a vector x, corresponding to a MPN(x) value. Using the binomial distribution, the probability of the obtaining a result x, $\gamma(x|r)$, is given as:

$$\gamma(x\,|\,r) = \prod_{j=1}^{6} \binom{n_j}{x_j} (1 - P_0(V_j, r))^{x_j} P_0(V_j, r)^{n_j - x_j}. \tag{F7}$$

The MPN is the MLE estimate using Equation F7. That is, the MLE estimate, $\hat{r}$, satisfies the following equation:

$$\sum_{j=1}^{6} \frac{v_j (x_j - n_j (1 - e^{-v_j \hat{r}}))}{1 - e^{-v_j \hat{r}}} = 0. \tag{F8}$$

A rough approximation of the variance of the MLE is determined from the negative of the inverse of the second derivative of the log-likelihood equation using Equation F7, with respect to r, evaluated at the MLE. Thus, the variance of the MLE can be approximated as:

$$\mathrm{Var}(\hat{r}) \approx \frac{1}{\sum_{j=1}^{6} \frac{x_j v_j^2 e^{-v_j \hat{r}}}{(1 - e^{-v_j \hat{r}})^2}} \qquad \text{(F9)}$$

where $\hat{r}$ is the MLE. Confidence intervals can be formed for ln(MPN) by assuming that MPN is distributed as a lognormal distribution with variance of ln(MPN) equal to $\mathrm{Var}(\hat{r})/\hat{r}^2$.[4]. Such confidence intervals, however, may not provide accurate coverage for 3-tube, 3-dilution MPN determinations. For the example given above, for the 3-tube, 3-dilution 2,400 MPN value (with a pattern of 333 330), the standard error of $\hat{r}$ is 1,743 and the upper 99th confidence limit using the above approximation is estimated to be 13,000, which is slightly less than the 15,500 limit estimated using a direct calculation. To assure an accurate calculation when estimating the distribution of levels using Equation F6, the probability distribution for the assigned pattern of positive tubes is used.

A few of the higher reported MPN values might have been based on second sets of analyses. The two results with reported MPN/ml of 24,000 were second analyses determined from a 7-ilution MPN; the reported result of 23,100 MPN/ml was a second set of analyses from an 8-dilution MPN. In all these cases, the 7th dilution tubes were negative. As mentioned above, these second sets of analyses may provide negative biased results. Hence, it is possible that the MPN levels in the samples are greater than those implied by the pattern of results of the second set. We believe the bias is no more than 10-fold (1 $\log_{10}$ decrease), corresponding to at most a 90% reduction in the *Salmonella* cells of the sample materials that were analyzed the second time. If this assumption were true, then 7th dilution tubes being all negative on samples that had been stored for an unknown number of days implies that it would not be likely that, from the unstored, original sample, a positive result from an 8th dilution tube would be possible. Thus, the second sets of analyses are important for determining an upper bound of possible levels. In the analysis presented below, it was assumed that the obtained pattern 333 333 on a first set of analyses, resulting in a reported MPN >11,000, would have resulted in no positives for 10th dilution tubes if such dilutions were tested. In other words, the likelihood associated with a 333 333 pattern is determined by adding the probabilities for the patterns, 333 333 *xyz*, where $0 \le x$, $y \le 3$, and $z \le 3$.

Estimating a distribution using Equation F4

Examining the estimate of distributions obtained with Equation F4 helps determine distributions to use in Equation F6. An unweighted analysis is performed so that the weights, w_k, are set equal to $1/(n + 1)$, where n is the number of observations for a given product type. To help determine a simple function to fit the cumulative distribution function (cdf), plots of the log-log transformation of the estimated cdf, $\hat{F}(x)$ derived from Equation 4, $\ln(-\ln(1-\hat{F}(x)))$, versus $\ln(x)$ where x ranges over the positive MPN values, and the linear regression lines that are given in Figure F3, for the product types and super risk categories. The linear regression lines provide reasonable good fits, suggesting fitting a Weibull distribution,

$$W(x \mid b, c)) = 1 - e^{-(x/c)^{b}} \qquad \text{(F10)}$$

where *b* is the shape parameter and *c* is the location parameter, for the cdf for each product type[c]. From the linear regression, values of *b* and *c* are derived (see Table F12), together with the 99th percentile of the estimated Weibull.

TABLE F12 DERIVED VALUES OF PARAMETERS *B* AND *C* FOR WEIBULL DISTRIBUTION USING (UNWEIGHTED) SAMPLE CUMULATIVE DENSITY FUNCTION AND LINEAR REGRESSION.

Type	Risk Categories	No. Samples	Expected Value (cfu/ml)	*b*-shape (Power) Parameter	*c*-location Parameter	99th Percentile	99.5th Percentile	99.9th Percentile
White	1-3	175	199	0.224	3.975	3681	6891	22571
White	4-5	166	96	0.236	2.815	1798	3254	9993
White	All	341	144	0.228	3.304	2674	4946	15825
Whole	1-3	203	403	0.246	15.070	7565	13390	39434
Whole	4-5	172	209	0.258	10.498	3908	6730	18816
Whole	All	375	271	0.256	13.017	5068	8763	24693
Yolk	1-3	184	960	0.186	4.154	15298	32512	135350
Yolk	4-5	135	144	0.257	7.076	2696	4653	13063
Yolk	All	319	398	0.214	5.712	7207	13883	47983

For the whole and white egg products, the two distributions are similar, with the risk categories 1 and 2 having slightly higher estimated percentiles than the corresponding ones for the other risk categories. Combining the results from the two super risk categories provides an estimated distribution close to the individual estimated distributions. However, for the yolk product this last statement is not true. In any case, using all the data, the Weibull distribution provides a good fit for the yolk product (not shown), and thus, would be representative of the levels of *Salmonella* in consumed product if for the risk categories the proportions of consumed of product are the same as that of the volume produced.

[c] The transformation: ln(-ln(1-$W(x|b, c)$)) is a linear function of ln(x).

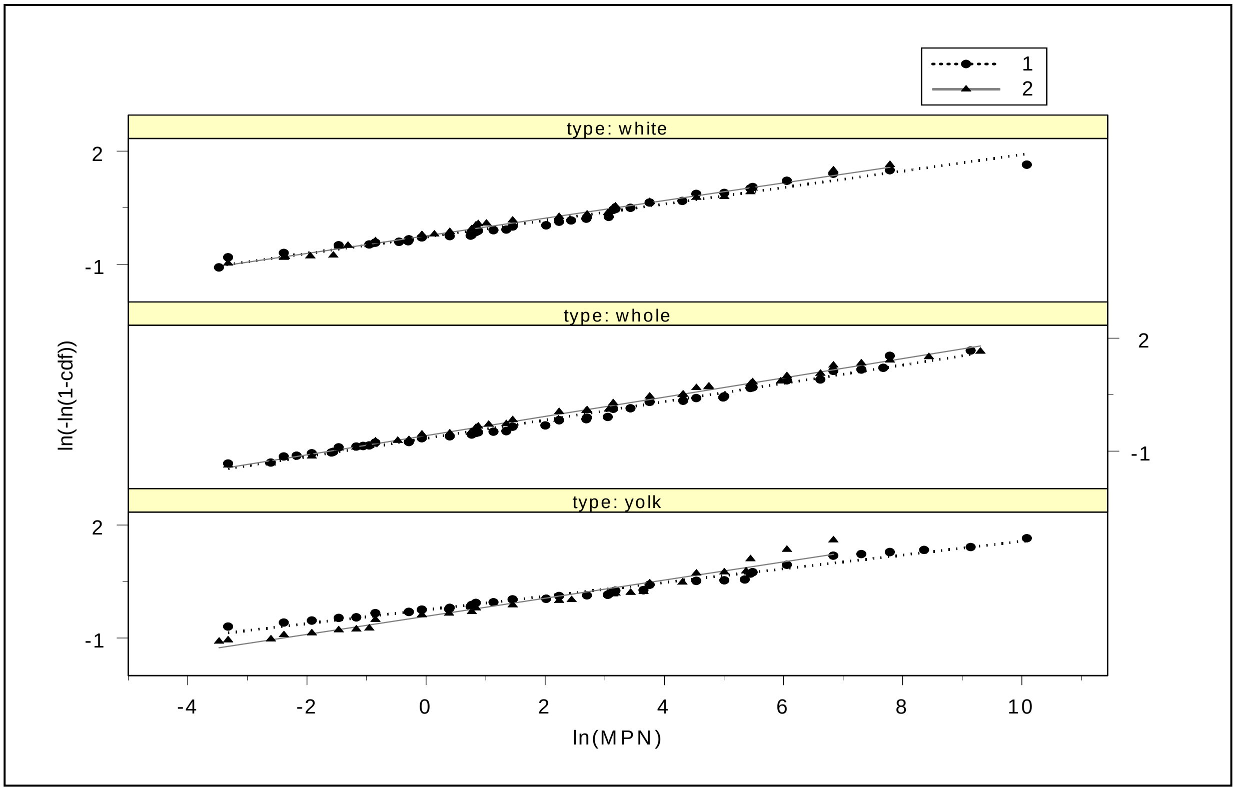


FIGURE F3 PLOT OF LOG-LOG TRANSFORMATION OF (UNWEIGHTED) CUMULATIVE DISTRIBUTION FUNCTION, (LN(-LN(1-CDF)) VERSUS LN(MPN), ESTIMATED USING EQUATION F4, BY PRODUCT TYPES AND SUPER RISK CATEGORIES, TOGETHER WITH LINEAR REGRESSION LINES. SUPER RISK CATEGORY 1 CONSISTS OF SAMPLES FROM RISK CATEGORIES 1 AND 2; SUPER RISK CATEGORY 2 CONSISTS OF SAMPLES FROM RISK CATEGORIES 3 THROUGH 5.

ESTIMATING A DISTRIBUTION USING EQUATION F6

G_A will be estimated for each product type and super risk category, assuming equal weights and weights proportional to production volume for the observations. If $W(r|b,c)$ is the assumed distribution of the levels of *Salmonella* spp. within the liquid product, then the likelihood of an observation (pattern of positive and negative tubes) is

$$L(x\,|\,b,c) = \int_0^\infty \gamma(x\,|\,r)\,dW(r\,|\,b,c). \qquad \text{(F11)}$$

where $\gamma(x|r)$ is the probability of obtaining the pattern x, given r. If there are n_x measured results with the same pattern x, the log of the likelihood, $H(\theta)$ that is to be maximized is

$$H(\theta) = \sum_x n_x \ln(L(x \mid \theta) \qquad \text{(F12)}$$

where $L(x|\theta)$ is given in Equation F11 and $\theta = (b, c)$. The MLE estimates of θ are derived using the Newton-Raphson procedure, iterating until changes in the estimates were less than 10^{-9}. For the weighted analysis, instead of the number of samples, the sum of the weights, w_k, of samples with MPN pattern x is used.

Two functional forms for W were considered: the Weibull and the lognormal. For the Weibull function, a transformation of the above function was used to simplify the calculations. Namely, the Weibull was expressed as

$$\mathrm{W}(\mathrm{r} \mid \mu, \mathrm{s}) = 1 - \exp(-\exp((\ln(\mathrm{r}) - \mu)/\exp(\mathrm{s}))) \qquad \text{(F13)}$$

where μ and s are parameters, so that $b = \exp(-s)$ and $c = \exp(\mu)$. Estimating μ and s avoids boundary conditions for the estimates of the parameters b and c. An estimate of the covariance matrix of μ and s is derived using the inverse of the negative of the Fisher information matrix, $[-M^2H(\theta)/M\theta^2]^{-1}$, estimated at θ_0. The unweighted MLE's, their standard errors and correlations, and estimates of the selected percentiles of the distribution are given in Table F13. Figure F4 shows plots of the sample cdf versus the estimated cdf for the different product types.

TABLE F13 MLE ESTIMATES (UNWEIGHTED) OF WEIBULL DISTRIBUTION PARAMETERS (EQUATION F13), WITH ESTIMATED SELECTED PERCENTILES, WITH 97.5% UPPER CONFIDENCE BOUNDS, FOR DIFFERENT PRODUCT TYPES. ESTIMATES, *M* = LN(*C*) AND *S* = -LN(*B*), AND STANDARD ERRORS, STDE*:* AND STDES, AND CORRELATION, CORR:S, OF *:* AND *S*.

Type	Risk Category	No. Samples	Expected Value of Level (cfu/ml)	99th Percentile	Upper 97.5% Confidence Limit	99.5th Percentile	Upper 97.5% Confidence Limit	99.9th Percentile	Upper 97.5% Confidence Limit
White	1-3	175	143	2656	6888	4908	13532	15676	48930
White	4-5	165	68	1276	3067	2224	5648	6365	18060
White	All	340	99	1864	3564	3348	6670	10135	21949
Whole	1-3	203	335	6270	14046	10988	25901	31761	82970
Whole	4-5	172	161	2977	6788	5042	12095	13658	36310
Whole	All	375	243	4545	8101	7852	14509	22091	43904
Yolk	1-3	184	917	14317	44834	30764	104E3	130774	512070
Yolk	4-5	135	131	2460	6708	4291	12502	12288	40914
Yolk	All	319	408	7210	15732	14234	32682	51541	131163

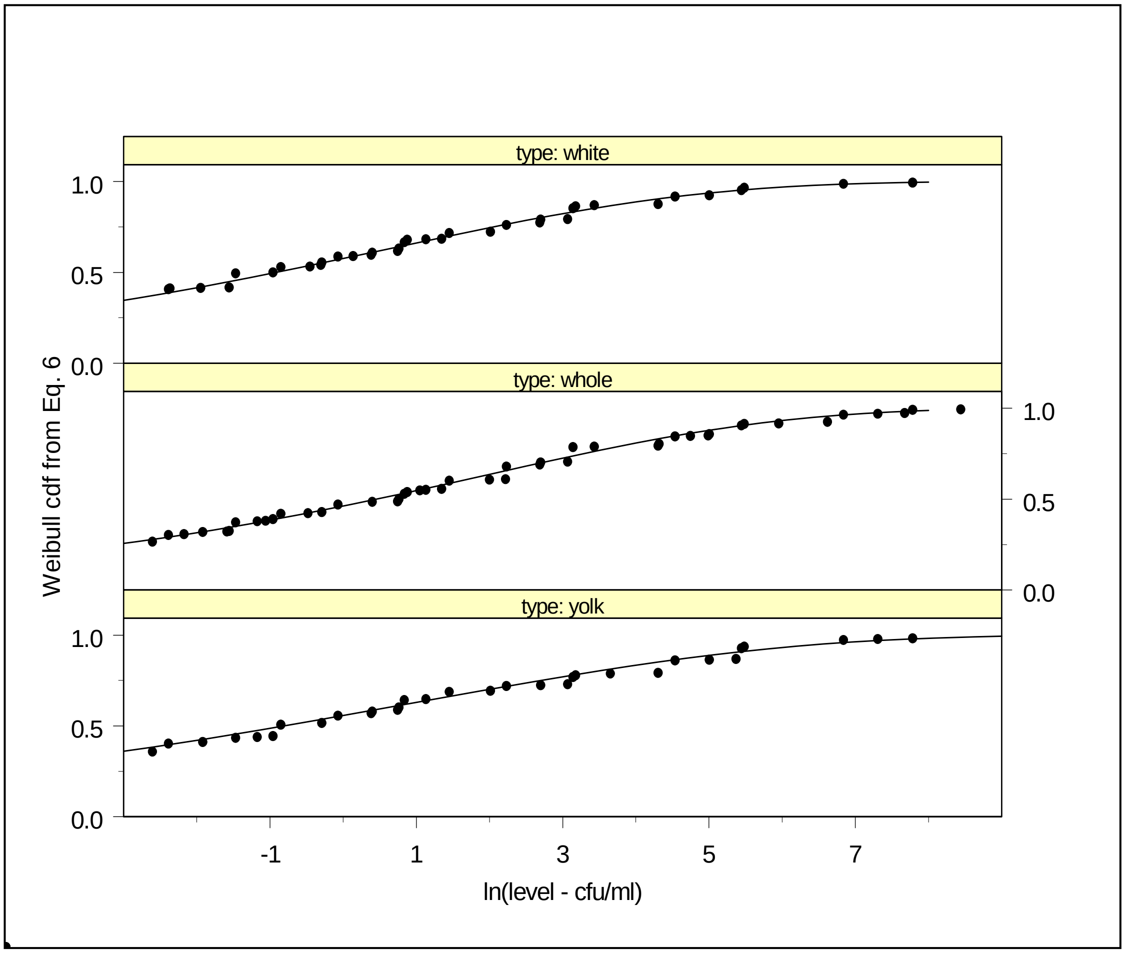


FIGURE F4 UNWEIGHTED SAMPLE CUMULATIVE DISTRIBUTION FUNCTION (CDF) AND THE ESTIMATED CDF OF THE WEIBULL DISTRIBUTION, USING MLE, FROM EQUATION F6 FOR DIFFERENT PRODUCT TYPES. THE X-AXIS REPRESENTS THE NATURAL LOG OF THE MEASUREMENTS, GIVEN IN UNITS OF CFU/ML.

The estimates of the expected values and selected percentiles from Table F13 are slightly less than those from Table F12 derived using Equation F4. This is expected, insofar as the estimates from Table F12 represent the distribution of the observed results, *X*, whereas, the estimates of Table F13 represent the distribution of the underlying true levels, after accounting for the analytical error of the MPN measurement.

As a comparison, a lognormal distribution, with density function

$$f(r \mid \mu, \sigma) = \frac{e^{-((\ln(r)-\mu)/\sigma)^2}}{r\sigma\sqrt{2\pi}} \tag{F14}$$

where μ is the mean and σ is the standard deviation of ln(r), was assumed and MLE estimates were calculated. The MLE estimates, their standard errors, and estimates of the 99th percentile, are given in Table F14. Figure F5 shows plots of the sample cdf versus the estimated cdf for the different product types.

TABLE F14 MLE (UNWEIGHTED) OF LOGNORMAL DISTRIBUTION PARAMETERS, WITH ESTIMATED 99TH PERCENTILES FOR DIFFERENT PRODUCT TYPES.

Type	Mean ln(level/ml)	ln(σ)	99th Percentile	Upper Confidence Limit	Std Error Mean	Std Error ln(σ)	Correlation of Mean and *s*
White	-0.802	1.482	12515	35064	0.256	0.050	-0.198
Whole	0.523	1.468	41072	105941	0.235	0.045	-0.136
Yolk	-0.858	1.669	97638	358122	0.324	0.054	-0.240

From a close comparison of Figures F4 and F5, it is seen that Weibull distribution provides a better fit to the observed data. For example, the percentiles between the median and 90th percentile of the estimated lognormal distribution are less than the corresponding sample percentiles, whereas in that range there does not appear to be any significant biases associated with those of the estimated Weibull distribution. The estimated 99th percentiles for the two assumed distributions are quite different. For example, the estimated 99th percentiles using the lognormal distribution are approximately 5 to 10 times higher than the estimated 99th percentiles using the Weibull distribution.

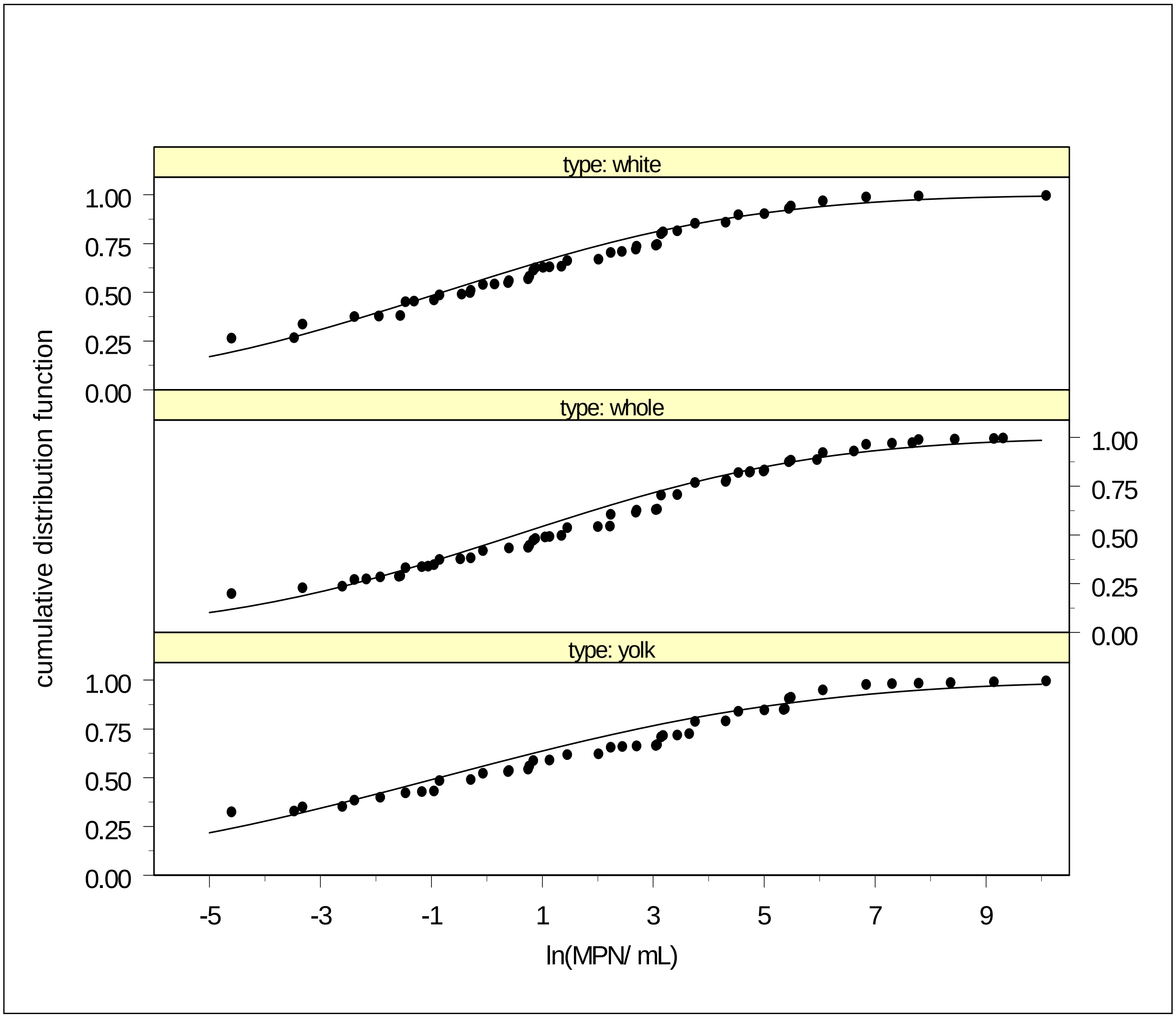


FIGURE F5 UNWEIGHTED SAMPLE CUMULATIVE DISTRIBUTION FUNCTION (CDF) AND THE ESTIMATED CDF OF THE LOGNORMAL DISTRIBUTION, USING MLE, FROM EQUATION F6 FOR DIFFERENT PRODUCT TYPES.

Weighted estimates of distribution

Comparison of the estimates of the parameter values of the Weibull distribution of levels, and selected percentiles for product types for weighted and unweighted data are given in Table F15.

TABLE F15 ESTIMATES OF THE PARAMETER VALUES OF WEIBULL DISTRIBUTION, COMPARING WEIGHTED AND UNWEIGHTED DATA.

Type	Method	*b*-shape (Power) Parameter	*c* Location Parameter	Expected Value	99th Percentile	Upper 97.5% Confidence Limit	99.5th Percentile	Upper 97.5% Confidence Limit	99.9th Percentile	Upper 97.5% Confidence Limit
White	Unweighted	0.239	3.168	99	1864	3564	3348	6670	10135	21949
White	Weighted	0.301	9.028	83	1446	2447	2304	4029	5565	10389
Whole	Unweighted	0.256	11.779	243	4545	8101	7852	14509	22091	43904
Whole	Weighted	0.287	14.027	160	2885	4815	4705	8099	11866	21743
Yolk	Unweighted	0.206	4.371	408	7210	15732	14234	32682	51541	131163
Yolk	Weighted	0.236	8.433	287	5383	10743	9740	20320	29905	68214

From Table F15 it is seen that the estimated distribution using the weighted data has lower higher percentiles that those, using the unweighted data. The above estimates (Table F15) include all the data (with the exception of one unusual MPN pattern and two results from plants with zero production volume for liquid products). However, as discussed above in the section on sample location, while there does not appear to be a systematic valve effect, it cannot be dismissed that a valve effect might have occurred on some occasions. Within particular plants this possibility might be higher than in other plants. If this were true then a reasonable candidate for which this effect had manifested itself is plant 67 that had 6 of the highest 8 MPN values. The estimates of the parameter values of a Weibull distribution without and without the results from plant 67 are given in Table F16. The estimated expected value for the yolk egg product distribution when results from plant 67 are not included is about 30% less than that when the results are not included (approximately 0.15 $\log_{10}$ units). For the other type egg products the decreases are modest, about 10%.

TABLE F16 ESTIMATES OF THE PARAMETER VALUES OF WEIBULL DISTRIBUTIONS, USING WEIGHTED DATA, COMPARING ESTIMATES WITH AND WITHOUT RESULTS FROM PLANT 67.

Type	Data	***b*-shape (Power) Parameter**	***c* Location Parameter**	**Expected**	**99^{th} Percentile**	**97.5% Confidence Limit**	**99.5^{th} Percentile**
White	Without Plant 67	0.31	8.63	72.85	1262	2122	1994
White	All	0.30	9.03	82.54	1446	2447	2304
Whole	Without Plant 67	0.29	13.40	147.29	2638	4395	4285
Whole	All	0.29	14.03	160.39	2885	4815	4705
Yolk	Without Plant 67	0.24	7.19	201.29	3776	7455	6711
Yolk	All	0.24	8.43	287.49	5383	10743	9740

Estimates of distributions for subsets of data defined by age of eggs and liquid product.

The weighted estimated Weibull distribution with parameter estimates given in Table 15 are used in the risk assessment. However, it is of particular interest to estimate the distributions for subsets of the data defined by age of eggs and liquid product. As noted above, the age of the eggs and liquid product used seemed to affect the levels of *Salmonella*. For the whole and yolk liquid egg products, estimates of the distribution were made for the following subsets of data, with the number of results in parentheses for whole and yolk liquid egg product, respectively: (i) samples for which the liquid product were more than 3 hours old (262 and 229); (ii) less than or equal to 3 hours old (100 and 79); 3) eggs more than 1 day old and liquid egg product more than 3 hours old (129 and 103); 4) the other samples not satisfying the condition for (iii) (93 and 82). Table 17 gives the estimated means (= $c\Gamma(1+b^{-1})$), 99^{th} percentiles, and 97.5% upper confidence bounds of the estimated 99^{th} percentiles, where the upper limits were calculated assuming asymptotic normal distributions of the parameter estimates from Equation 13.

TABLE F17 ESTIMATED MEANS, 99TH PERCENTILES, AND 97.5% UPPER CONFIDENCE LIMIT OF THE ESTIMATED 99TH PERCENTILES, USING WEIBULL DISTRIBUTION FOR LIQUID WHOLE AND YOLK PRODUCT USING VARIOUS SUBSETS OF DATA.

	Type					
	Whole			Yolk		
Data	Mean	99th Percentile	97.5% Upper Limit of 99th Percentile	Mean	99th Percentile	97.5% Upper Limit of 99th Percentile
Liquid Age ≤ 3 H	304.8	4828	21846	20.0	295	1683
Liquid Age > 3 h	202.7	3541	6386	353.4	6625	14311
Egg Age ≤1 d or Liquid Age ≤3 h	164.2	2869	9530	34.7	568	2258
Egg Age >1 d and Liquid Age >3 h	264.0	4623	9710	337.2	6153	15206

The results from Table F7 show that for yolk product there is an effect of age of liquid product on the levels of *Salmonella*, where, the average levels for the samples with liquid product <3 hours is more than 1 $\log_{10}$ less than the levels for the other samples. The age of the egg, however, does not seem to have a large effect on the results. For the whole egg product, the situation is not as clear: the subset with egg age being >1 day and liquid product age being >3 hours shows slightly higher levels than the levels of the other subsets.

Assumptions used for modeling

The level or number of *Salmonella* cells per ml, x, for a given lot of liquid product is assumed to be 3 times a random variable that is distributed as a Weibull distribution, given by Equation F13, with appropriate parameters, μ and s, given in Table F15. Given a level x, the number of cells in a volume of v ml is assumed to be a random variable distributed as a Poisson distribution with parameter (and expected value) equal to vx.

The uncertainty is quantified by generating values of μN and sN, where $(\mu N, sN)$ is distributed as a bivariate normal distribution with mean = (μ, s) and covariance matrix, given in Table F13 (as standard errors and a correlation).

Attachment F1: Analyses of valve effect

Two analyses for evaluating the relationship of MPN with sample collection sites from a valve were performed. The first analysis evaluates the relationship of the maximum MPN within plants with the valve indicator variable. The second analysis is based on the within plant correlation of the MPN values, and on an indicator variable with respect to the sample being collected from a valve.

First Analysis

Given n samples per plant, where n_v of them were sampled from valves, then, if there were no valve effect, the probability that the maximum MPN would be from a valve sample is $n_v/n = p$. Let δ be the indicator variable that the maximum MPN if from a valve sample. Then under the null hypothesis of no valve effect, the expected value of $diff = (\delta - p)$ is zero. The quantities *diff* were computed for all plants, and a weighted sum of them was computed, where the weight is equal to, $w = 1/(p(1-p))$. The variance of the weighted sum, assuming the null hypothesis is true, is the sum of the weights. Taking the ratio of the weighted sum of *diff*, to the square root of the sum of the weights yields a z-value, z, which provides a test for a significant valve effect.

This test can be expanded slightly by considering the number of samples from valves among the samples with the two highest MPN values. Assuming no valve effect, the probability of j samples collected from valves being among the two samples with the highest MPN values is based on the hypergeometric distribution,

$$p_j = \frac{\binom{n_v}{j}\binom{n-n_v}{2-j}}{\binom{n}{2}}.$$

The expected value of the number of samples collected from valves among the samples with the highest two MPN values, $*$, is $E(*) = 2p$, and the $\mathrm{var}(*) = (n-2)2p(1-p)/(n-1)$, where, as above, $p = n_v/n$. Thus, the weighted sum of $diff_2 = * - 2p$, with weights equal to the inverse of var($*$), offers a test statistic, z_2, for a valve effect. In case of ties, the average of the valve indicator variable was used in the count of the number of samples from valves.

The above two tests were applied to different aggregations of data: (ii) all data; (ii) excluding data from risk category 1; (iii) for all data in risk categories 2 and 3; (iv) for all data in risk categories 4 and 5; and (v) risk category 1. P-values reported below are one-sided significance levels.

1. All: $z = 0.66$, P-value =0.26; $z_2 = 0.66$, P-value = 0.25
2. Risk categories 2-5: $z = 0.80$, P-value =0.21; $z_2 = 0.42$, P-value = 0.34

3. Risk categories 2-3 : z = 0.24, P-value =0.41; z_2 = 0.13, P-value = 0.45
4. Risk categories 4-5: z = 0.42, P-value =0.34; z_2 = 0.25, P-value = 0.40
5. Risk category 1: z = 0.13, P-value =0.45; z_2 = 0.58, P-value = 0.28

Second Analysis

Assume random variables, x and y, measured on samples, where x is the valve indicator variable (= 1 when collected from a valve, 0 otherwise), and y is the MPN. To determine if there is a significant correlation between x and y, within plants, the average of the ranks of the values of y for valve samples is compared to the average rank, $(n+1)/2$, where n is the number of samples within a plant. Specifically, the statistic computed for each plant is

$$d_k = (\overline{r}_{m_k} - \frac{n_k + 1}{2})\delta_k \qquad \text{(FA1)}$$

where the index k specifies plant, m_k is the number of valve samples out of n_k samples of the plant, $\delta_k = m_k/n_k$ is the fraction of samples from valves, $\overline{r}_{m_k}$ is the average rank of the of the m_k valve samples among the n_k values of y (the lowest value being assigned the lowest rank of 1, and the next lowest a rank value of 2, and so forth, and ties are set equal to the average rank). This statistic is symmetric about δ = ½. Note that d_k is zero when δ_k = 0 or 1, or when all the rank scores of y are the same. The variance of d_k, when the null hypothesis of zero correlation is true, assuming no ties, is

$$\mathrm{var}(d_k) = (n_k + 1)\delta_k(1 - \delta_k)/12. \qquad \text{(FA2)}$$

The test statistic computed is

$$T = \sum_{k=1}^{K} n_k d_k \qquad \text{(FA3)}$$

where K is the number of plants. The variance of T is

$$\mathrm{var}(T) = \sum_{k=1}^{K} n_k^2 \, \mathrm{var}(d_k). \qquad \text{(FA4)}$$

Plants for which there were no differences in the rank values were deleted. Hence, to gauge the significance of the value of T for testing whether there is a relationship (rejecting the null hypothesis of no relationship), a z-value is computed,

$$Z = \frac{T}{\sqrt{\mathrm{var}(T)}} \qquad \text{(FA5)}$$

which is compared to the percentiles of the normal distribution.

The values of *z* computed for the different aggregations of data given above for the first analysis were negative, thus were not significant. The within plant Spearman correlations were also computed, and of the 39 correlations, 18 were negative, 20 were positive, indicating, on average, no significant within plant correlation. The table in Attachment 2 presents the maximum and second highest MPN values and whether their associated samples were from valves (=1) or not (=0). If there were two highest values, then a value of 0.5 was recorded. The within plant Spearman correlations also are given.

Attachment F2: Summary Tables for FSIS Baseline Data

TABLE SUMMARY OF RESULTS FOR EACH PLANT REGARDING HIGH MPN VALUES AND SAMPLE LOCATION (VALVE (=1), OR NOT (=0)). ALSO, THE WITHIN PLANT SPEARMAN CORRELATION OF THE MPN WITH AN INDICATOR VARIABLE OF SAMPLE VALVE LOCATION IS GIVEN. ALL DATA ARE INCLUDED.

Internal Assigned Plant Number	Number Samples (with known location)	Number Non-valve Samples	Max MPN	Valve Indicator for Max MPN	Second Highest MPN	Valve Indicator for Second Highest MPN	Within Plant Spear-man Corre-lation Valve and MPN
36	33	0	933	1.0	231	1.0	.
71	27	0	427	1.0	240	1.0	.
21	9	0	9	1.0	1	1.0	.
38	15	0	240	1.0	231	1.0	.
67	28	0	24000	1.0	11000	1.0	.
2	26	0	933	1.0	231	1.0	.
35	22	0	24000	1.0	933	1.0	.
20	7	0	933	1.0	43	1.0	.
61	18	0	933	1.0	427	1.0	.
7	23	0	427	1.0	43	1.0	.
22	10	0	231	1.0	75	1.0	.
1	25	0	933	1.0	427	1.0	.
3	13	0	240	1.0	75	1.0	.
49	2	0	23	1.0	0	1.0	.
56	15	0	2400	1.0	933	1.0	.
58	15	0	933	1.0	427	1.0	.
16	10	0	231	1.0	1	1.0	.
47	18	0	427	1.0	93	1.0	.
48	14	0	2400	1.0	427	1.0	.
26	2	0	0	1.0	0	1.0	.
44	4	0	231	1.0	23	1.0	.
17	6	0	2400	1.0	4	1.0	.
46	6	0	933	1.0	23	1.0	.
9	25	0	933	1.0	427	1.0	.
51	28	0	231	1.0	75	1.0	.
55	28	0	427	1.0	43	1.0	.
6	14	0	933	1.0	231	1.0	.
27	5	0	231	1.0	93	1.0	.
40	22	0	2	1.0	1	1.0	.
66	7	0	0	1.0	0	1.0	.
31	4	4	933	0.0	93	0.0	.
42	3	1	43	0.0	0	1.0	-1.00
39	4	1	93	0.0	1	1.0	-0.77
41	6	1	43	1.0	0	1.0	0.20

Internal Assigned Plant Number	Number Samples (with known location)	Number Non-valve Samples	Max MPN	Valve Indicator for Max MPN	Second Highest MPN	Valve Indicator for Second Highest MPN	Within Plant Spear-man Corre-lation Valve and MPN
57	17	1	231	1.0	93	1.0	-0.21
43	4	1	3	1.0	1	1.0	0.77
62	3	1	23	1.0	0	1.0	0.87
29	29	1	74	1.0	43	1.0	0.14
69	15	1	231	1.0	43	1.0	0.18
13	7	1	4620	1.0	43	1.0	0.25
25	21	1	933	1.0	427	1.0	-0.28
10	16	1	23	1.0	9	1.0	0.29
34	8	2	749	0.0	385	1.0	-0.19
30	3	2	15	0.0	9	1.0	0.00
4	30	2	2	1.0	0	1.0	0.07
24	5	2	427	1.0	93	1.0	0.87
18	27	2	2150	1.0	933	1.0	0.16

70	16	2	933	1.0	93	1.0	0.35
63	5	3	231	0.0	43	0.0	-0.29
68	12	3	933	0.5	93	0.0	-0.15
54	24	3	933	1.0	427	1.0	-0.11
28	18	3	1490	1.0	93	0.0	-0.28
50	22	3	231	1.0	93	0.0	-0.35
53	13	3	231	1.0	23	0.0	-0.06
14	6	3	9	1.0	1	1.0	0.69
33	5	4	21	0.0	4	0.0	-0.73
32	13	4	427	0.5	114	0.0	-0.11
59	9	4	231	1.0	43	0.0	-0.35
11	17	4	2400	1.0	231	1.0	0.14
19	10	4	933	1.0	427	0.0	0.29
60	7	4	2400	1.0	15	1.0	0.44
52	8	5	43	1.0	23	0.0	0.23
8	21	6	93	0.0	23	0.0	-0.76
15	10	6	427	0.0	23	0.0	0.22
23	16	7	2400	0.0	933	1.0	-0.34
64	20	7	933	1.0	427	1.0	-0.23
65	14	8	427	0.3	231	0.0	-0.20
5	23	8	147	1.0	43	1.0	0.22
12	28	19	427	1.0	240	1.0	0.26
37	25	23	427	0.0	231	0.0	0.12

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White ---------------------------------------

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
10/22/2001	602	2	white	7	2	0	0	0	0	0	0	0
10/31/2001	2902	5	white	6	5	0	0	0	0	0	0	0
11/19/2001	2902	40	white	21	2	0	0	0	0	0	0	0
11/06/2001	2902	29	white	72	1	0	0	0	0	0	0	0
11/19/2001	602	47	white	7	4	0	0	0	0	0	0	0
11/19/2001	1302	14	white	22	4	0	0	0	0	0	0	0
11/07/2001	1302	5	white	8	5	0	0	0	0	0	0	0
12/03/2002	2902	40	white	21	2	0	0	0	0	0	0	0
01/03/2002	602	60	white	1	5	0	0	0	0	0	0	0
12/11/2001	602	21	white	2	5	0	0	0	0	0	0	0
12/17/2001	602	59	white	7	5	0	0	0	0	0	0	0
12/18/2001	1302	5	white	6	4	0	0	0	0	0	0	0
01/28/2002	1302	1	white	.	1	0	0	0	0	0	0	0
02/25/2002	602	40	white	10	2	0	0	0	0	0	0	0
02/11/2002	1302	54	white	3	2	0	0	0	0	0	0	0
02/05/2002	602	1	white	0	1	0	0	0	0	0	0	0
03/04/2002	602	25	white	7	2	0	0	0	0	0	0	0
03/12/2002	1302	19	white	30	2	0	0	0	0	0	0	0
03/11/2002	2902	40	white	12	2	0	0	0	0	0	0	0
03/18/2002	2902	24	white	14	2	0	0	0	0	0	0	0
03/06/2002	1302	35	white	7	5	0	0	0	0	0	0	0
03/05/2002	2902	5	white	16	5	0	0	0	0	0	0	0
03/19/2002	602	52	white	.	2	0	0	0	0	0	0	0
03/19/2002	2902	46	white	.	2	0	0	0	0	0	0	0
03/12/2002	1302	11	white	.	2	0	0	0	0	0	0	0
04/03/2002	1302	35	white	2	5	0	0	0	0	0	0	0
04/03/2002	602	52	white	.	2	0	0	0	0	0	0	0
04/11/2002	2902	66	white	.	4	0	0	0	0	0	0	0
04/09/2002	602	30	white	7	4	0	0	0	0	0	0	0
04/15/2002	602	2	white	12	2	0	0	0	0	0	0	0
04/16/2002	602	40	white	5	2	0	0	0	0	0	0	0
04/18/2002	1302	34	white	1	5	0	0	0	0	0	0	0
04/17/2002	2902	54	white	4	2	0	0	0	0	0	0	0
04/23/2002	2902	25	white	8	2	0	0	0	0	0	0	0
04/24/2002	602	60	white	3	5	0	0	0	0	0	0	0
04/24/2002	2902	47	white	7	2	0	0	0	0	0	0	0
05/13/2002	2902	40	white	17	2	0	0	0	0	0	0	0
05/20/2002	602	40	white	21	2	0	0	0	0	0	0	0
05/20/2002	602	24	white	14	3	0	0	0	0	0	0	0
05/06/2002	1302	45	white	3	5	0	0	0	0	0	0	0
05/29/2002	1302	66	white	60	4	0	0	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
05/06/2002	602	34	white	1	4	0.000	0	0	0	0	0	0
05/28/2002	1302	54	white	2	4	0.000	0	0	0	0	0	0
06/05/2002	602	13	white	.	4	0.000	0	0	0	0	0	0
06/25/2002	602	47	white	6	2	0.000	0	0	0	0	0	0
06/19/2002	1302	35	white	2	5	0.000	0	0	0	0	0	0
06/17/2002	602	1	white	.	1	0.000	0	0	0	0	0	0
06/04/2002	602	17	white	.	2	0.000	0	0	0	0	0	0
07/08/2002	2902	60	white	2	5	0.000	0	0	0	0	0	0
07/30/2002	602	66	white	1	5	0.000	0	0	0	0	0	0
07/17/2002	1302	35	white	3	5	0.000	0	0	0	0	0	0
07/16/2002	602	1	white	.	1	0.000	0	0	0	0	0	0
07/01/2002	602	56	white	.	5	0.000	0	0	0	0	0	0
08/12/2002	1302	40	white	12	2	0.000	0	0	0	0	0	0
08/19/2002	2902	40	white	12	2	0.000	0	0	0	0	0	0
08/12/2002	1302	24	white	.	4	0.000	0	0	0	0	0	0
08/05/2002	2902	21	white	1	5	0.000	0	0	0	0	0	0
09/03/2002	2902	16	white	.	1	0.000	0	0	0	0	0	0
10/30/2002	2902	62	white	1	5	0.000	0	0	0	0	0	0
10/31/2002	1302	14	white	52	2	0.000	0	0	0	0	0	0
11/19/2002	1302	55	white	5	5	0.000	0	0	0	0	0	0
11/07/2002	602	14	white	30	2	0.000	0	0	0	0	0	0
11/19/2002	2902	43	white	19	5	0.000	0	0	0	0	0	0
11/04/2002	1302	5	white	8	4	0.000	0	0	0	0	0	0
11/18/2002	602	22	white	5	5	0.000	0	0	0	0	0	0
12/10/2002	2902	2	white	32	2	0.000	0	0	0	0	0	0
01/14/2002	2902	25	white	12	2	0.000	0	0	0	0	0	0
01/15/2002	602	2	white	4	2	0.000	0	0	0	0	0	0
01/07/2002	2902	40	white	8	2	0.000	0	0	0	0	0	0
01/23/2002	2902	70	white	.	4	0.000	0	0	0	0	0	0
01/17/2002	2902	1	white	.	1	0.000	0	0	0	0	0	0
10/16/2001	602	24	white	14	2	0.036	1	0	0	0	0	0
11/29/2001	602	23	white	18	5	0.036	1	0	0	0	0	0
11/14/2001	1302	34	white	1	5	0.036	1	0	0	0	0	0
03/20/2002	602	66	white	1	4	0.036	1	0	0	0	0	0
04/29/2002	602	21	white	1	5	0.036	1	0	0	0	0	0
04/29/2002	1302	37	white	10	1	0.036	1	0	0	0	0	0
05/13/2002	602	21	white	1	5	0.036	1	0	0	0	0	0
05/08/2002	2902	4	white	.	2	0.036	1	0	0	0	0	0
05/14/2002	1302	5	white	9	2	0.036	1	0	0	0	0	0
05/15/2002	602	53	white	10	2	0.036	1	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
06/27/2002	1302	54	white	7	2	0.036	1	0	0	0	0	0
07/08/2002	2902	44	white	.	4	0.036	1	0	0	0	0	0
07/01/2002	602	46	white	7	2	0.036	1	0	0	0	0	0
07/01/2002	2902	11	white	.	2	0.036	1	0	0	0	0	0
08/19/2002	602	32	white	13	4	0.036	1	0	0	0	0	0
08/27/2002	2902	52	white	.	2	0.036	1	0	0	0	0	0
08/15/2002	2902	11	white	.	2	0.036	1	0	0	0	0	0
09/11/2002	602	18	white	12	5	0.036	1	0	0	0	0	0
10/21/2002	1302	44	white	.	1	0.036	1	0	0	0	0	0
10/29/2002	1302	58	white	1	4	0.036	1	0	0	0	0	0
11/26/2002	1302	23	white	-16	5	0.036	1	0	0	0	0	0
11/04/2002	2902	62	white	1	4	0.036	1	0	0	0	0	0
11/25/2002	2902	43	white	5	5	0.036	1	0	0	0	0	0
01/15/2002	2902	13	white	.	4	0.036	1	0	0	0	0	0
10/22/2001	2902	43	white	18	5	0.092	2	0	0	0	0	0
10/19/2001	1302	54	white	.	2	0.092	2	0	0	0	0	0
11/19/2001	2902	19	white	30	2	0.092	2	0	0	0	0	0
11/14/2001	2902	24	white	.	4	0.092	2	0	0	0	0	0
03/25/2002	1302	1	white	.	1	0.092	2	0	0	0	0	0
04/22/2002	1302	59	white	5	2	0.092	2	0	0	0	0	0
05/06/2002	2902	43	white	8	5	0.092	2	0	0	0	0	0
	2902	5	white	.	4	0.094	0	3	0	0	0	0
03/14/2002	2902	43	white	15	5	0.143	2	0	1	0	0	0
11/04/2002	2902	50	white	3	5	0.211	2	2	0	0	0	0
12/05/2001	602	34	white	1	5	0.231	3	0	0	0	0	0
01/29/2002	2902	43	white	17	5	0.231	3	0	0	0	0	0
02/20/2002	602	29	white	.	1	0.231	3	0	0	0	0	0
03/12/2002	1302	18	white	4	5	0.231	3	0	0	0	0	0
04/01/2002	2902	15	white	19	2	0.231	3	0	0	0	0	0
04/24/2002	1302	4	white	.	2	0.231	3	0	0	0	0	0
05/01/2002	1302	56	white	.	2	0.231	3	0	0	0	0	0
05/06/2002	602	46	white	.	2	0.231	3	0	0	0	0	0
05/22/2002	1302	53	white	10	2	0.231	3	0	0	0	0	0
06/17/2002	602	60	white	2	5	0.231	3	0	0	0	0	0
07/01/2002	1302	45	white	3	5	0.231	3	0	0	0	0	0
07/31/2002	1302	39	white	5	4	0.231	3	0	0	0	0	0
07/01/2002	1302	47	white	11	1	0.231	3	0	0	0	0	0
08/20/2002	2902	24	white	.	4	0.231	3	0	0	0	0	0
10/16/2002	1302	30	white	12	2	0.231	3	0	0	0	0	0
12/05/2002	1302	11	white	.	2	0.231	3	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

--- Type = White ---

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
01/07/2002	1302	14	white	41	2	0.231	3	0	0	0	0	0
07/01/2002	2902	43	white	17	5	0.270	2	1	2	0	0	0
11/08/2001	2902	30	white	15	4	0.385	3	0	1	0	0	0
12/11/2001	1302	14	white	60	2	0.427	3	1	0	0	0	0
04/10/2002	2902	32	white	.	4	0.427	3	1	0	0	0	0
04/16/2002	1302	43	white	24	5	0.427	3	1	0	0	0	0
09/09/2002	2902	46	white	9	2	0.427	3	1	0	0	0	0
10/09/2002	2902	1	white	.	1	0.427	3	1	0	0	0	0
01/08/2002	602	43	white	12	5	0.427	3	1	0	0	0	0
06/24/2002	2902	56	white	.	2	0.636	3	0	2	0	0	0
12/26/2001	1302	17	white	.	2	0.740	3	1	1	0	0	0
06/04/2002	1302	22	white	7	5	0.740	3	1	1	0	0	0
11/23/2002	1302	51	white	-430	3	0.740	3	1	1	0	0	0
12/28/2001	2902	54	white	0	2	0.749	3	1	1	0	0	0
07/31/2002	2902	15	white	.	1	0.749	3	1	1	0	0	0
12/03/2002	602	17	white	.	2	0.749	3	1	1	0	0	0
12/12/2001	2902	71	white	10	4	0.933	3	2	0	0	0	0
03/20/2002	602	54	white	7	4	0.933	3	2	0	0	0	0
04/30/2002	2902	16	white	.	4	0.933	3	2	0	0	0	0
06/19/2002	602	3	white	.	2	0.933	3	2	0	0	0	0
07/22/2002	2902	32	white	15	4	0.933	3	2	0	0	0	0
08/19/2002	1302	38	white	.	1	0.933	3	2	0	0	0	0
08/08/2002	1302	5	white	8	5	0.933	3	2	0	0	0	0
10/29/2002	602	66	white	1	5	0.933	3	2	0	0	0	0
11/11/2002	2902	15	white	3	2	0.933	3	2	0	0	0	0
09/16/2002	2902	22	white	3	5	1.150	3	1	2	0	0	0
09/11/2002	1302	45	white	2	5	1.470	3	2	1	0	0	0
01/23/2002	1302	30	white	21	4	1.470	3	2	1	0	0	0
12/26/2001	2902	1	white	0	1	1.490	3	2	1	0	0	0
02/26/2002	2902	14	white	28	2	1.490	3	2	1	0	0	0
10/22/2002	2902	34	white	30	4	1.490	3	2	1	0	0	0
11/25/2002	2902	37	white	.	4	1.490	3	2	1	0	0	0
12/12/2001	1302	23	white	5	5	2.110	3	2	2	0	0	0
04/15/2002	1302	1	white	.	4	2.110	3	2	2	0	0	0
06/27/2002	1302	26	white	.	1	2.110	3	2	2	0	0	0
05/08/2002	2902	50	white	1	4	2.150	3	2	2	0	0	0
12/02/2002	2902	70	white	15	5	2.150	3	2	2	0	0	0
04/03/2002	2902	11	white	.	2	2.310	3	3	0	0	0	0
05/01/2002	2902	26	white	.	1	2.310	3	3	0	0	0	0
09/09/2002	602	66	white	1	5	2.310	3	3	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
09/23/2002	602	43	white	5.0	5	2.31	3	3	0	0	0	0
09/04/2002	602	17	white	7.0	4	2.31	3	3	0	0	0	0
10/15/2002	2902	37	white	.	4	2.31	3	3	0	0	0	0
11/13/2002	2902	60	white	7.0	4	2.31	3	3	0	0	0	0
11/20/2002	602	46	white	8.0	2	2.31	3	3	0	0	0	0
01/23/2002	602	5	white	8.0	4	2.31	3	3	0	0	0	0
08/29/2002	1302	54	white	5.0	2	2.40	3	3	0	0	0	0
11/11/2002	1302	45	white	2.0	5	2.40	3	3	0	0	0	0
12/17/2001	2902	43	white	17.0	5	2.76	3	2	2	1	0	0
06/25/2002	1302	39	white	5.0	2	3.10	3	3	0	1	0	0
06/10/2002	2902	70	white	.	2	3.85	3	3	0	1	0	0
02/12/2002	2902	59	white	4.0	4	4.27	3	3	1	0	0	0
04/09/2002	602	13	white	.	4	4.27	3	3	1	0	0	0
06/03/2002	2902	15	white	.	1	4.27	3	3	1	0	0	0
08/13/2002	602	56	white	.	4	4.27	3	3	1	0	0	0
09/16/2002	602	37	white	.	4	4.27	3	3	1	0	0	0
09/24/2002	1302	16	white	.	1	4.27	3	3	1	0	0	0
12/03/2002	1302	16	white	.	1	4.27	3	3	1	0	0	0
03/26/2002	2902	33	white	.	1	7.49	3	3	1	1	0	0
05/30/2002	602	26	white	.	1	7.49	3	3	1	1	0	0
01/29/2002	1302	2	white	31.0	2	9.33	3	3	2	0	0	0
02/22/2002	602	70	white	.	5	9.33	3	3	2	0	0	0
02/25/2002	1302	43	white	13.0	5	9.33	3	3	2	0	0	0
03/18/2002	602	65	white	1.5	4	9.33	3	3	2	0	0	0
03/06/2002	1302	30	white	4.0	4	9.33	3	3	2	0	0	0
05/30/2002	602	14	white	28.0	2	9.33	3	3	2	0	0	0
08/26/2002	602	12	white	14.0	1	9.33	3	3	2	0	0	0
08/26/2002	1302	26	white	.	1	9.33	3	3	2	0	0	0
10/21/2002	2902	15	white	16.0	2	9.33	3	3	2	0	0	0
10/29/2002	2902	39	white	5.0	4	9.33	3	3	2	0	0	0
01/28/2002	1302	14	white	33.0	2	11.40	3	3	1	2	0	0
11/11/2002	1302	44	white	.	1	11.40	3	3	1	2	0	0
12/12/2001	1302	29	white	0.0	1	14.70	3	3	2	1	0	0
03/28/2002	1302	13	white	.	4	14.70	3	3	2	1	0	0
08/06/2002	1302	50	white	4.0	2	14.70	3	3	2	1	0	0
09/10/2002	1302	14	white	54.0	2	14.70	3	3	2	1	0	0
06/12/2002	602	3	white	.	2	14.90	3	3	2	1	0	0
10/30/2002	2902	32	white	10.0	4	14.90	3	3	2	1	0	0
10/22/2002	602	3	white	.	2	14.90	3	3	2	1	0	0
03/28/2002	1302	39	white	3.0	4	21.10	3	3	2	2	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
11/20/2001	602	43	white	9	5	23.1	3	3	3	0	0	0
01/02/2002	2902	26	white	.	1	23.1	3	3	3	0	0	0
02/28/2002	2902	19	white	60	2	23.1	3	3	3	0	0	0
02/05/2002	602	23	white	10	5	23.1	3	3	3	0	0	0
03/11/2002	602	15	white	18	4	23.1	3	3	3	0	0	0
03/13/2002	602	67	white	.	5	23.1	3	3	3	0	0	0
03/14/2002	602	14	white	43	2	23.1	3	3	3	0	0	0
04/23/2002	602	23	white	8	5	23.1	3	3	3	0	0	0
06/12/2002	2902	52	white	.	2	23.1	3	3	3	0	0	0
07/16/2002	2902	18	white	2	5	23.1	3	3	3	0	0	0
09/23/2002	2902	46	white	6	2	23.1	3	3	3	0	0	0
10/07/2002	1302	45	white	.	1	23.1	3	3	3	0	0	0
10/22/2002	602	22	white	2	5	23.1	3	3	3	0	0	0
10/17/2001	1302	14	white	.	2	24.0	3	3	3	0	0	0
05/07/2002	1302	23	white	9	5	24.0	3	3	3	0	0	0
09/12/2002	1302	35	white	5	5	24.0	3	3	3	0	0	0
09/24/2002	1302	13	white	6	2	31.0	3	3	3	0	1	0
02/19/2002	1302	22	white	6	5	42.7	3	3	3	1	0	0
03/27/2002	2902	53	white	15	5	42.7	3	3	3	1	0	0
04/30/2002	602	38	white	2	1	42.7	3	3	3	1	0	0
05/22/2002	2902	61	white	3	1	42.7	3	3	3	1	0	0
05/14/2002	2902	65	white	4	4	42.7	3	3	3	1	0	0
08/20/2002	1302	53	white	8	2	42.7	3	3	3	1	0	0
10/02/2002	2902	44	white	.	4	42.7	3	3	3	1	0	0
11/18/2002	2902	59	white	12	2	42.7	3	3	3	1	0	0
	2902	39	white	.	2	42.7	3	3	3	1	0	0
	602	65	white	.	4	42.7	3	3	3	1	0	0
09/04/2002	1302	12	white	7	2	74.0	3	3	3	1	1	0
11/18/2002	1302	15	white	18	2	74.0	3	3	3	1	1	0
06/05/2002	2902	29	white	.	1	93.3	3	3	3	2	0	0
07/30/2002	2902	14	white	52	2	93.3	3	3	3	2	0	0
10/01/2002	602	65	white	3	4	93.3	3	3	3	2	0	0
09/09/2002	2902	1	white	.	1	93.3	3	3	3	2	0	0
09/18/2002	602	11	white	60	2	93.3	3	3	3	2	0	0
09/25/2002	2902	17	white	.	2	93.3	3	3	3	2	0	0
10/30/2002	1302	18	white	3	5	93.3	3	3	3	2	0	0
10/08/2002	1302	35	white	5	5	93.3	3	3	3	2	0	0
10/17/2002	2902	56	white	10	2	93.3	3	3	3	2	0	0
11/04/2002	1302	18	white	5	5	93.3	3	3	3	2	0	0
08/20/2002	602	39	white	2	2	149.0	3	3	3	2	1	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = White --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
10/31/2001	2902	71	white	14	4	231	3	3	3	3	0	0
03/19/2002	602	34	white	1	5	231	3	3	3	3	0	0
06/04/2002	2902	59	white	3	2	231	3	3	3	3	0	0
09/17/2002	2902	59	white	3	2	231	3	3	3	3	0	0
11/04/2002	1302	66	white	3	5	231	3	3	3	3	0	0
06/13/2002	1302	25	white	3	5	240	3	3	3	3	0	0
08/26/2002	1302	65	white	1	5	240	3	3	3	3	0	0
09/16/2002	1302	15	white	17	2	240	3	3	3	3	0	0
10/09/2002	1302	23	white	6	5	240	3	3	3	3	0	0
10/16/2001	602	25	white	12	2	427	3	3	3	3	1	0
10/16/2001	602	22	white	4	5	427	3	3	3	3	1	0
11/19/2001	1302	17	white	.	3	427	3	3	3	3	1	0
04/18/2002	2902	22	white	2	5	427	3	3	3	3	1	0
05/30/2002	2902	29	white	.	1	427	3	3	3	3	1	0
07/01/2002	2902	23	white	.	5	427	3	3	3	3	1	0
07/09/2002	2902	50	white	7	2	427	3	3	3	3	1	0
07/10/2002	602	32	white	3	4	427	3	3	3	3	1	0
09/18/2002	2902	3	white	.	2	427	3	3	3	3	1	0
03/06/2002	2902	22	white	5	5	933	3	3	3	3	2	0
03/27/2002	1302	3	white	.	2	933	3	3	3	3	2	0
05/16/2002	1302	18	white	5	5	933	3	3	3	3	2	0
09/05/2002	1302	19	white	7	2	933	3	3	3	3	2	0
11/20/2002	1302	23	white	7	5	933	3	3	3	3	2	0
05/21/2002	2902	16	white	.	4	2400	3	3	3	3	3	0
10/15/2002	1302	53	white	10	2	23100	3	3	3	3	3	3

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
11/01/2001	1302	11	whole	.	2	0	0	0	0	0	0	0
11/06/2001	2902	52	whole	.	2	0	0	0	0	0	0	0
12/10/2001	2902	35	whole	10	5	0	0	0	0	0	0	0
12/03/2001	2902	43	whole	16	5	0	0	0	0	0	0	0
02/06/2002	602	64	whole	5	2	0	0	0	0	0	0	0
02/13/2002	2902	39	whole	6	2	0	0	0	0	0	0	0
02/22/2002	2902	32	whole	7	4	0	0	0	0	0	0	0
02/18/2002	602	46	whole	.	2	0	0	0	0	0	0	0
03/25/2002	602	55	whole	4	5	0	0	0	0	0	0	0
03/27/2002	1302	62	whole	1	5	0	0	0	0	0	0	0
03/06/2002	1302	28	whole	1	5	0	0	0	0	0	0	0
03/13/2002	602	4	whole	.	2	0	0	0	0	0	0	0
03/11/2002	1302	69	whole	12	5	0	0	0	0	0	0	0
03/05/2002	2902	7	whole	7	2	0	0	0	0	0	0	0
04/02/2002	1302	10	whole	4	2	0	0	0	0	0	0	0
04/01/2002	602	69	whole	13	5	0	0	0	0	0	0	0
04/18/2002	1302	28	whole	1	5	0	0	0	0	0	0	0
04/15/2002	602	37	whole	2	2	0	0	0	0	0	0	0
04/22/2002	2902	46	whole	.	2	0	0	0	0	0	0	0
05/29/2002	602	10	whole	4	2	0	0	0	0	0	0	0
05/15/2002	2902	25	whole	5	2	0	0	0	0	0	0	0
05/08/2002	2902	4	whole	.	2	0	0	0	0	0	0	0
06/17/2002	602	24	whole	14	3	0	0	0	0	0	0	0
06/18/2002	1302	71	whole	10	4	0	0	0	0	0	0	0
06/04/2002	1302	36	whole	14	4	0	0	0	0	0	0	0
06/10/2002	2902	46	whole	10	1	0	0	0	0	0	0	0
06/19/2002	1302	11	whole	.	2	0	0	0	0	0	0	0
07/08/2002	2902	40	whole	12	2	0	0	0	0	0	0	0
07/29/2002	1302	24	whole	14	5	0	0	0	0	0	0	0
07/01/2002	602	57	whole	1	5	0	0	0	0	0	0	0
07/18/2002	602	28	whole	1	5	0	0	0	0	0	0	0
07/11/2002	602	6	whole	13	4	0	0	0	0	0	0	0
07/29/2002	2902	69	whole	14	5	0	0	0	0	0	0	0
07/02/2002	2902	27	whole	4	1	0	0	0	0	0	0	0
08/29/2002	602	13	whole	14	2	0	0	0	0	0	0	0
08/12/2002	1302	40	whole	12	2	0	0	0	0	0	0	0
09/09/2002	2902	40	whole	16	2	0	0	0	0	0	0	0
09/30/2002	2902	24	whole	14	3	0	0	0	0	0	0	0
09/12/2002	602	5	whole	7	4	0	0	0	0	0	0	0
09/05/2002	602	6	whole	13	2	0	0	0	0	0	0	0
10/16/2002	2902	66	whole	1	5	0	0	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
10/08/2002	2902	63	whole	6	5	0.000	0	0	0	0	0	0
10/30/2002	2902	62	whole	1	4	0.000	0	0	0	0	0	0
10/21/2002	1302	52	whole	.	2	0.000	0	0	0	0	0	0
10/21/2002	1302	69	whole	12	5	0.000	0	0	0	0	0	0
11/04/2002	2902	19	whole	10	2	0.000	0	0	0	0	0	0
11/04/2002	602	57	whole	1	5	0.000	0	0	0	0	0	0
11/11/2002	1302	9	whole	1	5	0.000	0	0	0	0	0	0
12/11/2002	1302	13	whole	15	2	0.000	0	0	0	0	0	0
12/09/2002	2902	55	whole	30	5	0.000	0	0	0	0	0	0
01/17/2002	602	64	whole	.	2	0.000	0	0	0	0	0	0
01/22/2002	602	52	whole	.	2	0.000	0	0	0	0	0	0
01/17/2002	2902	11	whole	.	2	0.000	0	0	0	0	0	0
12/27/2001	602	11	whole	.	2	0.036	1	0	0	0	0	0
04/10/2002	2902	4	whole	.	2	0.036	1	0	0	0	0	0
04/16/2002	1302	57	whole	1	5	0.036	1	0	0	0	0	0
05/22/2002	602	41	whole	8	5	0.036	1	0	0	0	0	0
06/11/2002	602	41	whole	8	5	0.036	1	0	0	0	0	0
09/09/2002	2902	19	whole	12	2	0.036	1	0	0	0	0	0
09/11/2002	2902	57	whole	1	5	0.036	1	0	0	0	0	0
11/21/2002	1302	71	whole	14	4	0.036	1	0	0	0	0	0
12/09/2002	602	46	whole	9	2	0.036	1	0	0	0	0	0
03/19/2002	2902	42	whole	.	1	0.074	1	1	0	0	0	0
	2902	5	whole	.	5	0.074	1	1	0	0	0	0
12/17/2001	602	24	whole	14	5	0.092	2	0	0	0	0	0
02/28/2002	1302	3	whole	.	2	0.092	2	0	0	0	0	0
03/12/2002	2902	57	whole	1	5	0.092	2	0	0	0	0	0
06/10/2002	1302	68	whole	2	5	0.092	2	0	0	0	0	0
06/11/2002	1302	48	whole	60	2	0.092	2	0	0	0	0	0
10/16/2002	2902	21	whole	1	5	0.092	2	0	0	0	0	0
	602	7	whole	.	2	0.092	2	0	0	0	0	0
11/05/2002	2902	70	whole	.	4	0.092	2	0	0	0	0	0
12/05/2002	1302	67	whole	.	2	0.092	2	0	0	0	0	0
12/11/2002	2902	35	whole	2	5	0.092	2	0	0	0	0	0
01/08/2002	1302	3	whole	.	2	0.092	2	0	0	0	0	0
03/25/2002	2902	59	whole	4	2	0.114	1	2	0	0	0	0
11/14/2001	602	15	whole	1	1	0.147	2	1	0	0	0	0
01/03/2002	2902	64	whole	8	2	0.147	2	1	0	0	0	0
01/04/2002	2902	61	whole	1	1	0.147	2	1	0	0	0	0
05/06/2002	602	21	whole	1	5	0.147	2	1	0	0	0	0
11/19/2002	2902	45	whole	1	1	0.205	2	1	1	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
05/07/2002	1302	45	whole	.	1	0.211	2	2	0	0	0	0
10/18/2001	1302	3	whole	.	2	0.231	3	0	0	0	0	0
11/06/2001	1302	58	whole	1	5	0.231	3	0	0	0	0	0
12/26/2001	1302	15	whole	4	1	0.231	3	0	0	0	0	0
04/30/2002	2902	63	whole	30	5	0.231	3	0	0	0	0	0
05/29/2002	602	13	whole	5	2	0.231	3	0	0	0	0	0
05/29/2002	2902	54	whole	8	4	0.231	3	0	0	0	0	0
05/29/2002	1302	52	whole	.	2	0.231	3	0	0	0	0	0
06/03/2002	1302	43	whole	4	5	0.231	3	0	0	0	0	0
07/22/2002	2902	63	whole	5	5	0.231	3	0	0	0	0	0
08/14/2002	2902	64	whole	4	2	0.231	3	0	0	0	0	0
09/02/2002	2902	15	whole	.	1	0.231	3	0	0	0	0	0
12/10/2002	1302	60	whole	5	4	0.231	3	0	0	0	0	0
12/12/2002	602	62	whole	1	4	0.231	3	0	0	0	0	0
12/04/2002	1302	58	whole	24	5	0.231	3	0	0	0	0	0
10/03/2002	1302	11	whole	60	2	0.310	3	0	1	0	0	0
11/06/2001	2902	32	whole	14	4	0.385	3	0	1	0	0	0
04/29/2002	2902	32	whole	8	4	0.385	3	0	1	0	0	0
06/26/2002	1302	53	whole	15	2	0.385	3	0	1	0	0	0
12/19/2001	602	39	whole	4	2	0.427	3	1	0	0	0	0
03/06/2002	2902	9	whole	1	5	0.427	3	1	0	0	0	0
09/03/2002	1302	66	whole	1	5	0.427	3	1	0	0	0	0
10/30/2002	1302	50	whole	2	5	0.427	3	1	0	0	0	0
01/21/2002	602	46	whole	.	2	0.427	3	1	0	0	0	0
01/08/2002	1302	65	whole	1	4	0.620	3	0	2	0	0	0
10/17/2001	602	12	whole	7	2	0.933	3	2	0	0	0	0
12/26/2001	2902	58	whole	.	4	0.933	3	2	0	0	0	0
04/23/2002	2902	12	whole	14	4	0.933	3	2	0	0	0	0
05/22/2002	2902	60	whole	5	2	0.933	3	2	0	0	0	0
06/10/2002	602	13	whole	3	2	0.933	3	2	0	0	0	0
08/06/2002	1302	58	whole	1	5	0.933	3	2	0	0	0	0
08/05/2002	602	52	whole	.	2	0.933	3	2	0	0	0	0
08/07/2002	602	33	whole	1	5	0.933	3	2	0	0	0	0
10/16/2002	602	10	whole	3	2	0.933	3	2	0	0	0	0
	602	58	whole	.	4	0.933	3	2	0	0	0	0
10/22/2002	602	48	whole	60	3	0.933	3	2	0	0	0	0
12/10/2002	602	61	whole	6	1	0.933	3	2	0	0	0	0
12/03/2002	602	62	whole	1	5	0.933	3	2	0	0	0	0
03/28/2002	602	39	whole	3	4	1.490	3	2	1	0	0	0
04/02/2002	602	59	whole	1	2	1.490	3	2	1	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

--- Type = Whole ---

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
04/09/2002	2902	9	whole	1	5	1.49	3	2	1	0	0	0
09/25/2002	2902	5	whole	.	1	1.49	3	2	1	0	0	0
03/18/2002	1302	60	whole	2	5	2.11	3	2	2	0	0	0
02/14/2002	2902	67	whole	.	1	2.15	3	2	2	0	0	0
09/16/2002	2902	15	whole	.	1	2.15	3	2	2	0	0	0
10/29/2002	2902	22	whole	2	2	2.15	3	2	2	0	0	0
11/25/2002	2902	32	whole	15	4	2.15	3	2	2	0	0	0
10/24/2001	2902	63	whole	5	4	2.31	3	3	0	0	0	0
01/04/2002	602	67	whole	2	1	2.31	3	3	0	0	0	0
01/02/2002	2902	52	whole	.	2	2.31	3	3	0	0	0	0
02/07/2002	2902	66	whole	3	5	2.31	3	3	0	0	0	0
04/03/2002	602	36	whole	13	5	2.31	3	3	0	0	0	0
04/11/2002	602	60	whole	2	5	2.31	3	3	0	0	0	0
05/08/2002	602	56	whole	.	2	2.31	3	3	0	0	0	0
07/23/2002	602	62	whole	1	4	2.31	3	3	0	0	0	0
11/12/2002	602	43	whole	6	5	2.31	3	3	0	0	0	0
04/03/2002	1302	23	whole	10	5	2.40	3	3	0	0	0	0
12/12/2001	2902	71	whole	10	4	2.86	3	2	3	0	0	0
12/11/2001	1302	33	whole	30	4	2.86	3	2	3	0	0	0
11/25/2002	1302	43	whole	15	5	2.86	3	2	3	0	0	0
09/19/2002	1302	49	whole	6	2	3.10	3	3	0	1	0	0
12/18/2001	2902	53	whole	10	2	3.85	3	3	0	1	0	0
05/22/2002	2902	39	whole	5	4	3.85	3	3	0	1	0	0
11/20/2001	602	3	whole	6	2	4.27	3	3	1	0	0	0
05/01/2002	602	66	whole	0	1	4.27	3	3	1	0	0	0
05/13/2002	602	28	whole	1	5	4.27	3	3	1	0	0	0
05/14/2002	1302	59	whole	2	2	4.27	3	3	1	0	0	0
06/10/2002	602	60	whole	.	5	4.27	3	3	1	0	0	0
06/18/2002	602	42	whole	.	1	4.27	3	3	1	0	0	0
07/17/2002	2902	30	whole	2	4	4.27	3	3	1	0	0	0
08/19/2002	1302	39	whole	1	5	4.27	3	3	1	0	0	0
09/24/2002	602	10	whole	6	2	4.27	3	3	1	0	0	0
09/04/2002	602	65	whole	4	4	4.27	3	3	1	0	0	0
	2902	42	whole	.	1	4.27	3	3	1	0	0	0
10/29/2002	602	61	whole	6	1	4.27	3	3	1	0	0	0
	2902	32	whole	.	4	4.27	3	3	1	0	0	0
08/13/2002	1302	44	whole	.	1	7.40	3	3	1	1	0	0
09/23/2002	1302	53	whole	8	2	7.40	3	3	1	1	0	0
01/15/2002	1302	33	whole	30	4	9.20	3	3	2	0	0	0
02/05/2002	1302	12	whole	7	4	9.33	3	3	2	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
02/19/2002	602	58	whole	1	4	9.33	3	3	2	0	0	0
02/06/2002	602	11	whole	.	2	9.33	3	3	2	0	0	0
04/02/2002	2902	47	whole	7	5	9.33	3	3	2	0	0	0
04/23/2002	1302	3	whole	.	2	9.33	3	3	2	0	0	0
06/24/2002	602	8	whole	2	4	9.33	3	3	2	0	0	0
07/31/2002	602	9	whole	1	5	9.33	3	3	2	0	0	0
08/12/2002	602	39	whole	6	4	9.33	3	3	2	0	0	0
09/05/2002	602	31	whole	25	4	9.33	3	3	2	0	0	0
10/02/2002	602	36	whole	12	5	9.33	3	3	2	0	0	0
09/03/2002	2902	43	whole	9	5	9.33	3	3	2	0	0	0
11/18/2002	602	64	whole	7	2	9.33	3	3	2	0	0	0
12/05/2002	602	61	whole	2	1	9.33	3	3	2	0	0	0
01/15/2002	602	13	whole	.	5	9.33	3	3	2	0	0	0
01/16/2002	602	12	whole	7	4	9.33	3	3	2	0	0	0
01/08/2002	2902	53	whole	12	2	9.33	3	3	2	0	0	0
03/19/2002	1302	65	whole	10	4	14.70	3	3	2	1	0	0
08/29/2002	1302	35	whole	2	4	14.70	3	3	2	1	0	0
10/07/2002	1302	14	whole	49	2	14.70	3	3	2	1	0	0
	1302	31	whole	.	1	14.70	3	3	2	1	0	0
06/05/2002	2902	4	whole	.	2	14.90	3	3	2	1	0	0
08/21/2002	2902	44	whole	.	1	14.90	3	3	2	1	0	0
04/16/2002	1302	42	whole	.	1	21.10	3	3	2	2	0	0
12/10/2001	602	22	whole	5	5	21.50	3	3	2	2	0	0
11/29/2001	602	66	whole	60	4	23.10	3	3	3	0	0	0
03/13/2002	1302	18	whole	0	2	23.10	3	3	3	0	0	0
03/05/2002	602	20	whole	7	1	23.10	3	3	3	0	0	0
04/03/2002	2902	70	whole	.	1	23.10	3	3	3	0	0	0
04/09/2002	602	27	whole	5	1	23.10	3	3	3	0	0	0
04/16/2002	602	18	whole	4	5	23.10	3	3	3	0	0	0
04/24/2002	602	52	whole	.	2	23.10	3	3	3	0	0	0
04/30/2002	2902	15	whole	.	1	23.10	3	3	3	0	0	0
05/02/2002	602	33	whole	15	4	23.10	3	3	3	0	0	0
05/07/2002	2902	65	whole	4	4	23.10	3	3	3	0	0	0
05/13/2002	602	7	whole	21	2	23.10	3	3	3	0	0	0
	2902	15	whole	.	1	23.10	3	3	3	0	0	0
07/24/2002	602	5	whole	.	1	23.10	3	3	3	0	0	0
07/18/2002	2902	20	whole	10	1	23.10	3	3	3	0	0	0
08/13/2002	2902	68	whole	2	5	23.10	3	3	3	0	0	0
08/29/2002	2902	46	whole	7	2	23.10	3	3	3	0	0	0
08/06/2002	2902	26	whole	.	1	23.10	3	3	3	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
08/07/2002	2902	22	whole	2	5	23.1	3	3	3	0	0	0
09/23/2002	2902	32	whole	13	4	23.1	3	3	3	0	0	0
09/30/2002	602	46	whole	5	2	23.1	3	3	3	0	0	0
10/21/2002	2902	37	whole	.	1	23.1	3	3	3	0	0	0
10/23/2002	2902	33	whole	7	4	23.1	3	3	3	0	0	0
11/11/2002	2902	18	whole	3	5	23.1	3	3	3	0	0	0
12/03/2002	602	35	whole	1	5	23.1	3	3	3	0	0	0
12/04/2002	2902	26	whole	.	1	23.1	3	3	3	0	0	0
02/12/2002	1302	15	whole	10	2	31.0	3	3	3	0	1	0
10/24/2001	2902	64	whole	5	5	42.7	3	3	3	1	0	0
12/05/2001	1302	12	whole	14	4	42.7	3	3	3	1	0	0
12/26/2001	1302	63	whole	4	4	42.7	3	3	3	1	0	0
01/28/2002	602	65	whole	1	5	42.7	3	3	3	1	0	0
04/16/2002	602	45	whole	.	1	42.7	3	3	3	1	0	0
05/21/2002	1302	55	whole	4	5	42.7	3	3	3	1	0	0
05/27/2002	2902	33	whole	15	4	42.7	3	3	3	1	0	0
06/03/2002	1302	45	whole	.	1	42.7	3	3	3	1	0	0
06/17/2002	2902	14	whole	18	2	42.7	3	3	3	1	0	0
07/31/2002	602	14	whole	25	2	42.7	3	3	3	1	0	0
07/31/2002	2902	26	whole	.	1	42.7	3	3	3	1	0	0
07/25/2002	2902	17	whole	.	2	42.7	3	3	3	1	0	0
08/21/2002	602	12	whole	14	2	42.7	3	3	3	1	0	0
08/14/2002	602	56	whole	.	2	42.7	3	3	3	1	0	0
09/18/2002	2902	28	whole	2	5	42.7	3	3	3	1	0	0
10/30/2002	1302	41	whole	5	5	42.7	3	3	3	1	0	0
10/22/2002	2902	2	whole	6	2	42.7	3	3	3	1	0	0
10/22/2002	1302	49	whole	9	2	42.7	3	3	3	1	0	0
10/09/2002	2902	1	whole	.	1	42.7	3	3	3	1	0	0
11/18/2002	1302	39	whole	11	4	42.7	3	3	3	1	0	0
11/20/2001	1302	63	whole	7	5	74.0	3	3	3	1	1	0
03/18/2002	1302	8	whole	1	5	74.0	3	3	3	1	1	0
05/01/2002	1302	64	whole	7	2	74.9	3	3	3	1	1	0
11/29/2001	602	13	whole	8	4	93.3	3	3	3	2	0	0
11/19/2001	602	53	whole	10	5	93.3	3	3	3	2	0	0
01/07/2002	602	19	whole	15	2	93.3	3	3	3	2	0	0
03/05/2002	602	50	whole	3	5	93.3	3	3	3	2	0	0
03/19/2002	602	48	whole	50	3	93.3	3	3	3	2	0	0
06/24/2002	2902	32	whole	9	4	93.3	3	3	3	2	0	0
06/25/2002	602	20	whole	6	1	93.3	3	3	3	2	0	0
08/19/2002	2902	1	whole	.	1	93.3	3	3	3	2	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
08/07/2002	1302	67	whole	10	4	114	3	3	3	1	2	0
01/03/2002	602	65	whole	2	4	115	3	3	3	1	2	0
08/13/2002	1302	45	whole	1	1	147	3	3	3	2	1	0
08/13/2002	2902	4	whole	.	2	149	3	3	3	2	1	0
10/21/2002	602	3	whole	.	2	149	3	3	3	2	1	0
11/26/2001	2902	64	whole	8	2	231	3	3	3	3	0	0
12/05/2001	2902	32	whole	12	4	231	3	3	3	3	0	0
04/17/2002	2902	39	whole	5	2	231	3	3	3	3	0	0
05/21/2002	602	44	whole	.	1	231	3	3	3	3	0	0
05/20/2002	602	8	whole	2	4	231	3	3	3	3	0	0
06/20/2002	2902	26	whole	.	1	231	3	3	3	3	0	0
07/16/2002	1302	2	whole	10	2	231	3	3	3	3	0	0
08/27/2002	602	50	whole	.	2	231	3	3	3	3	0	0
08/05/2002	602	7	whole	14	2	231	3	3	3	3	0	0
10/07/2002	602	47	whole	5	2	231	3	3	3	3	0	0
10/09/2002	602	11	whole	60	2	231	3	3	3	3	0	0
11/13/2002	2902	66	whole	3	5	231	3	3	3	3	0	0
12/04/2002	2902	50	whole	9	1	231	3	3	3	3	0	0
02/04/2002	1302	33	whole	30	3	240	3	3	3	3	0	0
10/15/2002	1302	65	whole	4	4	240	3	3	3	3	0	0
02/25/2002	2902	63	whole	30	5	385	3	3	3	3	0	1
01/31/2002	602	53	whole	10	2	427	3	3	3	3	1	0
04/23/2002	602	65	whole	4	4	427	3	3	3	3	1	0
05/02/2002	1302	67	whole	.	2	427	3	3	3	3	1	0
08/26/2002	2902	60	whole	2	5	427	3	3	3	3	1	0
10/02/2002	602	14	whole	50	2	427	3	3	3	3	1	0
09/18/2002	602	3	whole	.	2	427	3	3	3	3	1	0
10/16/2002	1302	32	whole	27	4	427	3	3	3	3	1	0
10/07/2002	2902	17	whole	.	2	427	3	3	3	3	1	0
11/14/2002	602	15	whole	3	2	427	3	3	3	3	1	0
11/12/2002	1302	65	whole	6	4	427	3	3	3	3	1	0
05/13/2002	1302	50	whole	1	4	749	3	3	3	3	1	1
06/05/2002	602	56	whole	.	2	749	3	3	3	3	1	1
01/09/2002	602	63	whole	.	4	749	3	3	3	3	1	1
10/17/2001	602	39	whole	5	2	933	3	3	3	3	2	0
11/07/2001	2902	30	whole	2	4	933	3	3	3	3	2	0
01/28/2002	1302	11	whole	.	2	933	3	3	3	3	2	0
02/27/2002	1302	53	whole	12	2	933	3	3	3	3	2	0
03/05/2002	2902	23	whole	6	5	933	3	3	3	3	2	0
04/08/2002	602	20	whole	7	1	933	3	3	3	3	2	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Whole --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
06/24/2002	2902	70	whole	.	1	933	3	3	3	3	2	0
06/19/2002	2902	36	whole	7	5	933	3	3	3	3	2	0
09/24/2002	1302	19	whole	11	2	933	3	3	3	3	2	0
09/12/2002	602	23	whole	26	5	933	3	3	3	3	2	0
09/30/2002	1302	17	whole	.	2	933	3	3	3	3	2	0
11/04/2002	1302	51	whole	5	1	933	3	3	3	3	2	0
12/03/2002	2902	22	whole	5	5	933	3	3	3	3	2	0
02/26/2002	602	35	whole	10	5	1490	3	3	3	3	2	1
11/20/2002	2902	56	whole	.	2	2150	3	3	3	3	2	2
02/11/2002	2902	24	whole	14	2	2400	3	3	3	3	3	0
03/19/2002	2902	10	whole	3	2	2400	3	3	3	3	3	0
07/17/2002	602	25	whole	15	2	2400	3	3	3	3	3	0
11/26/2002	1302	53	whole	8	2	2400	3	3	3	3	3	0
12/11/2002	1302	50	whole	11	1	2400	3	3	3	3	3	0
01/23/2002	2902	30	whole	21	4	2400	3	3	3	3	3	0
08/05/2002	2902	69	whole	6	5	4620	3	3	3	3	3	1
04/23/2002	1302	53	whole	20	2	9330	3	3	3	3	3	2
10/24/2001	1302	53	whole	14	5	11000	3	3	3	3	3	2

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
10/15/2001	602	2	yolk	5	2	0	0	0	0	0	0	0
10/22/2001	2902	40	yolk	12	2	0	0	0	0	0	0	0
10/30/2001	2902	21	yolk	1	5	0	0	0	0	0	0	0
10/19/2001	2902	59	yolk	1	5	0	0	0	0	0	0	0
11/14/2001	1302	25	yolk	13	2	0	0	0	0	0	0	0
11/12/2001	602	2	yolk	7	2	0	0	0	0	0	0	0
11/15/2001	2902	45	yolk	5	5	0	0	0	0	0	0	0
11/19/2001	2902	59	yolk	1	5	0	0	0	0	0	0	0
12/10/2001	602	47	yolk	8	2	0	0	0	0	0	0	0
11/07/2001	1302	56	yolk	.	2	0	0	0	0	0	0	0
12/26/2001	2902	70	yolk	.	4	0	0	0	0	0	0	0
12/17/2001	2902	60	yolk	1	5	0	0	0	0	0	0	0
12/05/2001	2902	39	yolk	3	2	0	0	0	0	0	0	0
12/10/2001	602	59	yolk	4	5	0	0	0	0	0	0	0
12/26/2001	1302	52	yolk	.	2	0	0	0	0	0	0	0
01/28/2002	602	59	yolk	5	2	0	0	0	0	0	0	0
02/12/2002	602	45	yolk	2	5	0	0	0	0	0	0	0
02/26/2002	1302	21	yolk	1	5	0	0	0	0	0	0	0
02/26/2002	602	59	yolk	4	2	0	0	0	0	0	0	0
03/04/2002	2902	40	yolk	11	2	0	0	0	0	0	0	0
03/27/2002	1302	45	yolk	7	5	0	0	0	0	0	0	0
04/11/2002	602	60	yolk	3	5	0	0	0	0	0	0	0
04/15/2002	602	55	yolk	.	2	0	0	0	0	0	0	0
04/23/2002	1302	52	yolk	.	2	0	0	0	0	0	0	0
05/15/2002	2902	25	yolk	2	5	0	0	0	0	0	0	0
05/20/2002	2902	40	yolk	21	2	0	0	0	0	0	0	0
05/13/2002	2902	45	yolk	.	1	0	0	0	0	0	0	0
05/13/2002	602	59	yolk	1	2	0	0	0	0	0	0	0
05/28/2002	1302	59	yolk	4	2	0	0	0	0	0	0	0
05/22/2002	1302	52	yolk	.	2	0	0	0	0	0	0	0
05/29/2002	1302	3	yolk	.	2	0	0	0	0	0	0	0
05/22/2002	602	17	yolk	.	2	0	0	0	0	0	0	0
06/17/2002	2902	40	yolk	9	2	0	0	0	0	0	0	0
06/13/2002	602	30	yolk	15	4	0	0	0	0	0	0	0
06/10/2002	2902	35	yolk	2	2	0	0	0	0	0	0	0
06/18/2002	1302	5	yolk	10	5	0	0	0	0	0	0	0
06/26/2002	1302	54	yolk	4	2	0	0	0	0	0	0	0
07/22/2002	1302	60	yolk	1	5	0	0	0	0	0	0	0
07/15/2002	2902	39	yolk	6	2	0	0	0	0	0	0	0
07/31/2002	1302	21	yolk	1	5	0	0	0	0	0	0	0
07/17/2002	2902	30	yolk	2	4	0	0	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
07/25/2002	602	47	yolk	8	2	0.000	0	0	0	0	0	0
07/01/2002	1302	5	yolk	.	4	0.000	0	0	0	0	0	0
08/01/2002	1302	5	yolk	11	5	0.000	0	0	0	0	0	0
07/23/2002	1302	54	yolk	.	1	0.000	0	0	0	0	0	0
07/09/2002	602	52	yolk	.	2	0.000	0	0	0	0	0	0
08/12/2002	602	25	yolk	10	2	0.000	0	0	0	0	0	0
08/26/2002	602	40	yolk	14	2	0.000	0	0	0	0	0	0
08/26/2002	602	55	yolk	49	2	0.000	0	0	0	0	0	0
08/14/2002	2902	35	yolk	21	5	0.000	0	0	0	0	0	0
08/19/2002	602	56	yolk	.	5	0.000	0	0	0	0	0	0
08/05/2002	1302	17	yolk	.	2	0.000	0	0	0	0	0	0
10/01/2002	602	25	yolk	7	2	0.000	0	0	0	0	0	0
09/23/2002	602	40	yolk	14	2	0.000	0	0	0	0	0	0
10/02/2002	2902	62	yolk	1	4	0.000	0	0	0	0	0	0
09/17/2002	1302	59	yolk	2	2	0.000	0	0	0	0	0	0
10/21/2002	602	40	yolk	9	2	0.000	0	0	0	0	0	0
10/28/2002	602	24	yolk	14	3	0.000	0	0	0	0	0	0
10/14/2002	602	52	yolk	.	2	0.000	0	0	0	0	0	0
11/19/2002	602	2	yolk	7	2	0.000	0	0	0	0	0	0
11/07/2002	602	67	yolk	7	1	0.000	0	0	0	0	0	0
11/11/2002	2902	21	yolk	1	5	0.000	0	0	0	0	0	0
11/18/2002	2902	59	yolk	6	2	0.000	0	0	0	0	0	0
11/19/2002	1302	47	yolk	5	2	0.000	0	0	0	0	0	0
11/13/2002	602	35	yolk	3	5	0.000	0	0	0	0	0	0
12/10/2002	1302	2	yolk	32	2	0.000	0	0	0	0	0	0
12/10/2002	2902	60	yolk	5	4	0.000	0	0	0	0	0	0
12/04/2002	2902	11	yolk	.	2	0.000	0	0	0	0	0	0
01/21/2002	1302	40	yolk	6	2	0.000	0	0	0	0	0	0
01/16/2002	602	39	yolk	4	2	0.000	0	0	0	0	0	0
01/07/2002	2902	59	yolk	4	5	0.000	0	0	0	0	0	0
01/09/2002	602	54	yolk	6	2	0.000	0	0	0	0	0	0
08/12/2002	2902	21	yolk	1	5	0.031	0	1	0	0	0	0
12/03/2001	1302	21	yolk	1	5	0.036	1	0	0	0	0	0
03/18/2002	2902	59	yolk	4	2	0.036	1	0	0	0	0	0
05/28/2002	2902	45	yolk	.	1	0.036	1	0	0	0	0	0
08/13/2002	1302	13	yolk	16	2	0.036	1	0	0	0	0	0
09/09/2002	1302	59	yolk	1	2	0.036	1	0	0	0	0	0
02/19/2002	1302	60	yolk	1	5	0.074	1	1	0	0	0	0
02/19/2002	2902	17	yolk	.	2	0.092	2	0	0	0	0	0
03/13/2002	1302	1	yolk	.	1	0.092	2	0	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
06/04/2002	2902	2	yolk	30.0	2	0.092	2	0	0	0	0	0
06/25/2002	1302	60	yolk	2.0	5	0.092	2	0	0	0	0	0
06/13/2002	1302	62	yolk	1.0	4	0.092	2	0	0	0	0	0
09/16/2002	602	45	yolk	5.0	5	0.092	2	0	0	0	0	0
10/07/2002	2902	59	yolk	3.0	2	0.092	2	0	0	0	0	0
11/04/2002	1302	70	yolk	.	1	0.092	2	0	0	0	0	0
11/04/2002	2902	1	yolk	.	1	0.092	2	0	0	0	0	0
12/05/2002	602	45	yolk	4.0	5	0.092	2	0	0	0	0	0
06/24/2002	2902	67	yolk	3.0	1	0.147	2	1	0	0	0	0
10/29/2002	2902	60	yolk	5.0	4	0.147	2	1	0	0	0	0
11/20/2001	602	18	yolk	3.0	5	0.231	3	0	0	0	0	0
03/05/2002	602	70	yolk	.	1	0.231	3	0	0	0	0	0
07/09/2002	602	17	yolk	.	2	0.231	3	0	0	0	0	0
08/26/2002	1302	13	yolk	16.0	2	0.231	3	0	0	0	0	0
08/13/2002	602	32	yolk	1.0	5	0.231	3	0	0	0	0	0
09/16/2002	2902	21	yolk	1.0	5	0.310	3	0	1	0	0	0
10/14/2002	2902	66	yolk	2.0	4	0.385	3	0	1	0	0	0
01/02/2002	602	17	yolk	.	2	0.427	3	1	0	0	0	0
03/19/2002	1302	21	yolk	1.0	5	0.427	3	1	0	0	0	0
03/27/2002	602	43	yolk	12.0	5	0.427	3	1	0	0	0	0
04/15/2002	2902	45	yolk	.	1	0.427	3	1	0	0	0	0
05/20/2002	2902	40	yolk	21.0	2	0.427	3	1	0	0	0	0
05/09/2002	1302	1	yolk	.	1	0.427	3	1	0	0	0	0
06/11/2002	2902	45	yolk	4.5	5	0.427	3	1	0	0	0	0
07/23/2002	2902	24	yolk	20.0	3	0.427	3	1	0	0	0	0
08/05/2002	2902	60	yolk	1.0	5	0.427	3	1	0	0	0	0
08/19/2002	2902	66	yolk	2.0	5	0.427	3	1	0	0	0	0
09/09/2002	1302	51	yolk	27.0	2	0.427	3	1	0	0	0	0
10/21/2002	1302	49	yolk	9.0	2	0.427	3	1	0	0	0	0
11/11/2002	1302	32	yolk	13.0	4	0.427	3	1	0	0	0	0
01/22/2002	602	60	yolk	1.0	5	0.427	3	1	0	0	0	0
06/24/2002	2902	56	yolk	.	2	0.749	3	1	1	0	0	0
08/08/2002	2902	3	yolk	60.0	2	0.749	3	1	1	0	0	0
10/30/2001	1302	70	yolk	8.0	5	0.933	3	2	0	0	0	0
03/13/2002	2902	56	yolk	7.0	4	0.933	3	2	0	0	0	0
06/06/2002	2902	66	yolk	60.0	4	0.933	3	2	0	0	0	0
06/04/2002	602	17	yolk	.	2	0.933	3	2	0	0	0	0
07/01/2002	1302	21	yolk	1.0	5	0.933	3	2	0	0	0	0
08/20/2002	1302	1	yolk	.	1	0.933	3	2	0	0	0	0
10/07/2002	2902	43	yolk	14.0	5	0.933	3	2	0	0	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
11/04/2002	2902	46	yolk	5	2	0.933	3	2	0	0	0	0
01/09/2002	1302	18	yolk	8	5	0.933	3	2	0	0	0	0
02/21/2002	1302	56	yolk	.	2	1.470	3	2	1	0	0	0
12/11/2002	1302	24	yolk	14	3	1.470	3	2	1	0	0	0
12/02/2002	1302	32	yolk	15	4	1.470	3	2	1	0	0	0
06/11/2002	602	39	yolk	5	2	1.490	3	2	1	0	0	0
08/28/2002	2902	34	yolk	8	2	1.490	3	2	1	0	0	0
12/05/2001	1302	56	yolk	.	2	2.110	3	2	2	0	0	0
07/23/2002	1302	46	yolk	4	2	2.110	3	2	2	0	0	0
02/12/2002	2902	62	yolk	1	5	2.150	3	2	2	0	0	0
06/24/2002	602	70	yolk	.	1	2.150	3	2	2	0	0	0
10/07/2002	602	18	yolk	3	5	2.150	3	2	2	0	0	0
12/26/2001	2902	50	yolk	1	1	2.310	3	3	0	0	0	0
03/12/2002	2902	60	yolk	1	5	2.310	3	3	0	0	0	0
04/01/2002	2902	40	yolk	17	2	2.310	3	3	0	0	0	0
04/16/2002	2902	65	yolk	5	4	2.310	3	3	0	0	0	0
05/13/2002	2902	35	yolk	2	4	2.310	3	3	0	0	0	0
08/12/2002	602	45	yolk	1	1	2.310	3	3	0	0	0	0
09/16/2002	602	32	yolk	8	4	2.310	3	3	0	0	0	0
11/26/2002	602	66	yolk	4	1	2.310	3	3	0	0	0	0
01/07/2002	602	21	yolk	1	5	2.310	3	3	0	0	0	0
05/07/2002	1302	52	yolk	.	2	3.100	3	3	0	1	0	0
12/19/2001	2902	12	yolk	14	4	4.270	3	3	1	0	0	0
03/11/2002	2902	54	yolk	5	2	4.270	3	3	1	0	0	0
04/03/2002	2902	43	yolk	10	5	4.270	3	3	1	0	0	0
05/01/2002	602	30	yolk	11	4	4.270	3	3	1	0	0	0
05/29/2002	2902	2	yolk	19	2	4.270	3	3	1	0	0	0
05/20/2002	2902	15	yolk	.	1	4.270	3	3	1	0	0	0
10/22/2002	1302	70	yolk	6	1	4.270	3	3	1	0	0	0
10/21/2002	2902	15	yolk	16	2	4.270	3	3	1	0	0	0
11/13/2002	602	45	yolk	2	5	4.270	3	3	1	0	0	0
11/13/2002	2902	51	yolk	7	2	7.490	3	3	1	1	0	0
02/05/2002	2902	39	yolk	5	2	9.330	3	3	2	0	0	0
03/06/2002	1302	39	yolk	6	2	9.330	3	3	2	0	0	0
06/13/2002	2902	25	yolk	7	5	9.330	3	3	2	0	0	0
06/24/2002	2902	39	yolk	5	4	9.330	3	3	2	0	0	0
07/17/2002	1302	62	yolk	1	4	9.330	3	3	2	0	0	0
08/21/2002	1302	46	yolk	5	2	9.330	3	3	2	0	0	0
	602	46	yolk	.	2	14.900	3	3	2	1	0	0
11/23/2001	2902	54	yolk	.	1	21.500	3	3	2	2	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
02/12/2002	2902	23	yolk	12	5	23.1	3	3	3	0	0	0
03/27/2002	2902	23	yolk	8	5	23.1	3	3	3	0	0	0
03/14/2002	602	50	yolk	3	5	23.1	3	3	3	0	0	0
04/23/2002	2902	47	yolk	.	1	23.1	3	3	3	0	0	0
06/18/2002	602	65	yolk	5	4	23.1	3	3	3	0	0	0
07/24/2002	2902	18	yolk	3	5	23.1	3	3	3	0	0	0
09/23/2002	602	39	yolk	5	4	23.1	3	3	3	0	0	0
11/05/2002	602	39	yolk	4	2	23.1	3	3	3	0	0	0
11/04/2002	1302	52	yolk	.	2	23.1	3	3	3	0	0	0
05/08/2002	1302	4	yolk	.	2	24.0	3	3	3	0	0	0
09/09/2002	1302	43	yolk	23	5	24.0	3	3	3	0	0	0
10/14/2002	2902	54	yolk	.	1	38.5	3	3	3	0	1	0
11/26/2002	602	50	yolk	1	5	38.5	3	3	3	0	1	0
03/27/2002	2902	61	yolk	5	1	42.7	3	3	3	1	0	0
03/26/2002	2902	65	yolk	5	4	42.7	3	3	3	1	0	0
04/23/2002	602	15	yolk	17	2	42.7	3	3	3	1	0	0
04/29/2002	2902	43	yolk	31	5	42.7	3	3	3	1	0	0
05/30/2002	1302	43	yolk	9	5	42.7	3	3	3	1	0	0
06/06/2002	1302	43	yolk	7	5	42.7	3	3	3	1	0	0
07/01/2002	602	60	yolk	2	5	42.7	3	3	3	1	0	0
07/15/2002	2902	56	yolk	14	5	42.7	3	3	3	1	0	0
07/25/2002	2902	56	yolk	.	5	42.7	3	3	3	1	0	0
08/27/2002	2902	15	yolk	14	4	42.7	3	3	3	1	0	0
08/20/2002	602	50	yolk	2	1	42.7	3	3	3	1	0	0
08/20/2002	2902	54	yolk	.	1	42.7	3	3	3	1	0	0
09/17/2002	1302	51	yolk	.	1	42.7	3	3	3	1	0	0
09/09/2002	602	12	yolk	7	4	42.7	3	3	3	1	0	0
11/20/2002	602	18	yolk	3	5	42.7	3	3	3	1	0	0
11/06/2002	602	56	yolk	.	2	42.7	3	3	3	1	0	0
12/10/2002	602	44	yolk	.	1	42.7	3	3	3	1	0	0
09/16/2002	1302	43	yolk	2	5	74.0	3	3	3	1	1	0
10/24/2001	1302	23	yolk	6	5	93.3	3	3	3	2	0	0
11/26/2001	602	70	yolk	3	1	93.3	3	3	3	2	0	0
12/11/2001	2902	65	yolk	1	5	93.3	3	3	3	2	0	0
02/04/2002	2902	70	yolk	.	1	93.3	3	3	3	2	0	0
04/03/2002	1302	5	yolk	10	4	93.3	3	3	3	2	0	0
05/07/2002	602	23	yolk	9	5	93.3	3	3	3	2	0	0
05/07/2002	602	65	yolk	4	4	93.3	3	3	3	2	0	0
06/05/2002	602	61	yolk	2	5	93.3	3	3	3	2	0	0
06/24/2002	602	22	yolk	5	5	93.3	3	3	3	2	0	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
07/31/2002	602	23	yolk	8	5	93.3	3	3	3	2	0	0
10/03/2002	1302	23	yolk	5	5	93.3	3	3	3	2	0	0
09/05/2002	1302	61	yolk	6	1	93.3	3	3	3	2	0	0
09/10/2002	2902	5	yolk	14	4	93.3	3	3	3	2	0	0
10/28/2002	1302	3	yolk	.	2	93.3	3	3	3	2	0	0
11/13/2002	602	5	yolk	.	1	93.3	3	3	3	2	0	0
07/30/2002	2902	44	yolk	.	1	149.0	3	3	3	2	1	0
07/15/2002	1302	54	yolk	.	1	211.0	3	3	3	2	2	0
07/01/2002	2902	18	yolk	4	5	215.0	3	3	3	2	2	0
02/26/2002	602	18	yolk	5	4	231.0	3	3	3	3	0	0
03/05/2002	602	50	yolk	3	5	231.0	3	3	3	3	0	0
04/10/2002	2902	23	yolk	10	5	231.0	3	3	3	3	0	0
04/24/2002	2902	53	yolk	15	2	231.0	3	3	3	3	0	0
05/15/2002	602	12	yolk	10	4	231.0	3	3	3	3	0	0
06/18/2002	2902	32	yolk	11	4	231.0	3	3	3	3	0	0
06/27/2002	602	53	yolk	10	2	231.0	3	3	3	3	0	0
07/30/2002	2902	18	yolk	2	5	231.0	3	3	3	3	0	0
07/30/2002	602	65	yolk	4	4	231.0	3	3	3	3	0	0
09/30/2002	2902	15	yolk	4	1	231.0	3	3	3	3	0	0
10/01/2002	602	65	yolk	3	4	231.0	3	3	3	3	0	0
09/24/2002	2902	1	yolk	.	1	231.0	3	3	3	3	0	0
01/23/2002	2902	56	yolk	.	2	231.0	3	3	3	3	0	0
06/06/2002	1302	3	yolk	.	2	240.0	3	3	3	3	0	0
12/10/2002	1302	53	yolk	15	2	240.0	3	3	3	3	0	0
02/26/2002	602	54	yolk	3	1	427.0	3	3	3	3	1	0
04/01/2002	602	22	yolk	5	5	427.0	3	3	3	3	1	0
07/16/2002	1302	67	yolk	4	1	427.0	3	3	3	3	1	0
09/05/2002	2902	44	yolk	.	1	427.0	3	3	3	3	1	0
09/02/2002	602	18	yolk	4	5	427.0	3	3	3	3	1	0
09/25/2002	2902	46	yolk	4	2	427.0	3	3	3	3	1	0
10/14/2002	1302	1	yolk	.	1	427.0	3	3	3	3	1	0
10/28/2002	602	53	yolk	12	2	427.0	3	3	3	3	1	0
11/19/2002	602	44	yolk	.	1	427.0	3	3	3	3	1	0
12/10/2002	2902	61	yolk	6	1	427.0	3	3	3	3	1	0
12/03/2002	1302	65	yolk	4	4	427.0	3	3	3	3	1	0
04/03/2002	602	54	yolk	1	2	933.0	3	3	3	3	2	0
04/18/2002	2902	56	yolk	.	2	933.0	3	3	3	3	2	0
05/02/2002	602	32	yolk	4	4	933.0	3	3	3	3	2	0
05/30/2002	602	61	yolk	6	1	933.0	3	3	3	3	2	0
08/29/2002	1302	23	yolk	9	5	933.0	3	3	3	3	2	0

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

-- Type = Yolk --

(continued)

Assigned Week	Lab	Assigned Plant Number	Type	Max Age of Eggs	Risk	Reported MPN	Lowest Dilution 10 ml	Next 1 ml	Next 0.1 ml	Next 0.01 ml	Next 0.001 ml	Next 0.0001 ml
08/27/2002	2902	4	yolk	60	2	933	3	3	3	3	2	0
09/05/2002	1302	3	yolk	24	2	933	3	3	3	3	2	0
10/14/2002	602	49	yolk	19	2	933	3	3	3	3	2	0
10/31/2001	2902	61	yolk	1	1	1490	3	3	3	3	2	1
11/26/2002	1302	53	yolk	8	2	2400	3	3	3	3	3	0
07/24/2002	602	53	yolk	15	2	9330	3	3	3	3	3	2
06/12/2002	1302	11	yolk	.	2	24000	3	3	3	3	3	3
08/06/2002	1302	53	yolk	15	2	24000	3	3	3	3	3	

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