ANNEX F

Levels of *Salmonella* spp. in Egg Products

Many eggs are manufactured into egg products, such as liquid, dried, powdered, frozen, or reduced cholesterol products. They may be contaminated with *Salmonella* spp. if they are made from contaminated eggs. Contamination of fresh eggs may be on the outside of the egg, or it may be inside the egg, on the interior surface of the shell, or in the egg contents. The goal of this annex is to describe the data and methods used to model the distribution of levels of S*almonella* spp. contamination in egg products. FSIS conducted a national survey to determine the distribution of *Salmonella* spp. levels in liquid egg product immediately before pasteurization. The survey took place from October 2001 to March 2003. The following material discusses some of the issues related to estimating the distribution of *Salmonella* spp. levels in egg products for the risk assessment, and derives a distribution for use in these risk assessments.

Egg Product Baseline Survey

Sample Design

All federally inspected plants that produced raw liquid egg products were eligible for sample selection in these studies. 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. The resulting frames varied in number of plants by quarter and by product. The approximate numbers of plants in the frames included 70 whole egg plants, 50 egg yolk plants, and 40 egg white plants. Each quarter, a total of 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. 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 will have been allocated to each plant, achieving a nearly balanced allocation over the seasons of the year.

Samples were collected from Monday through Thursday of the designated week. The type of sample collected was determined by the Inspector in Charge, but priority was given to products in order of the risk category. That is, products in the highest risk category (defined below) were given the highest priority. 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 was to be 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, before collecting the sample, the valve was opened to let sufficient liquid pass from the nozzle/spout to ensure that the sample represented product that was in the tank, and not in the valve.

MPN analyses

Levels of *Salmonella* spp. in collected samples were measured using a 3-tube, 6-dilution most probable number (MPN) procedure. How the results obtained from the MPN analyses are used is explained later in this annex. However, before proceeding with the presentation of the results of the survey, a short description of some aspects about use of the analytical results is given. More technical detail of the computational aspects is given later in this annex.

MPN is a method of inferring the level of viable cells in a sample from the results of a series of qualitative tests of sub-samples of different volumes (or dilutions of the sample). The tested materials are stored in tubes, and typically the numbers of tests for each 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 volume tested. The MPN is the maximum likelihood estimator (MLE) of the level (number of cfu per mL), based on the pattern of results obtained from the tests, assuming that: the distribution of the number of cells is uniform throughout the sample, the sub-sampled 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. If the recovery were expected to be 33% instead of 100%, a reasonable approximation of the MPN would be to multiply by 3 the MPN for an assumed 100% recovery.

For this survey, 6 volumes were typically used: 10 ml, 1 ml, 0.1ml, 0.01 mL, 0.001 mL, and 0.0001 mL, with 3 tubes per volume. If all 18 results were positive, then another set of analyses were performed, with higher dilutions (lower volumes, e. g., 0.00001 mL and 0.000001 mL.) According to normal FSIS reporting procedure, the reported MPN value is the one determined from the second set of analyses. However, 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 that were in the sample when it arrived in the laboratory. For the risk assessment, since probabilities of outcomes for all possible levels are needed, the MPN values themselves are not used, but rather the pattern of results that were obtained, as is explained below.

Information collected

Besides MPN, FSIS is collecting 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 by the means by which the product arrived at the plant: 1) bulk shipments from another plant, not previously heat treated, without additives, and processed separately; liquid product from shell eggs received from another plant; liquid product from shell eggs returned from retail market for processing; liquid products stored in the plant; and products from the plant's own current production.

For dried egg products, the levels of *Salmonella* are assumed to be 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 are used to determine 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 or experiment, 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. Conditions can be varied in a controlled fashion, and the conclusions then are stated with "all things being equal" or similar modifier, such as: "The effect of changing values of factors, given all else being equal, is such and such." 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 in order 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, in so far 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, in the same way, be assumed to be realizations of processes that have a few common factors that influence the 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 the 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 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,

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

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*. Since 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 due to 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, or extra, 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 be taking place that could influence the distribution. However, these variables are thought to be important ones that might be able to serve as post-stratification variables and thus help explain some of the variability among the results from that 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 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_kX_k, where $\Sigma w_k = 1$.

Of primary interest, though, is the cdf, $\ddot{o}$, 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

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

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) can not 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. An advantage of using Equation F6, thus, is that it would permit straightforward estimates of the higher percentiles, beyond the range of the data.

Preliminary analysis of data

We are presenting a brief discussion of the preliminary data and are providing an estimate of the distribution using non-survey estimation procedures. When all the survey information is gathered, attempts will be made to use more formal survey estimation procedures to estimate *F* (from Equation F6) or $\Im$ (from Equation F4), taking into consideration the volume of plants producing the different products, and non-response, if needed. Initially we are presenting information regarding possible factors that might affect results and might be of interest in its own right.

As of this writing, data for 814 samples of egg products are available for use. From the 814 MPN results, 75.9% were positive; 26.5% were greater than 24; and 15.5% were greater than 100. There were 18 MPN results greater than 1,000, with 2 from an egg white product; 5 from egg yolk product, and 11 from whole egg product. The 6 highest results are given in Table F1.

TABLE F1 HIGHEST REPORTED MPN VALUES. WHEN TWO SETS OF ANALYSES WERE PERFORMED, THE MPN FROM THE FIRST SET IS IN PARENTHESES.

Highest MPN values (MPN/mL)	Product	Risk category
(>11,000) 24,000	Yolk	2
(>11,000) 24,000	Yolk	2
(>11,000) 23,100	White	2
>11,000	Whole	5
9,330	Whole	2
9.330	Yolk	2

If the true level of *Salmonella* in a sample were 155,000 cfu/mL, there would be about 1% chance of observing an MPN result (using a 3-tube, 3-dilution MPN table) equal to or less than 24,000 MPN/mL. 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 cell clustering effects, the true level (actual number of *Salmonella* per mL) could be even higher than this value. It is natural to ask, Is this possible? The following calculation addresses the plausibility of such high levels.

The average weight and volume for a dozen small eggs are about 17-18 ounces or about 40 mL per egg. The average weight and volume for a dozen large eggs are about 23-24 ounces or about 53 mL per egg. For small eggs, there are about 25 eggs/L; for large eggs, there are about 19 eggs/L. In 500-1,000 L volume (roughly 1,000-2,000 pounds), egg product would contain approximately 10,000-25,000 eggs. This number of eggs could be the number of eggs in a flock. Assume that an infected flock provides 10,000 eggs. If the eggs are about 10 days or more old, then about 20% of the infected eggs might have experienced yolk membrane breakdown and have high levels of *Salmonella* Enteritidis (SE).[4] Supposing 100 eggs have high levels, on average 10^9 cells per egg, the contribution to the number of *Salmonella* from these eggs would be about 10^{11}. In 500 - 1000 liters this would amount to about 10^8 cells per liter, or about 10^5 cells per mL. Thus, if the above were true, it would be possible to have levels of *Salmonella* close to, or even greater than, 10^5 per mL. Since the volume of the yolk is smaller than that of the whole egg, the number of eggs needed to make 500-1,000 liters of yolk product would be about 3 times higher. For yolk products, the levels could be higher by about a factor of 3 or ½ $\log_{10}$.

The distribution of the ages of the eggs from the preliminary FSIS data that have been collected so far indicates that about 40% of the samples indicated product made from eggs more than a week old, and about 8.3% more than 3 weeks old. The oldest was 6 weeks old. It needs to be pointed out that the reported ages represent the highest ages in the batch of eggs that were sampled, so that not all the eggs in the batch would be of the reported ages. Nevertheless, it cannot be dismissed that within a batch there would be a significant number of eggs with high levels of *Salmonella*, and commensurately high levels of *Salmonella* in liquid product.

The above discussion explained possible high levels in the liquid product due to SE contamination within eggs, thus ignoring the possibility of high levels occurring due to contamination of the exterior shell. FSIS is identifying serotypes in positive samples, thus, while not conclusive, the results of these analyses might provide an indication of possible sources of contamination.

Some factors correlated with MPN levels

Seasonality

Table F2 presents the fraction of the MPN results that were positive, greater than 24 MPN/ml, and greater than 100 MPN/ml, by month of survey and type of product (white, whole, and yolk).

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

		White				Whole				Yolk			
Yr	**Mo**	N	>0 Fract-ion	>24 Fract-ion	>100 Fract-ion	N	>0 Fract-ion	>24 Fract-ion	>100 Fract-ion	N	>0 Fract-ion	>24 Fract-ion	>100 Fract-ion
01	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
02	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	26	0.654	0.154	0.115	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	23	0.652	0.261	0.130
	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	23	0.957	0.391	0.174	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	7	0.857	0.286	0.000	16	0.875	0.188	0.188	10	0.700	0.400	0.300
All		266	0.733	0.184	0.098	299	0.823	0.301	0.194	249	0.711	0.309	

A graph of the information in the above table is presented below to help visualize the patterns.

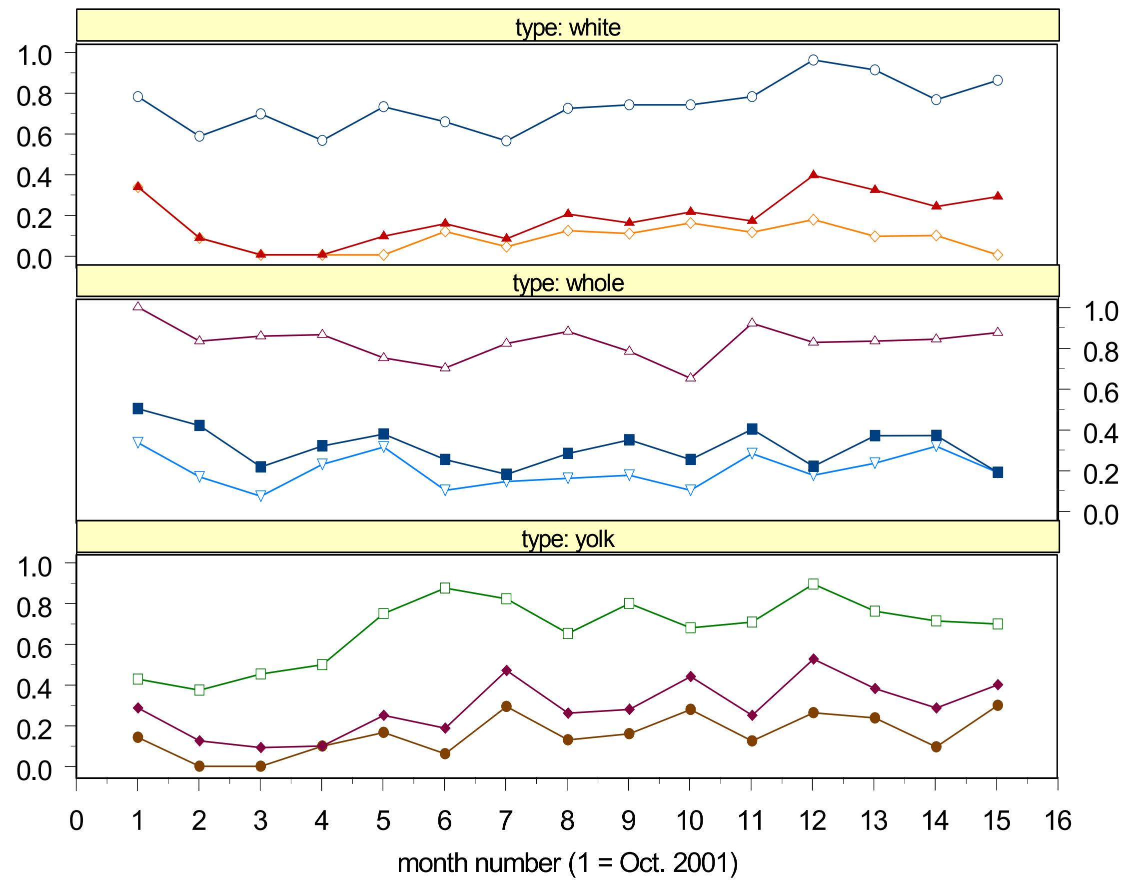

FIGURE F1 GRAPHS OF FRACTION OF MPN RESULTS, > 0, > 24, AND >100 MPN/ML, BY MONTH OF SURVEY, AND TYPE OF PRODUCT (NEED LEGEND TO CONNECT EACH SYMBOL/LINE TO THE PRODUCT) (NEED LABEL ON Y AXIS).

As is evident from perusing the above table and graphs, 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 (Oct. 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.

Risk Category

Besides type of product, we categorized samples with respect to their processing history, identifying factors that were thought might affect the levels of *Salmonella* in the liquid product. There were five "risk" categories of product as explained above. Table F3 provides the fraction of MPN positive results and MPN results greater than 100, by type of product and time of sample: early = (2001 and the first four months of 2002), and late = the remainder. (what is the rationale for this choice of division?) As is evident the percentage of MPN positive samples from risk 1 category is the highest.

Table F3 Fraction MPN positive and > 100 by type, risk category and period of sample collection. Early = 2001 and 2002 up to April 30, Late = May-Dec. 20002.

		Type											
		White			**Whole**			**Yolk**			**All**		
Risk	**Time**	*N*	>0 Fract	>100 Fract	N	>0 Fract	>100 Fract	*N*	>0 Fract	>100 Fract	*N*	>0 Fract	>100 Fract
1	early	12	0.67	0.000	13	1.00	0.077	11	1.00	0.182	36	0.89	0.083
	late	22	0.86	0.045	34	0.94	0.206	31	0.90	0.323	87	0.91	0.207
2	early	40	0.48	0.050	43	0.70	0.209	31	0.48	0.129	114	0.56	0.132
	late	57	0.84	0.140	64	0.81	0.281	64	0.59	0.188	185	0.75	0.205
3	early	1	1.00	1.000	2	1.00	0.500	.	.	.	3	1.00	0.667
	late	2	0.50	0.000	3	0.33	0.000	3	0.67	0.000	8	0.50	0.000
4	early	25	0.76	0.040	26	0.96	0.231	7	0.86	0.143	58	0.86	0.138
	late	30	0.80	0.067	33	0.85	0.182	28	0.82	0.214	91	0.82	0.154
5	early	34	0.71	0.118	34	0.76	0.118	32	0.66	0.094	100	0.71	0.110
	late	43	0.74	0.163	47	0.79	0.128	42	0.79	0.095	132	0.77	0.129
All		266	0.73	0.098	299	0.82	0.194	249	0.71	0.169	814	0.76	0.155

Tables F1 and F3 could imply that whole and yolk product from risk category 2 represents the highest risks, based on the observation that 5 of the 6 highest results of Table F1 are from risk category 2 products, and that this risk category has the highest percentage of MPN values greater than 100.

Plant effects

However, the above impressions may not hold when considering the possible plant effects that are evident in the data. There are results from 71 plants, where the numbers of samples per plant range from 2 to 23. That there are plant effects can be seen very quickly by examining the highest results. In Table F1, 5 of the 6 highest MPN results listed are from one plant. This plant may have a large volume, judging by the number of samples collected so far from the plant (22 in total). All the results were positive; 60% of the results were greater than 100 MPN/mL. For comparison, another plant had only two positive results (0.43, and 2.31 MPN/mL) from 23 samples that were all from risk category 2, in which there were 10 yolk and 10 white egg product samples and 3 whole egg samples (all zero MPN).

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 2 hours for all the samples, whereas for the "worst" plant, the ages generally were higher, between 0.5 hours and 24 hours (the highest MPN result (24,000) was for the 24 hour aged sample). However, even the MPN results for liquid samples that were 0.5 and 2 hours old in this plant were high: 42.7 MPN/mL and > 11,000 MPN/mL. So age itself does not explain the high results for this plant.

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. For the final analysis, FSIS will consider and incorporate volume of production if necessary.

Sample location

FSIS wanted to be sure that the samples represented the product at the time immediately before pasteurization. Any sample for which there is a reasonable question concerning this would be excluded from the analysis. To help assure that the samples did represent the product right before pasteurization FSIS asked for the location of the sampling, in particular, whether the sample was collected from a valve or spigot. It might be thought that there exists a possibility that samples taken from valves or spigots would be contaminated by a build up of bacteria on them, which would not be representative of the product as it is right before pasteurization.

Among the 814 samples for which MPN results are available, 40 did not include information about the location of sample collection; 126 samples did not include the words valve or spigot in their sample location descriptions; the remaining 648 samples had at least one of these words in their sample location descriptions. All samples collected from the identified plant with 5 of the highest 6 MPN results for the survey were from valves. In this plant, MPN results ranged from a low of 0.04 to the high of a reported 24,000 MPN/ml from a second set of analyses. Because of the plant effect, for determining the significance of a "valve" effect, the plant variable needs to be accounted for. Table F4 includes results from samples that are taken at plants that had sample locations for both from valves and not valves. As is evident, the differences between the fractions and means for the valve and non-valve sample locations are small, and through analyses of variance, with plant as a fixed effect, are not statistically significant. The evidence thus, presented so far, does not indicate, in some average sense over establishments, a significant valve effect.

To explore this farther, the relationship of MPN and whether samples were from valves is analyzed. Two analyses are presented: 1) an analysis of the within plant correlations of the MPN and the incidence variable, "Valve", defined as equal to 1 when the sample was tanked from a valve, and zero otherwise, and 2) an analysis of the relationship of the maximum MPN within a plant and the variable "Valve." Both analyses did not produce significant evidence suggesting a valve effect. The details of these analyses are presented in an attachment to this annex.

Table F4 Fraction of MPN results greater than 24 and the average of the $\log_{10}$(MPN) for positive MPN values.

	Sample Location						All		
	No value			Value					
	Frac. MPN>24		Mean log10 MPN	Frac. MPN>24		Mean log10 MPN	Frac. MPN>24		Mean log10 MPN
Risk Category	*N*	Mean	Mean	*N*	Mean	Mean	*N*	Mean	Mean
1	56	0.23	0.77	26	0.54	1.43	82	0.33	1.00
2	18	0.39	1.27	70	0.23	0.91	88	0.26	0.99
3	3	0.67	1.59	5	0.00	-0.20	8	0.25	0.87
4	10	0.50	1.33	24	0.17	0.58	34	0.26	0.83
5	20	0.15	0.61	67	0.21	0.67	87	0.20	0.66
All	107	0.28	0.91	192	0.25	0.87	299	0.26	0.88

Estimation procedures

To estimate the distribution $\mathfrak{I}$ using Equation F6, the error distribution from Equation F2, of the MPN measurements needs to be specified.

<u>More detailed account of the use of the results obtained from the MPN procedure</u>

For this survey, sets of 3 tubes covering 6 dilutions (1:10 successive dilutions) were used to estimate levels up to 11,000 MPN/mL. From these 6 sets of tubes, the 3 with the highest dilutions are considered first; if these are all negative, then the 3 starting with the second highest dilutions are considered, and this is repeated until there is a set of 3 dilutions with a positive finding. FSIS then uses a 3-tube, 3-dilution MPN table for determining the MPN values. These values are MLEs based on the numbers of positive results seen in 3 tubes containing a fixed amount of sample material obtained by diluting the samples by known amounts. For a given sample, if all analyses were positive (MPN value designated as > 11,000 MPN/mL), then FSIS would repeat the analysis with more sets of tubes at higher dilutions. Thus, it would be possible that the repeat analysis would provide an estimate less than 11,000 MPN/mL. By established procedures, FSIS reports the MPN for the second set of analyses. One time this event occurred and mistakenly, the sample was not analyzed further.

Given a reported MPN result, in order to compute an MLE of parameter values defined in Equation F6, the pattern of results 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, say, abc, where ‘a’ represents the number of positives in the lowest dilution (largest volume of sample); ‘b’, the next lowest dilution; and ‘c’ 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, so that, for example, an assumed pattern could be 33a bc0, 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 PN/mL (twice) and there was one reported value of 23,100. These results from second sets of analyses and the one reported as >> 11,000

MPN/mL, however, were assigned a pattern 333 333. Thus, a 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. This assumption 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, $\gamma(x| r)$ of the obtaining a result x, is given as:

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

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

$$\sum_{j=1}^{6} \frac{v_j}{1 - e^{-v_j \hat{r}}} \left[x_j - n_j (1 - e^{-v \hat{r}}) \right] = 0. \qquad \text{(F8)}$$

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:

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

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 $Var(\hat{r})/\hat{r}^2$, as described by Haldane.[5] However, such confidence intervals 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: 333 330), the standard error of $\hat{r}$ is 1,743; the upper 99[th] confidence limit estimated as stated above is 13,000, which is slightly less than the 15,500 limit estimated using a direct calculation. In order to assure an accurate calculation when estimating the distribution of levels using Equation F6, the actual 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 of 24,000 were second analyses determined from a 7 dilution MPN; the reported result of 23,100 was a second set of analyses from an 8 dilution MPN. (Actually the lower dilutions were not repeated). In all these cases, the 7[th] dilution tubes were negative. As mentioned above, these second sets of analyses may provide negative biased results; hence it is possible that the actual levels in the samples are greater than those implied by the pattern of results of the second set. However, we believe that 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. Thus, the 7th dilution tubes being all negative implies that it is not likely that a positive result from a 8th dilution tube would be possible. Thus, the second sets of analyses are important for determining an upper bound of the 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 greater than 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 $y \le 3$. In the final analysis, when all the results are made available, FSIS will use the first sets of MPN results, and from the second sets of analyses determine upper bounds of possibilities by assuming that, for a given sample, the results are from a s+ 3th dilution MPN, where s is the highest dilution which had a positive result.

<u>Estimating a distribution using Equation F4</u>

Since volume of production is not available, and there are no non-response adjustments being made for the risk assessment, 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, ö (x) derived from Equation F4, ln(-ln(1- ö (x)), versus ln(x) where *x* ranges over the positive, and the linear regression lines are given in Figure F1. 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. From the linear regression, values of *b* and *c* are derived, and given in Table F5, together with the 99th percentile of the estimated Weibull.

TABLE F5 DERIVED VALUES OF PARAMETERS *B* AND *C* FOR WEIBULL DISTRIBUTION USING SAMPLE CUMULATIVE DENSITY FUNCTION AND LINEAR REGRESSION.

Type	**Number of Samples**	**b - shape (power) parameter**	**c – location parameter**	**99th percentile**
white	266	0.22	3.04	2778
whole	299	0.26	16.05	5895
yolk	249	0.22	7.65	7865

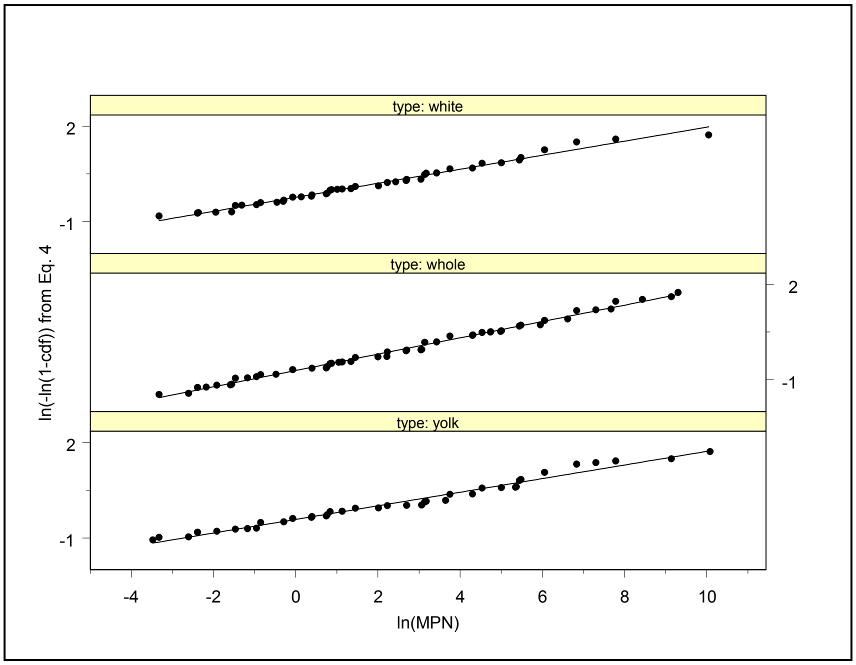

FIGURE F1 PLOT OF LOG-LOG TRANSFORMATION OF CUMULATIVE DISTRIBUTION FUNCTION, (LN(-LN(1-CDF)) VERSUS LN(MPN), ESTIMATED USING EQUATION F4, BY PRODUCT TYPES, TOGETHER WITH LINEAR REGRESSION LINES.

Estimating a distribution using Equation F6

G_A will be estimated for each product type, where it is assumed equal weights for each observation. 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

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

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^{-8}.

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

$$W(r \mid \mu, s) = 1 - exp\left[-exp(\frac{\ln(r) - \mu}{exp(s)}) \right] \tag{F13}$$

where μ and s are parameters, so that b = exp(-s) and c = exp(μ). 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 MLE estimates, their standard errors and correlation and an estimate of the 99th percentiles are given in Table F6. Figure F2 shows plots of the sample cdf versus the estimated cdf for the different product types.

TABLE F6 MLE ESTIMATES OF WEIBULL DISTRIBUTION PARAMETERS (EQUATION F12), WITH ESTIMATED 99TH PERCENTILES FOR DIFFERENT PRODUCT TYPES. ESTIMATES, μ = LN(c) AND s = -LN(b).

							Std errors		
Type	**b–shape (power) parameter**	**c-location parameter**	**99th percentile**	**Upper 97.5% confid-ence limit**	**μ**	**s**	**μ**	**s**	**Correlation μ and s**
white	0.24	1.55	849	1818	0.44	1.42	0.29	0.06	-0.34
whole	0.25	9.67	4819	9742	2.27	1.40	0.27	0.05	-0.30
yolk	0.20	3.09	5871	15139	1.13	1.60	0.36	0.06	-0.34

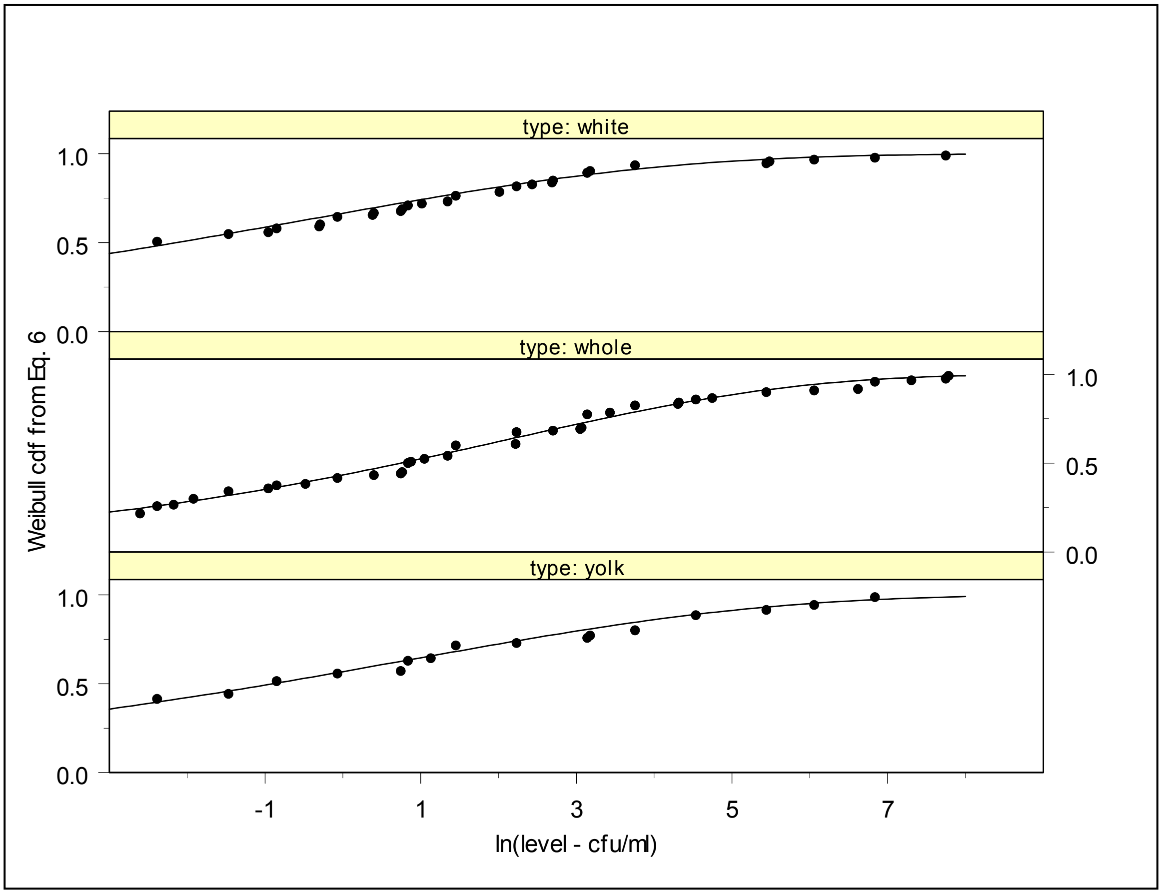

FIGURE F2 SAMPLE CUMULATIVE DISTRIBUTION FUNCTION (CDF) AND THE ESTIMATED CDF OF THE WEIBULL DISTRIBUTION, USING MLE, FROM EQUATION F6 FOR DIFFERENT PRODUCT TYPES. THE X-AXIS REPRESENTS THE NATURAL LOG OF THE MEASUREMENTS, GIVEN IN UNITS OF CFU/ML.

The estimates of the 99th percentiles from Table F6 are slightly less than those from Table F4, derived using Equation F4. This is expected, in so far as the estimates from Table F5 represent the distribution of the observed results, *X*, whereas, the estimates of Table F6, represent the distribution of the underlying true levels, after accounting for the error of the MPN measurement.

As a comparison, a lognormal distribution, with density function

$$f(r \mid \mu,\sigma) = \frac{e^{-0.5((\ln(r)-\mu)/\sigma)^2}}{r\sigma\sqrt{2\pi}} \tag{F14}$$

where μ is the mean, and σ is the standard deviation, of ln(*r*), was assumed and MLE estimates were calculated. Similar to above, let s = exp(σ). The MLE estimates, standard errors of them, and estimates of the 99th percentile, are given in Table F7. Figure F3 shows plots of the sample cdf versus the estimated cdf for the different product types.

TABLE F7 MLE OF LOGNORMAL DISTRIBUTION PARAMETERS, WITH ESTIMATED 99TH PERCENTILES FOR DIFFERENT PRODUCT TYPES.

Type	Mean of ln (level / mL)	Ln (σ)	99th percentile	Upper 97.5% confidence limit	Std error mean	Std error ln (σ)	Correlation of mean
white	-1.437	1.444	4535	14938	0.298	0.061	-0.233
whole	0.312	1.467	32686	100095	0.278	0.053	-0.136
yolk	-1.138	1.643	53497	247015	0.381	0.065	-0.243

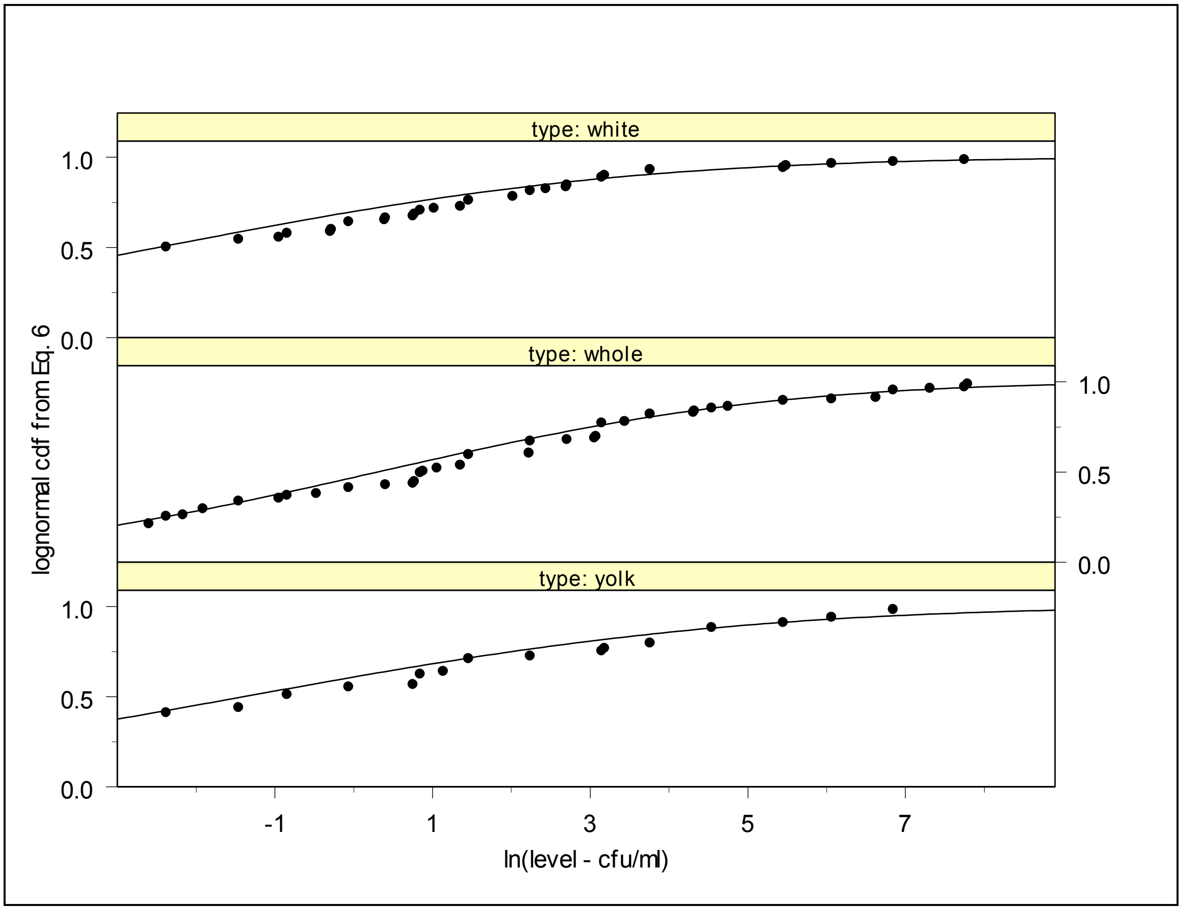

FIGURE F3 SAMPLE CUMULATIVE DISTRIBUTION FUNCTION (CDF) AND THE ESTIMATED CDF OF THE LOGNORMAL DISTRIBUTION, USING MLE, FROM EQUATION F6 FOR DIFFERENT PRODUCT TYPES. ONLY DATA FROM SAMPLES THAT WERE COLLECTED FROM LOCATIONS DESCRIBED NOT USING THE WORDS "VALVE" OR "SPIGOT" ARE INCLUDED. THE X-AXIS IS THE NATURAL LOG OF THE LEVEL, GIVEN IN UNITS OF CFU/ML.

From a close comparison of Figures F2 and 3, it is seen that Weibull distribution provides a better fit to the observed data. The estimated 99th percentiles for the two assumed distributions are quite different. For example, the 99th percentiles calculated using the MLE method are approximately 6 to 10 times higher than the 99th percentile estimates calculated using the Weibull distribution.

Adjustments to estimates

The MPN procedure, as with any analytical procedure or assay, most likely does not have 100% expected recovery. Further, the MPN may not measure individual cells, but rather clusters of cells, so that the actual number of cells would be some multiple of the measured amount. We have no direct information concerning what these factors might be, and thus the magnitude of the biases that are caused by these factors with respect to determining the number of cells in portions of liquid product. If cell clusters exist, they might protect individual cells when the product is subjected to a pasteurized. The inactivation models used in this risk assessment do not account for such effects. All inactivation models known to us assume a mutual independence of the inactivation events for cells. Thus, ignoring possible cell clusters compounds the possible negative bias in the risk assessment in two ways: 1) by underestimating the number of cells in the product, and 2) by overestimating the reductions that might occur during pasteurization. Consequently, it is appropriate to introduce a factor that could account for the possible negative bias introduced by clusters and lack of 100% recovery.

The clustering effect for *Salmonella* spp. may not be as severe as it is for other organisms, such as *Campylobacter* spp. However, the possibility of some clustering and a slightly less than 100% recovery cannot be dismissed. Consequently, in the absence of better data, the levels used in the risk assessment are obtained by multiplying the levels derived from the estimated Weibull distribution of Table F4 (Equation F6) by a factor of 3.

Determining the portion of **Salmonella** *levels due to contamination within eggs*

Contamination of the pre-pasteurized liquid product can happen two ways. *Salmonella* can contaminate the exterior of the shell or exist within the egg, either on the inner shell or the contents of the egg. Thus, a natural question is what portion of the levels could be attributed to *Salmonella* from within the egg, particularly from SE contaminated eggs that are more than a few days old? Would processing eggs that are from known SE free flocks make a difference in some circumstances? The answer to this question may depend upon how the eggs are stored.

There is question regarding the growth potential of *Salmonella* on the exterior egg shell. In a dry environment, the *Salmonella* should not grow much. Therefore, if the eggs were kept in a dry environment soon after they were laid or contaminated, the distribution of *Salmonella* levels due to contamination on the exterior of the shell would not likely be affected by age of the egg before breaking. This would not be true of levels of *Salmonella* within the egg; these levels would change over time and would depend upon time and temperature storage in a direct fashion as discussed in previous sections.

The information provided in the previous section permits modeling the distribution of the levels of *Salmonella* within eggs from a flock. It is necessary to determine the number of flocks that contribute eggs to vats or holding tanks. This in turn depends upon the size of the flock and the size of the vats. For the latter, FSIS is collecting the information regarding vat sizes in its baseline survey. For the former, information is available.[6]

For a given vat size, the number of eggs needed to fill the vat is known. When the product is pasteurized, however, the vat is not completely filled. For example, even if a vat can hold 5,000 pounds of product, at the time of pasteurization it may only be half full.

FSIS also assumes that the distribution of *Salmonella* within egg product when it is pasteurized is uniform. It is difficult to evaluate this assumption; FSIS did not collect two samples from a vat to determine how homogeneous the levels are within a vat before pasteurization. The continuous nature of processing further complicates the assessment: some portion of the vat contents might be in the vat for a long time.

A further difficulty is the assumption needed to determine the distribution of *Salmonella* levels from eggs of more than one flock from the same hen house or houses from the same farm. Should it be assumed that the distribution of levels from a set of flocks are pairwise mutually independent over the flocks? This assumption seems unrealistic; it seems possible that some factors influencing potential levels in the first flock would also influence the levels in the second flock or subsequent flocks. The assessment of this possibility of course would depend upon the particulars of the operation: are the flocks from common sources; do the farms and processing plants hold eggs in a similar fashion from all the flocks? Answers to these questions are not available.

The easiest assumption to implement, and one that would the most conservative, is to assume that the eggs in a vat are from one flock, ignoring other possibilities. The second easiest assumption is to assume that the distributions of levels in eggs and flocks are independent. This assumption could be modified without much difficulty by assuming that the variable "SE positive flock" is correlated perfectly, but that given that the flocks are SE positive, the distribution of levels would be independent of flock. Thus there are three assumptions that could be made, for which calculations can be performed. This risk assessment relies on the most conservative assumption.

Assumptions Used for Modeling

The level (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 F10, with appropriate parameters, μ and s, given in Table F4, to account for lack of knowledge about clustering and recovery, as discussed above. Given a level x, the number of cells in a volume of v mL is assumed to be random variable distributed as a Poisson distribution with parameter (and expected value) equal to vx.

The uncertainty is determined by generating, values of μ' and s′, s' where it is (μ', s') are assumed that (μ', s′) is distributed as a bivariate normal distribution with mean = (μ, s) and variance matrix, given in Table F4 (as standard errors and a correlation).

When the baseline survey is completed, the data will be more thoroughly analyzed. If the data from the completed survey confirm a plant effect, then production volume of the plants will be used to weight the samples. Imputation procedures for missing data will be considered. For example, if known ages of the samples are reasonably similar within a plant, then ages that are missing for samples will be imputed by using an average of the known ages of the samples.

Introducing weights, though decreasing bias, may increase uncertainty. These formal survey estimation procedures could have a significant impact on the final estimates.

ATTACHMENT: ANALYSES OF VALVE EFFECT

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

For the first analysis, to help decide the significance of any pattern, the following approach is used. Assume random variables, *x* and *y*, measured on a sample, where *x* is the Valve and *y* is the MPN. To determine if there is a correlation between *x* and *y*, the average of the ranks of the values of *y* for positive 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

$$d_k = (\overline{r}_{m_k} - \frac{n_k + 1}{2})\delta_k \qquad \text{(F-A1)}$$

where the index *k* specifies plant, m_k is the number of positive 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

$$var(d_k) = \frac{(n_k + 1)\delta_k(1-\delta_k)}{12} \qquad \text{(F-A2)}$$

The test statistic computed is

$$T = \sum_{k=1}^{K} n_k d_k \qquad \text{(F-A3)}$$

where *k* is the number of plants. The variance of *t* is

$$var(T) = \sum_{k=1}^{K} n_k^2 \, var(d_k) \qquad \text{(F-A4)}$$

Observations 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,

$$Z = \frac{T}{\sqrt{var(T)}} \quad \text{(F-A5)}$$

which is compared to the percentiles of the normal distribution.

The value of z computed is -0.79, which of course is not significant. The within plant Spearman correlations were also computed, and of the 40 correlations, 18 were negative, 20 were positive.

For the second 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. The under the null hypothesis of no valve effect, the expected value of diff = (δ - 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 hypotheses is the sum of the weights. Taking the ratio of the sum to the square root of the sum of the weights, yielded a (z-) value of 1.15, which is significant at the 0.125 one-sided significance level. Multiplying the weight by the number of samples within the plant, and adjusting the variance accordingly, yields a ratio value of 1.10; multiplying the weight by different factors, such as the ln(n) or the square root of n, yields z- values of 1.17.

The following table presents the maximum and second highest MPN values and whether their associated samples were form valves (= 1) or not (= 0). If there were two highest values, then a value of 0.5 was recorded. In addition, the within plant spearman correlations are given.

TABLE F-A1 SUMMARY OF RESULTS FOR EACH PLANT REGARDING HIGH MPN VALUES AND SAMPLE LOCATION (VALVE OR NOT). ALSO THE WITHIN PLANT SPEARMAN CORRELATION OF THE MPN WITH AN INDICATOR VARIABLE OF SAMPLE VALVE LOCATION IS GIVEN.

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
39	22	0	231	1.0	149	1.0	.
65	21	0	427	1.0	240	1.0	.
12	10	0	231	1.0	74	1.0	.
53	21	0	24000	1.0	23100	1.0	.
52	18	0	23	1.0	3	1.0	.
11	15	0	24000	1.0	933	1.0	.
51	5	0	933	1.0	43	1.0	.
3	16	0	933	1.0	427	1.0	.
46	18	0	427	1.0	23	1.0	.
64	7	0	231	1.0	75	1.0	.
32	19	0	933	1.0	427	1.0	.
33	8	0	240	1.0	43	1.0	.
27	2	0	23	1.0	0	1.0	.
30	11	0	2400	1.0	933	1.0	.
13	13	0	93	1.0	31	1.0	.
31	1	0	9	1.0	.	1.0	.
34	7	0	231	1.0	1	1.0	.
25	10	0	2400	1.0	240	1.0	.
6	2	0	0	1.0	0	1.0	.
7	3	0	231	1.0	23	1.0	.
10	5	0	2400	1.0	4	1.0	.
36	4	0	933	1.0	9	1.0	.
23	17	0	933	1.0	240	1.0	.
60	22	0	427	1.0	43	1.0	.
4	7	0	933	1.0	149	1.0	.
8	3	0	231	1.0	74	1.0	.
21	15	0	2	1.0	1	1.0	.
57	5	0	0	1.0	0	1.0	.
49	4	0	933	1.0	43	1.0	.
38	2	2	43	0.0	1	0.0	.
20	4	4	933	0.0	93	0.0	.
41	3	1	43	0.0	0	1.0	-1.00
48	3	1	93	0.0	1	1.0	-0.87
55	6	1	43	1.0	0	1.0	0.20
18	18	1	933	1.0	427	1.0	0.07
58	6	1	9	1.0	1	0.0	-0.27
66	17	1	231	1.0	23	1.0	-0.26
71	4	1	3	1.0	1	1.0	0.77
68	2	1	23	1.0	0	0.0	1.00
43	25	1	74	1.0	43	1.0	0.18
22	13	1	933	1.0	427	1.0	-0.15
14	15	1	427	1.0	93	1.0	-0.28
2	11	1	231	1.0	43	1.0	0.27
69	5	1	4620	1.0	0	0.0	0.25
70	14	1	933	1.0	93	1.0	0.28
59	21	1	231	1.0	43	1.0	0.22
9	4	1	9	1.0	1	1.0	0.77
62	11	1	9	1.0	2	1.0	0.36
63	7	2	749	0.0	385	1.0	-0.24
37	6	2	23	0.0	4	1.0	0.00
42	3	2	21	0.0	4	0.0	-0.87
24	13	2	2400	1.0	1	0.0	-0.12
40	22	2	2	1.0	0	1.0	0.10
29	4	2	427	1.0	93	1.0	0.89
56	20	2	2150	1.0	933	1.0	0.23
47	10	2	231	1.0	23	0.0	-0.15
35	15	3	1490	1.0	93	0.0	-0.27
17	15	3	933	1.0	427	1.0	-0.33
16	5	3	2400	1.0	4	0.0	0.30
28	5	3	43	1.0	4	0.0	0.32
67	9	4	427	0.5	114	1.0	-0.04
19	8	4	933	0.5	93	0.0	0.00
26	9	4	231	1.0	43	0.0	-0.35
61	10	4	933	1.0	427	0.0	0.29
54	17	5	933	1.0	427	1.0	-0.28

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
5	17	6	93	0.0	23	0.0	-0.68
44	11	6	427	0.5	231	0.0	-0.06
45	21	6	147	1.0	43	1.0	0.11
50	15	7	2400	0.0	749	0.0	-0.47
15	20	13	427	1.0	240	1.0	0.16
1	17	16	427	0.0	231	0.0	0.15

Table F-A2 MPN values and assigned pattern of positive tubes used in analysis.

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

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

Week of	Type	Age of Egg	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
03/12/2002	white	.	2	0	0	0	0	0	0	0
03/19/2002	white	.	2	0	0	0	0	0	0	0
03/06/2002	white	7	5	0	0	0	0	0	0	0
04/03/2002	white	2	5	0	0	0	0	0	0	0
06/19/2002	white	2	5	0	0	0	0	0	0	0
07/17/2002	white	3	5	0	0	0	0	0	0	0
04/11/2002	white	.	4	0	0	0	0	0	0	0
05/29/2002	white	60	4	0	0	0	0	0	0	0
07/30/2002	white	1	5	0	0	0	0	0	0	0
03/18/2002	white	14	2	0	0	0	0	0	0	0
05/20/2002	white	14	3	0	0	0	0	0	0	0
08/12/2002	white	.	4	0	0	0	0	0	0	0
03/12/2002	white	30	2	0	0	0	0	0	0	0
04/09/2002	white	7	4	0	0	0	0	0	0	0
06/05/2002	white	.	4	0	0	0	0	0	0	0
11/19/2002	white	19	5	0	0	0	0	0	0	0
11/18/2002	white	5	5	0	0	0	0	0	0	0
01/28/2002	white	.	1	0	0	0	0	0	0	0
01/17/2002	white	.	1	0	0	0	0	0	0	0
02/05/2002	white	0	1	0	0	0	0	0	0	0
06/17/2002	white	.	1	0	0	0	0	0	0	0
07/16/2002	white	.	1	0	0	0	0	0	0	0
04/18/2002	white	1	5	0	0	0	0	0	0	0
05/06/2002	white	1	4	0	0	0	0	0	0	0
11/19/2001	white	22	4	0	0	0	0	0	0	0
10/31/2002	white	52	2	0	0	0	0	0	0	0
11/07/2002	white	30	2	0	0	0	0	0	0	0
10/31/2001	white	6	5	0	0	0	0	0	0	0
11/07/2001	white	8	5	0	0	0	0	0	0	0
12/18/2001	white	6	4	0	0	0	0	0	0	0
03/05/2002	white	16	5	0	0	0	0	0	0	0
11/04/2002	white	8	4	0	0	0	0	0	0	0
10/22/2001	white	7	2	0	0	0	0	0	0	0
01/15/2002	white	4	2	0	0	0	0	0	0	0
04/15/2002	white	12	2	0	0	0	0	0	0	0
12/10/2002	white	32	2	0	0	0	0	0	0	0
02/11/2002	white	3	2	0	0	0	0	0	0	0
04/17/2002	white	4	2	0	0	0	0	0	0	0
05/28/2002	white	2	4	0	0	0	0	0	0	0
11/19/2001	white	21	2	0	0	0	0	0	0	0
12/03/2002	white	21	2	0	0	0	0	0	0	0
01/07/2002	white	8	2	0	0	0	0	0	0	0
02/25/2002	white	10	2	0.000	0	0	0	0	0	0
03/11/2002	white	12	2	0.000	0	0	0	0	0	0
04/16/2002	white	5	2	0.000	0	0	0	0	0	0
05/13/2002	white	17	2	0.000	0	0	0	0	0	0
05/20/2002	white	21	2	0.000	0	0	0	0	0	0
08/12/2002	white	12	2	0.000	0	0	0	0	0	0
08/19/2002	white	12	2	0.000	0	0	0	0	0	0
11/06/2001	white	72	1	0.000	0	0	0	0	0	0
01/14/2002	white	12	2	0.000	0	0	0	0	0	0
03/04/2002	white	7	2	0.000	0	0	0	0	0	0
04/23/2002	white	8	2	0.000	0	0	0	0	0	0
07/01/2002	white	.	5	0.000	0	0	0	0	0	0
11/19/2001	white	7	4	0.000	0	0	0	0	0	0
04/24/2002	white	7	2	0.000	0	0	0	0	0	0
06/25/2002	white	6	2	0.000	0	0	0	0	0	0
06/04/2002	white	.	2	0.000	0	0	0	0	0	0
09/03/2002	white	.	1	0.000	0	0	0	0	0	0
01/23/2002	white	.	4	0.000	0	0	0	0	0	0
12/17/2001	white	7	5	0.000	0	0	0	0	0	0
01/03/2002	white	1	5	0.000	0	0	0	0	0	0
04/24/2002	white	3	5	0.000	0	0	0	0	0	0
07/08/2002	white	2	5	0.000	0	0	0	0	0	0
10/30/2002	white	1	5	0.000	0	0	0	0	0	0
12/11/2001	white	2	5	0.000	0	0	0	0	0	0
08/05/2002	white	1	5	0.000	0	0	0	0	0	0
09/11/2002	white	12	5	0.036	1	0	0	0	0	0
10/29/2002	white	1	4	0.036	1	0	0	0	0	0
05/15/2002	white	10	2	0.036	1	0	0	0	0	0

08/27/2002	white	.	2	0.036	1	0	0	0	0	0
07/01/2002	white	.	2	0.036	1	0	0	0	0	0
08/15/2002	white	.	2	0.036	1	0	0	0	0	0
07/01/2002	white	7	2	0.036	1	0	0	0	0	0
07/08/2002	white	.	4	0.036	1	0	0	0	0	0
10/21/2002	white	.	1	0.036	1	0	0	0	0	0
03/20/2002	white	1	4	0.036	1	0	0	0	0	0
08/19/2002	white	13	4	0.036	1	0	0	0	0	0
10/16/2001	white	14	2	0.036	1	0	0	0	0	0
01/15/2002	white	.	4	0.036	1	0	0	0	0	0
11/25/2002	white	5	5	0.036	1	0	0	0	0	0
11/14/2001	white	1	5	0.036	1	0	0	0	0	0
05/14/2002	white	9	2	0.036	1	0	0	0	0	0
06/27/2002	white	7	2	0.036	1	0	0	0	0	0
11/29/2001	white	18	5	0.036	1	0	0	0	0	0
11/26/2002	white	-16	5	0.036	1	0	0	0	0	0
04/29/2002	white	10	1	0.036	1	0	0	0	0	0
05/08/2002	white	.	2	0.036	1	0	0	0	0	0
11/04/2002	white	1	4	0.036	1	0	0	0	0	0
04/29/2002	white	1	5	0.036	1	0	0	0	0	0
05/13/2002	white	1	5	0.036	1	0	0	0	0	0
11/14/2001	white	.	4	0.092	2	0	0	0	0	0
11/19/2001	white	30	2	0.092	2	0	0	0	0	0
10/22/2001	white	18	5	0.092	2	0	0	0	0	0
05/06/2002	white	8	5	0.092	2	0	0	0	0	0
03/25/2002	white	.	1	0.092	2	0	0	0	0	0
10/19/2001	white	.	2	0.092	2	0	0	0	0	0
04/22/2002	white	5	2	0.092	2	0	0	0	0	0
	white	.	4	0.094	0	3	0	0	0	0
03/14/2002	white	15	5	0.143	2	0	1	0	0	0
11/04/2002	white	3	5	0.211	2	2	0	0	0	0
07/01/2002	white	3	5	0.231	3	0	0	0	0	0
03/12/2002	white	4	5	0.231	3	0	0	0	0	0
07/31/2002	white	5	4	0.231	3	0	0	0	0	0
05/22/2002	white	10	2	0.231	3	0	0	0	0	0
12/05/2002	white	.	2	0.231	3	0	0	0	0	0
05/06/2002	white	.	2	0.231	3	0	0	0	0	0
04/01/2002	white	19	2	0.231	3	0	0	0	0	0
08/20/2002	white	.	4	0.231	3	0	0	0	0	0
10/16/2002	white	12	2	0.231	3	0	0	0	0	0
01/29/2002	white	17	5	0.231	3	0	0	0	0	0
12/05/2001	white	1	5	0.231	3	0	0	0	0	0
01/07/2002	white	41	2	0.231	3	0	0	0	0	0
02/20/2002	white	.	1	0.231	3	0	0	0	0	0
05/01/2002	white	.	2	0.231	3	0	0	0	0	0
07/01/2002	white	11	1	0.231	3	0	0	0	0	0
06/17/2002	white	2	5	0.231	3	0	0	0	0	0
04/24/2002	white	.	2	0.231	3	0	0	0	0	0
07/01/2002	white	17	5	0.270	2	1	2	0	0	0
11/08/2001	white	15	4	0.385	3	0	1	0	0	0
09/09/2002	white	9	2	0.427	3	1	0	0	0	0
04/10/2002	white	.	4	0.427	3	1	0	0	0	0
01/08/2002	white	12	5	0.427	3	1	0	0	0	0
04/16/2002	white	24	5	0.427	3	1	0	0	0	0
10/09/2002	white	.	1	0.427	3	1	0	0	0	0
12/11/2001	white	60	2	0.427	3	1	0	0	0	0
06/24/2002	white	.	2	0.636	3	0	2	0	0	0
11/23/2002	white	-430	3	0.740	3	1	1	0	0	0
06/04/2002	white	7	5	0.740	3	1	1	0	0	0
12/26/2001	white	.	2	0.740	3	1	1	0	0	0
07/31/2002	white	.	1	0.749	3	1	1	0	0	0
12/28/2001	white	0	2	0.749	3	1	1	0	0	0
12/03/2002	white	.	2	0.749	3	1	1	0	0	0
08/19/2002	white	.	1	0.933	3	2	0	0	0	0
06/19/2002	white	.	2	0.933	3	2	0	0	0	0
11/11/2002	white	3.0	2	0.933	3	2	0	0	0	0
10/29/2002	white	1.0	5	0.933	3	2	0	0	0	0
07/22/2002	white	15.0	4	0.933	3	2	0	0	0	0
12/12/2001	white	10.0	4	0.933	3	2	0	0	0	0
08/08/2002	white	8.0	5	0.933	3	2	0	0	0	0
03/20/2002	white	7.0	4	0.933	3	2	0	0	0	0
04/30/2002	white	.	4	0.933	3	2	0	0	0	0
09/16/2002	white	3.0	5	1.150	3	1	2	0	0	0
09/11/2002	white	2.0	5	1.470	3	2	1	0	0	0
01/23/2002	white	21.0	4	1.470	3	2	1	0	0	0
12/26/2001	white	0.0	1	1.490	3	2	1	0	0	0
10/22/2002	white	30.0	4	1.490	3	2	1	0	0	0
02/26/2002	white	28.0	2	1.490	3	2	1	0	0	0

11/25/2002	white	.	4	1.490	3	2	1	0	0	0
06/27/2002	white	.	1	2.110	3	2	2	0	0	0
04/15/2002	white	.	4	2.110	3	2	2	0	0	0
12/12/2001	white	5.0	5	2.110	3	2	2	0	0	0
05/08/2002	white	1.0	4	2.150	3	2	2	0	0	0
12/02/2002	white	15.0	5	2.150	3	2	2	0	0	0
04/03/2002	white	.	2	2.310	3	3	0	0	0	0
11/20/2002	white	8.0	2	2.310	3	3	0	0	0	0
05/01/2002	white	.	1	2.310	3	3	0	0	0	0
09/09/2002	white	1.0	5	2.310	3	3	0	0	0	0
09/23/2002	white	5.0	5	2.310	3	3	0	0	0	0
01/23/2002	white	8.0	4	2.310	3	3	0	0	0	0
09/04/2002	white	7.0	4	2.310	3	3	0	0	0	0
10/15/2002	white	.	4	2.310	3	3	0	0	0	0
11/13/2002	white	7.0	4	2.310	3	3	0	0	0	0
11/11/2002	white	2.0	5	2.400	3	3	0	0	0	0
08/29/2002	white	5.0	2	2.400	3	3	0	0	0	0
12/17/2001	white	17.0	5	2.760	3	2	2	1	0	0
06/25/2002	white	5.0	2	3.100	3	3	0	1	0	0
06/10/2002	white	.	2	3.850	3	3	0	1	0	0
06/03/2002	white	.	1	4.270	3	3	1	0	0	0
04/09/2002	white	.	4	4.270	3	3	1	0	0	0
08/13/2002	white	.	4	4.270	3	3	1	0	0	0
09/24/2002	white	.	1	4.270	3	3	1	0	0	0
12/03/2002	white	.	1	4.270	3	3	1	0	0	0
09/16/2002	white	.	4	4.270	3	3	1	0	0	0
02/12/2002	white	4.0	4	4.270	3	3	1	0	0	0
05/30/2002	white	.	1	7.490	3	3	1	1	0	0
03/26/2002	white	.	1	7.490	3	3	1	1	0	0
10/29/2002	white	5.0	4	9.33	3	3	2	0	0	0
03/18/2002	white	1.5	4	9.33	3	3	2	0	0	0
08/26/2002	white	14.0	1	9.33	3	3	2	0	0	0
10/21/2002	white	16.0	2	9.33	3	3	2	0	0	0
08/26/2002	white	.	1	9.33	3	3	2	0	0	0
03/06/2002	white	4.0	4	9.33	3	3	2	0	0	0
02/25/2002	white	13.0	5	9.33	3	3	2	0	0	0
05/30/2002	white	28.0	2	9.33	3	3	2	0	0	0
01/29/2002	white	31.0	2	9.33	3	3	2	0	0	0
02/22/2002	white	.	5	9.33	3	3	2	0	0	0
11/11/2002	white	.	1	11.40	3	3	1	2	0	0
01/28/2002	white	33.0	2	11.40	3	3	1	2	0	0
08/06/2002	white	4.0	2	14.70	3	3	2	1	0	0
03/28/2002	white	.	4	14.70	3	3	2	1	0	0
09/10/2002	white	54.0	2	14.70	3	3	2	1	0	0
12/12/2001	white	0.0	1	14.70	3	3	2	1	0	0
06/12/2002	white	.	2	14.90	3	3	2	1	0	0
10/22/2002	white	.	2	14.90	3	3	2	1	0	0
10/30/2002	white	10.0	4	14.90	3	3	2	1	0	0
03/28/2002	white	3.0	4	21.10	3	3	2	2	0	0
10/07/2002	white	.	1	23.10	3	3	3	0	0	0
07/16/2002	white	2.0	5	23.10	3	3	3	0	0	0
06/12/2002	white	.	2	23.10	3	3	3	0	0	0
09/23/2002	white	6.0	2	23.10	3	3	3	0	0	0
03/11/2002	white	18.0	4	23.10	3	3	3	0	0	0
01/02/2002	white	.	1	23.10	3	3	3	0	0	0
03/13/2002	white	.	5	23.10	3	3	3	0	0	0
02/28/2002	white	60.0	2	23.10	3	3	3	0	0	0
11/20/2001	white	9.0	5	23.10	3	3	3	0	0	0
10/22/2002	white	2.0	5	23.10	3	3	3	0	0	0
03/14/2002	white	43.0	2	23.10	3	3	3	0	0	0
02/05/2002	white	10.0	5	23.10	3	3	3	0	0	0
04/23/2002	white	8.0	5	23.10	3	3	3	0	0	0
09/12/2002	white	5.0	5	24.00	3	3	3	0	0	0
10/17/2001	white	.	2	24.00	3	3	3	0	0	0
05/07/2002	white	9.0	5	24.00	3	3	3	0	0	0
09/24/2002	white	6.0	2	31.00	3	3	3	0	1	0
04/30/2002	white	2.0	1	42.70	3	3	3	1	0	0
	white	.	2	42.70	3	3	3	1	0	0
05/14/2002	white	4.0	4	42.70	3	3	3	1	0	0
	white	.	4	42.70	3	3	3	1	0	0
03/27/2002	white	15.0	5	42.70	3	3	3	1	0	0
08/20/2002	white	8.0	2	42.70	3	3	3	1	0	0
10/02/2002	white	.	4	42.70	3	3	3	1	0	0
05/22/2002	white	3.0	1	42.70	3	3	3	1	0	0
02/19/2002	white	6	5	42.7	3	3	3	1	0	0
11/18/2002	white	12	2	42.7	3	3	3	1	0	0
09/04/2002	white	7	2	74.0	3	3	3	1	1	0
11/18/2002	white	18	2	74.0	3	3	3	1	1	0

10/30/2002	white	3	5	93.3	3	3	3	2	0	0
11/04/2002	white	5	5	93.3	3	3	3	2	0	0
10/01/2002	white	3	4	93.3	3	3	3	2	0	0
09/18/2002	white	60	2	93.3	3	3	3	2	0	0
10/08/2002	white	5	5	93.3	3	3	3	2	0	0
09/09/2002	white	.	1	93.3	3	3	3	2	0	0
07/30/2002	white	52	2	93.3	3	3	3	2	0	0
06/05/2002	white	.	1	93.3	3	3	3	2	0	0
10/17/2002	white	10	2	93.3	3	3	3	2	0	0
09/25/2002	white	.	2	93.3	3	3	3	2	0	0
08/20/2002	white	2	2	149.0	3	3	3	2	1	0
11/04/2002	white	3	5	231.0	3	3	3	3	0	0
10/31/2001	white	14	4	231.0	3	3	3	3	0	0
03/19/2002	white	1	5	231.0	3	3	3	3	0	0
06/04/2002	white	3	2	231.0	3	3	3	3	0	0
09/17/2002	white	3	2	231.0	3	3	3	3	0	0
08/26/2002	white	1	5	240.0	3	3	3	3	0	0
09/16/2002	white	17	2	240.0	3	3	3	3	0	0
06/13/2002	white	3	5	240.0	3	3	3	3	0	0
10/09/2002	white	6	5	240.0	3	3	3	3	0	0
07/09/2002	white	7	2	427.0	3	3	3	3	1	0
09/18/2002	white	.	2	427.0	3	3	3	3	1	0
07/10/2002	white	3	4	427.0	3	3	3	3	1	0
10/16/2001	white	4	5	427.0	3	3	3	3	1	0
04/18/2002	white	2	5	427.0	3	3	3	3	1	0
05/30/2002	white	.	1	427.0	3	3	3	3	1	0
10/16/2001	white	12	2	427.0	3	3	3	3	1	0
11/19/2001	white	.	3	427.0	3	3	3	3	1	0
07/01/2002	white	.	5	427.0	3	3	3	3	1	0
05/16/2002	white	5	5	933.0	3	3	3	3	2	0
03/27/2002	white	.	2	933.0	3	3	3	3	2	0
09/05/2002	white	7	2	933.0	3	3	3	3	2	0
03/06/2002	white	5	5	933.0	3	3	3	3	2	0
11/20/2002	white	7	5	933.0	3	3	3	3	2	0
05/21/2002	white	.	4	2400.0	3	3	3	3	3	0
10/15/2002	white	10	2	23100.0	3	3	3	3	3	3

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

------------------------------------ Type = Whole ------------------------------------

Week of	Type	Age of Egg	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
03/25/2002	whole	4	5	0	0	0	0	0	0	0
12/09/2002	whole	30	5	0	0	0	0	0	0	0
02/13/2002	whole	6	2	0	0	0	0	0	0	0
11/06/2001	whole	.	2	0	0	0	0	0	0	0
01/22/2002	whole	.	2	0	0	0	0	0	0	0
10/21/2002	whole	.	2	0	0	0	0	0	0	0
11/01/2001	whole	.	2	0	0	0	0	0	0	0
01/17/2002	whole	.	2	0	0	0	0	0	0	0
06/19/2002	whole	.	2	0	0	0	0	0	0	0
02/18/2002	whole	.	2	0	0	0	0	0	0	0
04/22/2002	whole	.	2	0	0	0	0	0	0	0
06/10/2002	whole	10	1	0	0	0	0	0	0	0
01/17/2002	whole	.	2	0	0	0	0	0	0	0
02/06/2002	whole	5	2	0	0	0	0	0	0	0
12/10/2001	whole	10	5	0	0	0	0	0	0	0
10/16/2002	whole	1	5	0	0	0	0	0	0	0
10/08/2002	whole	6	5	0	0	0	0	0	0	0
02/22/2002	whole	7	4	0	0	0	0	0	0	0
06/17/2002	whole	14	3	0	0	0	0	0	0	0
07/29/2002	whole	14	5	0	0	0	0	0	0	0
09/30/2002	whole	14	3	0	0	0	0	0	0	0
07/02/2002	whole	4	1	0	0	0	0	0	0	0
11/04/2002	whole	10	2	0	0	0	0	0	0	0
08/29/2002	whole	14	2	0	0	0	0	0	0	0
12/11/2002	whole	15	2	0	0	0	0	0	0	0
06/18/2002	whole	10	4	0	0	0	0	0	0	0
12/03/2001	whole	16	5	0	0	0	0	0	0	0
09/12/2002	whole	7	4	0	0	0	0	0	0	0
07/08/2002	whole	12	2	0	0	0	0	0	0	0
08/12/2002	whole	12	2	0	0	0	0	0	0	0
09/09/2002	whole	16	2	0	0	0	0	0	0	0
05/15/2002	whole	5	2	0	0	0	0	0	0	0
07/11/2002	whole	13	4	0	0	0	0	0	0	0
09/05/2002	whole	13	2	0	0	0	0	0	0	0

03/05/2002	whole	7	2	0	0	0	0	0	0	0
04/02/2002	whole	4	2	0	0	0	0	0	0	0
05/29/2002	whole	4	2	0	0	0	0	0	0	0
03/11/2002	whole	12	5	0	0	0	0	0	0	0
04/01/2002	whole	13	5	0	0	0	0	0	0	0
07/29/2002	whole	14	5	0	0	0	0	0	0	0
10/21/2002	whole	12	5	0	0	0	0	0	0	0
06/04/2002	whole	14	4	0	0	0	0	0	0	0
04/15/2002	whole	2	2	0	0	0	0	0	0	0
03/13/2002	whole	.	2	0	0	0	0	0	0	0
05/08/2002	whole	.	2	0	0	0	0	0	0	0
11/11/2002	whole	1	5	0	0	0	0	0	0	0
03/27/2002	whole	1	5	0.000	0	0	0	0	0	0
10/30/2002	whole	1	4	0.000	0	0	0	0	0	0
07/01/2002	whole	1	5	0.000	0	0	0	0	0	0
11/04/2002	whole	1	5	0.000	0	0	0	0	0	0
03/06/2002	whole	1	5	0.000	0	0	0	0	0	0
04/18/2002	whole	1	5	0.000	0	0	0	0	0	0
07/18/2002	whole	1	5	0.000	0	0	0	0	0	0
12/27/2001	whole	.	2	0.036	1	0	0	0	0	0
12/09/2002	whole	9	2	0.036	1	0	0	0	0	0
09/09/2002	whole	12	2	0.036	1	0	0	0	0	0
11/21/2002	whole	14	4	0.036	1	0	0	0	0	0
05/22/2002	whole	8	5	0.036	1	0	0	0	0	0
06/11/2002	whole	8	5	0.036	1	0	0	0	0	0
04/10/2002	whole	.	2	0.036	1	0	0	0	0	0
04/16/2002	whole	1	5	0.036	1	0	0	0	0	0
09/11/2002	whole	1	5	0.036	1	0	0	0	0	0
	whole	.	5	0.074	1	1	0	0	0	0
03/19/2002	whole	.	1	0.074	1	1	0	0	0	0
01/08/2002	whole	.	2	0.092	2	0	0	0	0	0
02/28/2002	whole	.	2	0.092	2	0	0	0	0	0
12/11/2002	whole	2	5	0.092	2	0	0	0	0	0
12/05/2002	whole	.	2	0.092	2	0	0	0	0	0
12/17/2001	whole	14	5	0.092	2	0	0	0	0	0
06/10/2002	whole	2	5	0.092	2	0	0	0	0	0
	whole	.	2	0.092	2	0	0	0	0	0
11/05/2002	whole	.	4	0.092	2	0	0	0	0	0
06/11/2002	whole	60	2	0.092	2	0	0	0	0	0
10/16/2002	whole	1	5	0.092	2	0	0	0	0	0
03/12/2002	whole	1	5	0.092	2	0	0	0	0	0
03/25/2002	whole	4	2	0.114	1	2	0	0	0	0
01/03/2002	whole	8	2	0.147	2	1	0	0	0	0
11/14/2001	whole	1	1	0.147	2	1	0	0	0	0
01/04/2002	whole	1	1	0.147	2	1	0	0	0	0
05/06/2002	whole	1	5	0.147	2	1	0	0	0	0
11/19/2002	whole	1	1	0.205	2	1	1	0	0	0
05/07/2002	whole	.	1	0.211	2	2	0	0	0	0
11/06/2001	whole	1	5	0.231	3	0	0	0	0	0
12/04/2002	whole	24	5	0.231	3	0	0	0	0	0
05/29/2002	whole	.	2	0.231	3	0	0	0	0	0
10/18/2001	whole	.	2	0.231	3	0	0	0	0	0
08/14/2002	whole	4	2	0.231	3	0	0	0	0	0
12/26/2001	whole	4	1	0.231	3	0	0	0	0	0
09/02/2002	whole	.	1	0.231	3	0	0	0	0	0
04/30/2002	whole	30	5	0.231	3	0	0	0	0	0
07/22/2002	whole	5	5	0.231	3	0	0	0	0	0
05/29/2002	whole	5	2	0.231	3	0	0	0	0	0
06/03/2002	whole	4	5	0.231	3	0	0	0	0	0
05/29/2002	whole	8	4	0.231	3	0	0	0	0	0
12/10/2002	whole	5	4	0.231	3	0	0	0	0	0
12/12/2002	whole	1	4	0.231	3	0	0	0	0	0
10/03/2002	whole	60	2	0.310	3	0	1	0	0	0
06/26/2002	whole	15	2	0.385	3	0	1	0	0	0
11/06/2001	whole	14	4	0.385	3	0	1	0	0	0
04/29/2002	whole	8	4	0.385	3	0	1	0	0	0
10/30/2002	whole	2	5	0.427	3	1	0	0	0	0
12/19/2001	whole	4	2	0.427	3	1	0	0	0	0
01/21/2002	whole	.	2	0.427	3	1	0	0	0	0
09/03/2002	whole	1	5	0.427	3	1	0	0	0	0
03/06/2002	whole	1	5	0.427	3	1	0	0	0	0
01/08/2002	whole	1	4	0.620	3	0	2	0	0	0
12/26/2001	whole	.	4	0.933	3	2	0	0	0	0
08/06/2002	whole	1	5	0.933	3	2	0	0	0	0
	whole	.	4	0.933	3	2	0	0	0	0
10/17/2001	whole	7	2	0.933	3	2	0	0	0	0
04/23/2002	whole	14	4	0.933	3	2	0	0	0	0
08/05/2002	whole	.	2	0.933	3	2	0	0	0	0

08/07/2002	whole	1	5	0.933	3	2	0	0	0	0
06/10/2002	whole	3	2	0.933	3	2	0	0	0	0
12/10/2002	whole	6	1	0.933	3	2	0	0	0	0
10/16/2002	whole	3	2	0.933	3	2	0	0	0	0
10/22/2002	whole	60	3	0.933	3	2	0	0	0	0
05/22/2002	whole	5	2	0.933	3	2	0	0	0	0
12/03/2002	whole	1	5	0.933	3	2	0	0	0	0
03/28/2002	whole	3	4	1.490	3	2	1	0	0	0
09/25/2002	whole	.	1	1.490	3	2	1	0	0	0
04/02/2002	whole	1	2	1.490	3	2	1	0	0	0
04/09/2002	whole	1	5	1.490	3	2	1	0	0	0
03/18/2002	whole	2	5	2.110	3	2	2	0	0	0
09/16/2002	whole	.	1	2.150	3	2	2	0	0	0
02/14/2002	whole	.	1	2.150	3	2	2	0	0	0
11/25/2002	whole	15	4	2.150	3	2	2	0	0	0
10/29/2002	whole	2	2	2.150	3	2	2	0	0	0
01/02/2002	whole	.	2	2.310	3	3	0	0	0	0
02/07/2002	whole	3	5	2.310	3	3	0	0	0	0
01/04/2002	whole	2	1	2.310	3	3	0	0	0	0
10/24/2001	whole	5	4	2.310	3	3	0	0	0	0
11/12/2002	whole	6	5	2.310	3	3	0	0	0	0
05/08/2002	whole	.	2	2.310	3	3	0	0	0	0
04/03/2002	whole	13	5	2.310	3	3	0	0	0	0
04/11/2002	whole	2	5	2.310	3	3	0	0	0	0
07/23/2002	whole	1	4	2.31	3	3	0	0	0	0
04/03/2002	whole	10	5	2.40	3	3	0	0	0	0
12/11/2001	whole	30	4	2.86	3	2	3	0	0	0
12/12/2001	whole	10	4	2.86	3	2	3	0	0	0
11/25/2002	whole	15	5	2.86	3	2	3	0	0	0
09/19/2002	whole	6	2	3.10	3	3	0	1	0	0
05/22/2002	whole	5	4	3.85	3	3	0	1	0	0
12/18/2001	whole	10	2	3.85	3	3	0	1	0	0
08/19/2002	whole	1	5	4.27	3	3	1	0	0	0
09/04/2002	whole	4	4	4.27	3	3	1	0	0	0
11/20/2001	whole	6	2	4.27	3	3	1	0	0	0
05/01/2002	whole	0	1	4.27	3	3	1	0	0	0
	whole	.	4	4.27	3	3	1	0	0	0
07/17/2002	whole	2	4	4.27	3	3	1	0	0	0
10/29/2002	whole	6	1	4.27	3	3	1	0	0	0
09/24/2002	whole	6	2	4.27	3	3	1	0	0	0
05/14/2002	whole	2	2	4.27	3	3	1	0	0	0
06/10/2002	whole	.	5	4.27	3	3	1	0	0	0
06/18/2002	whole	.	1	4.27	3	3	1	0	0	0
	whole	.	1	4.27	3	3	1	0	0	0
05/13/2002	whole	1	5	4.27	3	3	1	0	0	0
09/23/2002	whole	8	2	7.40	3	3	1	1	0	0
08/13/2002	whole	.	1	7.40	3	3	1	1	0	0
01/15/2002	whole	30	4	9.20	3	3	2	0	0	0
08/12/2002	whole	6	4	9.33	3	3	2	0	0	0
02/19/2002	whole	1	4	9.33	3	3	2	0	0	0
01/16/2002	whole	7	4	9.33	3	3	2	0	0	0
02/05/2002	whole	7	4	9.33	3	3	2	0	0	0
01/08/2002	whole	12	2	9.33	3	3	2	0	0	0
02/06/2002	whole	.	2	9.33	3	3	2	0	0	0
04/23/2002	whole	.	2	9.33	3	3	2	0	0	0
11/18/2002	whole	7	2	9.33	3	3	2	0	0	0
01/15/2002	whole	.	5	9.33	3	3	2	0	0	0
09/05/2002	whole	25	4	9.33	3	3	2	0	0	0
12/05/2002	whole	2	1	9.33	3	3	2	0	0	0
09/03/2002	whole	9	5	9.33	3	3	2	0	0	0
04/02/2002	whole	7	5	9.33	3	3	2	0	0	0
10/02/2002	whole	12	5	9.33	3	3	2	0	0	0
07/31/2002	whole	1	5	9.33	3	3	2	0	0	0
06/24/2002	whole	2	4	9.33	3	3	2	0	0	0
03/19/2002	whole	10	4	14.70	3	3	2	1	0	0
08/29/2002	whole	2	4	14.70	3	3	2	1	0	0
	whole	.	1	14.70	3	3	2	1	0	0
10/07/2002	whole	49	2	14.70	3	3	2	1	0	0
08/21/2002	whole	.	1	14.90	3	3	2	1	0	0
06/05/2002	whole	.	2	14.9	3	3	2	1	0	0
04/16/2002	whole	.	1	21.1	3	3	2	2	0	0
12/10/2001	whole	5	5	21.5	3	3	2	2	0	0
03/13/2002	whole	0	2	23.1	3	3	3	0	0	0
04/16/2002	whole	4	5	23.1	3	3	3	0	0	0
11/11/2002	whole	3	5	23.1	3	3	3	0	0	0
05/07/2002	whole	4	4	23.1	3	3	3	0	0	0
04/24/2002	whole	.	2	23.1	3	3	3	0	0	0
08/29/2002	whole	7	2	23.1	3	3	3	0	0	0

09/30/2002	whole	5	2	23.1	3	3	3	0	0	0
04/30/2002	whole	.	1	23.1	3	3	3	0	0	0
	whole	.	1	23.1	3	3	3	0	0	0
12/03/2002	whole	1	5	23.1	3	3	3	0	0	0
08/06/2002	whole	.	1	23.1	3	3	3	0	0	0
12/04/2002	whole	.	1	23.1	3	3	3	0	0	0
11/29/2001	whole	60	4	23.1	3	3	3	0	0	0
09/23/2002	whole	13	4	23.1	3	3	3	0	0	0
05/02/2002	whole	15	4	23.1	3	3	3	0	0	0
10/23/2002	whole	7	4	23.1	3	3	3	0	0	0
04/09/2002	whole	5	1	23.1	3	3	3	0	0	0
08/13/2002	whole	2	5	23.1	3	3	3	0	0	0
08/07/2002	whole	2	5	23.1	3	3	3	0	0	0
07/24/2002	whole	.	1	23.1	3	3	3	0	0	0
03/05/2002	whole	7	1	23.1	3	3	3	0	0	0
07/18/2002	whole	10	1	23.1	3	3	3	0	0	0
05/13/2002	whole	21	2	23.1	3	3	3	0	0	0
04/03/2002	whole	.	1	23.1	3	3	3	0	0	0
10/21/2002	whole	.	1	23.1	3	3	3	0	0	0
02/12/2002	whole	10	2	31.0	3	3	3	0	1	0
05/21/2002	whole	4	5	42.7	3	3	3	1	0	0
04/16/2002	whole	.	1	42.7	3	3	3	1	0	0
06/03/2002	whole	.	1	42.7	3	3	3	1	0	0
11/18/2002	whole	11	4	42.7	3	3	3	1	0	0
01/28/2002	whole	1	5	42.7	3	3	3	1	0	0
12/05/2001	whole	14	4	42.7	3	3	3	1	0	0
08/21/2002	whole	14	2	42.7	3	3	3	1	0	0
10/24/2001	whole	5	5	42.7	3	3	3	1	0	0
07/31/2002	whole	.	1	42.7	3	3	3	1	0	0
12/26/2001	whole	4	4	42.7	3	3	3	1	0	0
05/27/2002	whole	15	4	42.7	3	3	3	1	0	0
10/09/2002	whole	.	1	42.7	3	3	3	1	0	0
06/17/2002	whole	18	2	42.7	3	3	3	1	0	0
07/31/2002	whole	25	2	42.7	3	3	3	1	0	0
10/22/2002	whole	6	2	42.7	3	3	3	1	0	0
10/30/2002	whole	5	5	42.7	3	3	3	1	0	0
08/14/2002	whole	.	2	42.7	3	3	3	1	0	0
07/25/2002	whole	.	2	42.7	3	3	3	1	0	0
09/18/2002	whole	2	5	42.7	3	3	3	1	0	0
10/22/2002	whole	9	2	42.7	3	3	3	1	0	0
11/20/2001	whole	7	5	74.0	3	3	3	1	1	0
03/18/2002	whole	1	5	74.0	3	3	3	1	1	0
05/01/2002	whole	7	2	74.9	3	3	3	1	1	0
03/05/2002	whole	3	5	93.3	3	3	3	2	0	0
11/19/2001	whole	10	5	93.3	3	3	3	2	0	0
06/24/2002	whole	9	4	93.3	3	3	3	2	0	0
01/07/2002	whole	15	2	93.3	3	3	3	2	0	0
11/29/2001	whole	8	4	93.3	3	3	3	2	0	0
08/19/2002	whole	.	1	93.3	3	3	3	2	0	0
06/25/2002	whole	6	1	93.3	3	3	3	2	0	0
03/19/2002	whole	50	3	93.3	3	3	3	2	0	0
08/07/2002	whole	10	4	114.0	3	3	3	1	2	0
01/03/2002	whole	2	4	115.0	3	3	3	1	2	0
08/13/2002	whole	1	1	147.0	3	3	3	2	1	0
10/21/2002	whole	.	2	149.0	3	3	3	2	1	0
08/13/2002	whole	.	2	149.0	3	3	3	2	1	0
08/27/2002	whole	.	2	231.0	3	3	3	3	0	0
12/04/2002	whole	9	1	231.0	3	3	3	3	0	0
04/17/2002	whole	5	2	231.0	3	3	3	3	0	0
10/09/2002	whole	60	2	231.0	3	3	3	3	0	0
11/26/2001	whole	8	2	231.0	3	3	3	3	0	0
06/20/2002	whole	.	1	231.0	3	3	3	3	0	0
05/21/2002	whole	.	1	231.0	3	3	3	3	0	0
11/13/2002	whole	3	5	231.0	3	3	3	3	0	0
12/05/2001	whole	12	4	231.0	3	3	3	3	0	0
07/16/2002	whole	10	2	231.0	3	3	3	3	0	0
08/05/2002	whole	14	2	231.0	3	3	3	3	0	0
10/07/2002	whole	5	2	231.0	3	3	3	3	0	0
05/20/2002	whole	2	4	231.0	3	3	3	3	0	0
10/15/2002	whole	4	4	240.0	3	3	3	3	0	0
02/04/2002	whole	30	3	240.0	3	3	3	3	0	0
02/25/2002	whole	30	5	385.0	3	3	3	3	0	1
04/23/2002	whole	4	4	427.0	3	3	3	3	1	0
11/12/2002	whole	6	4	427.0	3	3	3	3	1	0
01/31/2002	whole	10	2	427.0	3	3	3	3	1	0
09/18/2002	whole	.	2	427.0	3	3	3	3	1	0
11/14/2002	whole	3	2	427.0	3	3	3	3	1	0
05/02/2002	whole	.	2	427.0	3	3	3	3	1	0

10/16/2002	whole	27	4	427.0	3	3	3	3	1	0
10/02/2002	whole	50	2	427.0	3	3	3	3	1	0
10/07/2002	whole	.	2	427.0	3	3	3	3	1	0
08/26/2002	whole	2	5	427	3	3	3	3	1	0
05/13/2002	whole	1	4	749	3	3	3	3	1	1
01/09/2002	whole	.	4	749	3	3	3	3	1	1
06/05/2002	whole	.	2	749	3	3	3	3	1	1
10/17/2001	whole	5	2	933	3	3	3	3	2	0
02/27/2002	whole	12	2	933	3	3	3	3	2	0
01/28/2002	whole	.	2	933	3	3	3	3	2	0
11/04/2002	whole	5	1	933	3	3	3	3	2	0
09/24/2002	whole	11	2	933	3	3	3	3	2	0
11/07/2001	whole	2	4	933	3	3	3	3	2	0
12/03/2002	whole	5	5	933	3	3	3	3	2	0
04/08/2002	whole	7	1	933	3	3	3	3	2	0
09/30/2002	whole	.	2	933	3	3	3	3	2	0
06/24/2002	whole	.	1	933	3	3	3	3	2	0
06/19/2002	whole	7	5	933	3	3	3	3	2	0
03/05/2002	whole	6	5	933	3	3	3	3	2	0
09/12/2002	whole	26	5	933	3	3	3	3	2	0
02/26/2002	whole	10	5	1490	3	3	3	3	2	1
11/20/2002	whole	.	2	2150	3	3	3	3	2	2
12/11/2002	whole	11	1	2400	3	3	3	3	3	0
11/26/2002	whole	8	2	2400	3	3	3	3	3	0
02/11/2002	whole	14	2	2400	3	3	3	3	3	0
01/23/2002	whole	21	4	2400	3	3	3	3	3	0
07/17/2002	whole	15	2	2400	3	3	3	3	3	0
03/19/2002	whole	3	2	2400	3	3	3	3	3	0
08/05/2002	whole	6	5	4620	3	3	3	3	3	1
04/23/2002	whole	20	2	9330	3	3	3	3	3	2
10/24/2001	whole	14	5	>11000	3	3	3	3	3	3

MPN Values and Assigned Pattern of Positive Tubes Used in Analysis

------------------------------------- Type = Yolk -------------------------------------

Week of	Type	Age of Egg	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
04/15/2002	yolk	.	2	0	0	0	0	0	0	0
08/26/2002	yolk	49	2	0	0	0	0	0	0	0
11/15/2001	yolk	5	5	0	0	0	0	0	0	0
02/12/2002	yolk	2	5	0	0	0	0	0	0	0
03/27/2002	yolk	7	5	0	0	0	0	0	0	0
05/13/2002	yolk	.	1	0	0	0	0	0	0	0
12/05/2001	yolk	3	2	0	0	0	0	0	0	0
01/16/2002	yolk	4	2	0	0	0	0	0	0	0
07/15/2002	yolk	6	2	0	0	0	0	0	0	0
12/26/2001	yolk	.	2	0	0	0	0	0	0	0
04/23/2002	yolk	.	2	0	0	0	0	0	0	0
05/22/2002	yolk	.	2	0	0	0	0	0	0	0
07/09/2002	yolk	.	2	0	0	0	0	0	0	0
10/14/2002	yolk	.	2	0	0	0	0	0	0	0
12/04/2002	yolk	.	2	0	0	0	0	0	0	0
05/29/2002	yolk	.	2	0	0	0	0	0	0	0
06/10/2002	yolk	2	2	0	0	0	0	0	0	0
08/14/2002	yolk	21	5	0	0	0	0	0	0	0
11/13/2002	yolk	3	5	0	0	0	0	0	0	0
11/07/2002	yolk	7	1	0	0	0	0	0	0	0
10/28/2002	yolk	14	3	0	0	0	0	0	0	0
06/13/2002	yolk	15	4	0	0	0	0	0	0	0
07/17/2002	yolk	2	4	0	0	0	0	0	0	0
06/18/2002	yolk	10	5	0	0	0	0	0	0	0
07/01/2002	yolk	.	4	0	0	0	0	0	0	0
08/01/2002	yolk	11	5	0	0	0	0	0	0	0
10/15/2001	yolk	5	2	0	0	0	0	0	0	0
11/12/2001	yolk	7	2	0	0	0	0	0	0	0
11/19/2002	yolk	7	2	0	0	0	0	0	0	0
12/10/2002	yolk	32	2	0	0	0	0	0	0	0
01/09/2002	yolk	6	2	0	0	0	0	0	0	0
06/26/2002	yolk	4	2	0	0	0	0	0	0	0
07/23/2002	yolk	.	1	0	0	0	0	0	0	0
10/22/2001	yolk	12	2	0	0	0	0	0	0	0
01/21/2002	yolk	6	2	0	0	0	0	0	0	0
03/04/2002	yolk	11	2	0	0	0	0	0	0	0
05/20/2002	yolk	21	2	0	0	0	0	0	0	0
06/17/2002	yolk	9	2	0	0	0	0	0	0	0
08/26/2002	yolk	14	2	0	0	0	0	0	0	0

09/23/2002	yolk	14	2	0	0	0	0	0	0	0
10/21/2002	yolk	9	2	0	0	0	0	0	0	0
11/14/2001	yolk	13	2	0	0	0	0	0	0	0
05/15/2002	yolk	2	5	0	0	0	0	0	0	0
08/12/2002	yolk	10	2	0	0	0	0	0	0	0
10/01/2002	yolk	7	2	0	0	0	0	0	0	0
11/07/2001	yolk	.	2	0	0	0	0	0	0	0
08/19/2002	yolk	.	5	0.000	0	0	0	0	0	0
12/10/2001	yolk	8	2	0.000	0	0	0	0	0	0
07/25/2002	yolk	8	2	0.000	0	0	0	0	0	0
11/19/2002	yolk	5	2	0.000	0	0	0	0	0	0
05/22/2002	yolk	.	2	0.000	0	0	0	0	0	0
08/05/2002	yolk	.	2	0.000	0	0	0	0	0	0
12/26/2001	yolk	.	4	0.000	0	0	0	0	0	0
10/19/2001	yolk	1	5	0.000	0	0	0	0	0	0
11/19/2001	yolk	1	5	0.000	0	0	0	0	0	0
12/10/2001	yolk	4	5	0.000	0	0	0	0	0	0
01/28/2002	yolk	5	2	0.000	0	0	0	0	0	0
01/07/2002	yolk	4	5	0.000	0	0	0	0	0	0
02/26/2002	yolk	4	2	0.000	0	0	0	0	0	0
05/13/2002	yolk	1	2	0.000	0	0	0	0	0	0
05/28/2002	yolk	4	2	0.000	0	0	0	0	0	0
09/17/2002	yolk	2	2	0.000	0	0	0	0	0	0
11/18/2002	yolk	6	2	0.000	0	0	0	0	0	0
12/17/2001	yolk	1	5	0.000	0	0	0	0	0	0
04/11/2002	yolk	3	5	0.000	0	0	0	0	0	0
07/22/2002	yolk	1	5	0.000	0	0	0	0	0	0
12/10/2002	yolk	5	4	0.000	0	0	0	0	0	0
10/02/2002	yolk	1	4	0.000	0	0	0	0	0	0
10/30/2001	yolk	1	5	0.000	0	0	0	0	0	0
02/26/2002	yolk	1	5	0.000	0	0	0	0	0	0
07/31/2002	yolk	1	5	0.000	0	0	0	0	0	0
11/11/2002	yolk	1	5	0.000	0	0	0	0	0	0
08/12/2002	yolk	1	5	0.031	0	1	0	0	0	0
05/28/2002	yolk	.	1	0.036	1	0	0	0	0	0
08/13/2002	yolk	16	2	0.036	1	0	0	0	0	0
03/18/2002	yolk	4	2	0.036	1	0	0	0	0	0
09/09/2002	yolk	1	2	0.036	1	0	0	0	0	0
12/03/2001	yolk	1	5	0.036	1	0	0	0	0	0
02/19/2002	yolk	1	5	0.074	1	1	0	0	0	0
09/16/2002	yolk	5	5	0.092	2	0	0	0	0	0
12/05/2002	yolk	4	5	0.092	2	0	0	0	0	0
03/13/2002	yolk	.	1	0.092	2	0	0	0	0	0
11/04/2002	yolk	.	1	0.092	2	0	0	0	0	0
06/04/2002	yolk	30	2	0.092	2	0	0	0	0	0
02/19/2002	yolk	.	2	0.092	2	0	0	0	0	0
11/04/2002	yolk	.	1	0.092	2	0	0	0	0	0
10/07/2002	yolk	3	2	0.092	2	0	0	0	0	0
06/25/2002	yolk	2	5	0.092	2	0	0	0	0	0
06/13/2002	yolk	1	4	0.092	2	0	0	0	0	0
06/24/2002	yolk	3	1	0.147	2	1	0	0	0	0
10/29/2002	yolk	5	4	0.147	2	1	0	0	0	0
11/20/2001	yolk	3.0	5	0.231	3	0	0	0	0	0
08/13/2002	yolk	1.0	5	0.231	3	0	0	0	0	0
08/26/2002	yolk	16.0	2	0.231	3	0	0	0	0	0
07/09/2002	yolk	.	2	0.231	3	0	0	0	0	0
03/05/2002	yolk	.	1	0.231	3	0	0	0	0	0
09/16/2002	yolk	1.0	5	0.310	3	0	1	0	0	0
10/14/2002	yolk	2.0	4	0.385	3	0	1	0	0	0
04/15/2002	yolk	.	1	0.427	3	1	0	0	0	0
06/11/2002	yolk	4.5	5	0.427	3	1	0	0	0	0
09/09/2002	yolk	27.0	2	0.427	3	1	0	0	0	0
08/19/2002	yolk	2.0	5	0.427	3	1	0	0	0	0
11/11/2002	yolk	13.0	4	0.427	3	1	0	0	0	0
07/23/2002	yolk	20.0	3	0.427	3	1	0	0	0	0
03/27/2002	yolk	12.0	5	0.427	3	1	0	0	0	0
05/09/2002	yolk	.	1	0.427	3	1	0	0	0	0
05/20/2002	yolk	21.0	2	0.427	3	1	0	0	0	0
01/02/2002	yolk	.	2	0.427	3	1	0	0	0	0
01/22/2002	yolk	1.0	5	0.427	3	1	0	0	0	0
08/05/2002	yolk	1.0	5	0.427	3	1	0	0	0	0
03/19/2002	yolk	1.0	5	0.427	3	1	0	0	0	0
10/21/2002	yolk	9.0	2	0.427	3	1	0	0	0	0
08/08/2002	yolk	60.0	2	0.749	3	1	1	0	0	0
06/24/2002	yolk	.	2	0.749	3	1	1	0	0	0
01/09/2002	yolk	8.0	5	0.933	3	2	0	0	0	0
11/04/2002	yolk	5.0	2	0.933	3	2	0	0	0	0
06/06/2002	yolk	60.0	4	0.933	3	2	0	0	0	0

10/07/2002	yolk	14.0	5	0.933	3	2	0	0	0	0
08/20/2002	yolk	.	1	0.933	3	2	0	0	0	0
03/13/2002	yolk	7.0	4	0.933	3	2	0	0	0	0
06/04/2002	yolk	.	2	0.933	3	2	0	0	0	0
10/30/2001	yolk	8.0	5	0.933	3	2	0	0	0	0
07/01/2002	yolk	1.0	5	0.933	3	2	0	0	0	0
12/02/2002	yolk	15.0	4	1.470	3	2	1	0	0	0
12/11/2002	yolk	14.0	3	1.470	3	2	1	0	0	0
02/21/2002	yolk	.	2	1.470	3	2	1	0	0	0
06/11/2002	yolk	5.0	2	1.490	3	2	1	0	0	0
08/28/2002	yolk	8.0	2	1.490	3	2	1	0	0	0
07/23/2002	yolk	4.0	2	2.110	3	2	2	0	0	0
12/05/2001	yolk	.	2	2.110	3	2	2	0	0	0
10/07/2002	yolk	3.0	5	2.150	3	2	2	0	0	0
06/24/2002	yolk	.	1	2.150	3	2	2	0	0	0
02/12/2002	yolk	1.0	5	2.150	3	2	2	0	0	0
08/12/2002	yolk	1.0	1	2.310	3	3	0	0	0	0
12/26/2001	yolk	1.0	1	2.310	3	3	0	0	0	0
04/16/2002	yolk	5.0	4	2.310	3	3	0	0	0	0
05/13/2002	yolk	2	4	2.31	3	3	0	0	0	0
11/26/2002	yolk	4	1	2.31	3	3	0	0	0	0
09/16/2002	yolk	8	4	2.31	3	3	0	0	0	0
04/01/2002	yolk	17	2	2.31	3	3	0	0	0	0
03/12/2002	yolk	1	5	2.31	3	3	0	0	0	0
01/07/2002	yolk	1	5	2.31	3	3	0	0	0	0
05/07/2002	yolk	.	2	3.10	3	3	0	1	0	0
11/13/2002	yolk	2	5	4.27	3	3	1	0	0	0
12/19/2001	yolk	14	4	4.27	3	3	1	0	0	0
05/20/2002	yolk	.	1	4.27	3	3	1	0	0	0
10/21/2002	yolk	16	2	4.27	3	3	1	0	0	0
05/01/2002	yolk	11	4	4.27	3	3	1	0	0	0
04/03/2002	yolk	10	5	4.27	3	3	1	0	0	0
05/29/2002	yolk	19	2	4.27	3	3	1	0	0	0
03/11/2002	yolk	5	2	4.27	3	3	1	0	0	0
10/22/2002	yolk	6	1	4.27	3	3	1	0	0	0
11/13/2002	yolk	7	2	7.49	3	3	1	1	0	0
02/05/2002	yolk	5	2	9.33	3	3	2	0	0	0
03/06/2002	yolk	6	2	9.33	3	3	2	0	0	0
06/24/2002	yolk	5	4	9.33	3	3	2	0	0	0
08/21/2002	yolk	5	2	9.33	3	3	2	0	0	0
06/13/2002	yolk	7	5	9.33	3	3	2	0	0	0
07/17/2002	yolk	1	4	9.33	3	3	2	0	0	0
	yolk	.	2	14.90	3	3	2	1	0	0
11/23/2001	yolk	.	1	21.50	3	3	2	2	0	0
07/24/2002	yolk	3	5	23.10	3	3	3	0	0	0
03/14/2002	yolk	3	5	23.10	3	3	3	0	0	0
09/23/2002	yolk	5	4	23.10	3	3	3	0	0	0
11/05/2002	yolk	4	2	23.10	3	3	3	0	0	0
06/18/2002	yolk	5	4	23.10	3	3	3	0	0	0
11/04/2002	yolk	.	2	23.10	3	3	3	0	0	0
04/23/2002	yolk	.	1	23.10	3	3	3	0	0	0
02/12/2002	yolk	12	5	23.10	3	3	3	0	0	0
03/27/2002	yolk	8	5	23.10	3	3	3	0	0	0
09/09/2002	yolk	23	5	24.00	3	3	3	0	0	0
05/08/2002	yolk	.	2	24.00	3	3	3	0	0	0
11/26/2002	yolk	1	5	38.50	3	3	3	0	1	0
10/14/2002	yolk	.	1	38.50	3	3	3	0	1	0
11/20/2002	yolk	3	5	42.70	3	3	3	1	0	0
08/20/2002	yolk	2	1	42.70	3	3	3	1	0	0
03/26/2002	yolk	5	4	42.70	3	3	3	1	0	0
09/09/2002	yolk	7	4	42.70	3	3	3	1	0	0
09/17/2002	yolk	.	1	42.70	3	3	3	1	0	0
04/23/2002	yolk	17	2	42.70	3	3	3	1	0	0
08/27/2002	yolk	14	4	42.70	3	3	3	1	0	0
12/10/2002	yolk	.	1	42.7	3	3	3	1	0	0
03/27/2002	yolk	5	1	42.7	3	3	3	1	0	0
04/29/2002	yolk	31	5	42.7	3	3	3	1	0	0
05/30/2002	yolk	9	5	42.7	3	3	3	1	0	0
06/06/2002	yolk	7	5	42.7	3	3	3	1	0	0
08/20/2002	yolk	.	1	42.7	3	3	3	1	0	0
07/15/2002	yolk	14	5	42.7	3	3	3	1	0	0
07/25/2002	yolk	.	5	42.7	3	3	3	1	0	0
11/06/2002	yolk	.	2	42.7	3	3	3	1	0	0
07/01/2002	yolk	2	5	42.7	3	3	3	1	0	0
09/16/2002	yolk	2	5	74.0	3	3	3	1	1	0
12/11/2001	yolk	1	5	93.3	3	3	3	2	0	0
05/07/2002	yolk	4	4	93.3	3	3	3	2	0	0
10/28/2002	yolk	.	2	93.3	3	3	3	2	0	0

06/05/2002	yolk	2	5	93.3	3	3	3	2	0	0
09/05/2002	yolk	6	1	93.3	3	3	3	2	0	0
06/24/2002	yolk	5	5	93.3	3	3	3	2	0	0
04/03/2002	yolk	10	4	93.3	3	3	3	2	0	0
09/10/2002	yolk	14	4	93.3	3	3	3	2	0	0
11/13/2002	yolk	.	1	93.3	3	3	3	2	0	0
11/26/2001	yolk	3	1	93.3	3	3	3	2	0	0
02/04/2002	yolk	.	1	93.3	3	3	3	2	0	0
10/24/2001	yolk	6	5	93.3	3	3	3	2	0	0
05/07/2002	yolk	9	5	93.3	3	3	3	2	0	0
07/31/2002	yolk	8	5	93.3	3	3	3	2	0	0
10/03/2002	yolk	5	5	93.3	3	3	3	2	0	0
07/30/2002	yolk	.	1	149.0	3	3	3	2	1	0
07/15/2002	yolk	.	1	211.0	3	3	3	2	2	0
07/01/2002	yolk	4	5	215.0	3	3	3	2	2	0
02/26/2002	yolk	5	4	231.0	3	3	3	3	0	0
07/30/2002	yolk	2	5	231.0	3	3	3	3	0	0
03/05/2002	yolk	3	5	231.0	3	3	3	3	0	0
07/30/2002	yolk	4	4	231.0	3	3	3	3	0	0
10/01/2002	yolk	3	4	231.0	3	3	3	3	0	0
05/15/2002	yolk	10	4	231.0	3	3	3	3	0	0
04/24/2002	yolk	15	2	231.0	3	3	3	3	0	0
06/27/2002	yolk	10	2	231.0	3	3	3	3	0	0
09/30/2002	yolk	4	1	231.0	3	3	3	3	0	0
06/18/2002	yolk	11	4	231.0	3	3	3	3	0	0
09/24/2002	yolk	.	1	231.0	3	3	3	3	0	0
01/23/2002	yolk	.	2	231.0	3	3	3	3	0	0
04/10/2002	yolk	10	5	231.0	3	3	3	3	0	0
12/10/2002	yolk	15	2	240.0	3	3	3	3	0	0
06/06/2002	yolk	.	2	240.0	3	3	3	3	0	0
09/02/2002	yolk	4	5	427.0	3	3	3	3	1	0
12/03/2002	yolk	4	4	427	3	3	3	3	1	0
10/28/2002	yolk	12	2	427	3	3	3	3	1	0
09/25/2002	yolk	4	2	427	3	3	3	3	1	0
09/05/2002	yolk	.	1	427	3	3	3	3	1	0
11/19/2002	yolk	.	1	427	3	3	3	3	1	0
07/16/2002	yolk	4	1	427	3	3	3	3	1	0
12/10/2002	yolk	6	1	427	3	3	3	3	1	0
04/01/2002	yolk	5	5	427	3	3	3	3	1	0
10/14/2002	yolk	.	1	427	3	3	3	3	1	0
02/26/2002	yolk	3	1	427	3	3	3	3	1	0
09/05/2002	yolk	24	2	933	3	3	3	3	2	0
05/02/2002	yolk	4	4	933	3	3	3	3	2	0
05/30/2002	yolk	6	1	933	3	3	3	3	2	0
04/03/2002	yolk	1	2	933	3	3	3	3	2	0
04/18/2002	yolk	.	2	933	3	3	3	3	2	0
08/29/2002	yolk	9	5	933	3	3	3	3	2	0
08/27/2002	yolk	60	2	933	3	3	3	3	2	0
10/14/2002	yolk	19	2	933	3	3	3	3	2	0
10/31/2001	yolk	1	1	1490	3	3	3	3	2	1
11/26/2002	yolk	8	2	2400	3	3	3	3	3	0
07/24/2002	yolk	15	2	9330	3	3	3	3	3	2
08/06/2002	yolk	15	2	24000	3	3	3	3	3	3
06/12/2002	yolk	.	2	24000	3	3	3	3	3	3

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