Inherent Risk Measure (IRM) in Processing Establishments in 30 Prototype Locations

Introduction

FSIS is introducing a more robust risk-based inspection system in processing plants to better protect public health. By better utilizing information regularly collected by inspection program personnel at processing establishments, the Agency will focus resources on products that post the highest inherent risk and processing plants that have demonstrated the least ability to control risk. Daily inspection will continue at processing facilities. Background information on this initiative is available at www.fsis.usda.gov.

FSIS is using an algorithm, or mathematical formula, to determine the level of inspection that needs to be performed in processing plants. The algorithm combines two measures. The first is the inherent risk measure associated with different types of processed products and the volume of the processed produces produced by the establishment. The second is the processing establishment risk control measure, which represents how each plant is controlling risk in its operations.

FSIS will test the algorithm in 30 prototype locations beginning in spring 2007 and is providing additional information on how the algorithm will be determined in these prototype locations. This paper provides the values determined through the expert elicitation that will represent inherent risk. The paper also explains the methodology for determining volume. A companion paper provides additional detail on the establishment risk control measure, including the factors to be considered and how these factors are used to determine the numerical measure. A third paper describes how the Inherent Risk Measure and the Risk Control Measure (RCM) will be used to determine the level of inspection in processing plants during phase 1. …….

For Phase I of risk-based inspection, the measure for inherent risk will be:

Species/Process x Volume

In addition, the measure will be calculated on a 100 point scale, with 2 being the lowest calculated score:

Phase I Inherent Risk Measure
(2) Least inherent risk ←==========→ Most inherent risk (100)

Expert Values for Species/Process

FSIS is using expert elicitation to determine the relative inherent risk posed by various types of processed meat and poultry products. The Species/Process values will be the median expert elicitation values (see Table 1) adjusted to range from 2 through 20 for the express purpose of

yielding an inherent risk score on a 100-point scale.[1] The 24 categories also will be collapsed into 19 categories so as to match up with the categories currently being used to collect volume data from inspection program personnel. Because of the many identical median values in the original elicitation no information will be lost by this adjustment.

TABLE 1: Median Expert Values

Finished Product Type	Median Score
Raw ground, comminuted, or otherwise non-intact beef	10
Raw ground, comminuted, or otherwise non-intact chicken	10
Raw ground, comminuted, or otherwise non-intact turkey	10
Raw ground, comminuted, or otherwise non-intact poultry other than chicken or turkey	10
Raw ground, comminuted, or otherwise non-intact meat other than beef or pork	9.7
Raw intact turkey	9
Raw intact chicken	8
Raw intact poultry—other than chicken or turkey	8
Raw ground, comminuted, or otherwise non-intact pork	8
Raw otherwise processed meat	7
Raw otherwise processed poultry	7
Raw intact beef	5
Raw intact meat—other than beef or pork	5
Raw intact pork	4
RTE fully-cooked meat	3
RTE fully-cooked poultry	3
RTE acidified/fermented meat (without cooking)	2
RTE acidified/fermented poultry (without cooking)	2
RTE dried meat	2
RTE dried poultry	2
RTE salt-cured meat	2
RTE salt-cured poultry	2
RTE meat fully cooked without subsequent exposure to the environment	1
RTE poultry fully cooked without subsequent exposure to the environment	1

Volume

Volume data has been collected by inspection program personnel using a PBIS extension. The extension will not record point estimates of production volume over a set time period, but instead estimates of ranges of pounds produced in a typical day over ranges of days in a thirty-day period. A "volume survey group" with representatives from six FSIS Program Offices decided to collect the data in this manner because:

[1] In the 30 prototype locations, RBI will include 9 canning establishments at start-up. FSIS will assign a Level of Inspection of 2 to these nine establishments. Thermally-processed, commercially sterile (typically canned) product will be included in the upcoming expert elicitation so that canning establishments' inherent risk can be computed, and their Level of Inspection derived like all other establishments.

- Data collected in these categories served purposes other than RBI, such as planned micro-sampling programs;
- Data had been collected in this manner before for selected products to be sampled and inspection program personnel would be comfortable with this format;
- It would be easier for inspection program personnel to make accurate estimates within these combinations of ranges.

The volume value is determined by assigning each establishment to one of 5 volume categories, with 1 representing the lowest possible volumes and 5 representing the highest possible volumes. These categories were determined by (1) charting the product poundage an establishment typically ships in a day and the number of days the establishment has shipped product in the last 30 days, (2) calculating the averages of each of poundage/day combination for each establishment, and (3) grouping these averages into quintiles by like-volumes. Using this approach, we can compute the values for any given establishment, and use the final value to determine into which volume category that establishment should be assigned. The following tables present this process in detail.

The ranges of pounds-per-day and days-per-month are shown in TABLE 2, along with the calculated volume ranges.

TABLE 2: Volume Extension Ranges

Pounds Shipped in a Typical Day	**Number of Days Product Shipped in the Last 30 Days**				
	1 - 5 Day(s)	6 - 10 Days	11 - 15 Days	16 - 20 Days	More than 20 Days
Don't Know	*	*	*	*	*
1 - 50 Pounds	1-250	6-500	11-750	16-1000	21-1500
51 - 250 Pounds	51-1250	306-2500	561-3750	816-5000	1071-7500
251 - 500 Pounds	251-2500	1506-5000	2761-7500	4016-10000	5271-15000
501 - 2,000 Pounds	501-10000	3006-20000	5511-30000	8016-40000	10521-60000
2,001 - 10,000 Pounds	2001-50000	12006-100000	22011-150000	32016-200000	42021-300000
10,001 - 50,000 Pounds	10001-250000	60006-500000	110011-750000	160016-1000000	210021-15000000
More than 50,000 Pounds	*	*	*	*	*

The layout of this table allows for considerable overlap among cells when considering total possible volumes over various time periods within a month. For example, an establishment that produces 200 pounds of a product within a month could fall in 6 cells, depending on pounds-per-day and days-per-month; an establishment that produces 50,000 pounds of product per month could fall in 7 cells; and so on. Eventually we may want to modify the extension to eliminate this overlap and thus ensure that establishments with the same total volume over time have the same volume score.

We will use 5 volume categories, developed by calculating the product of the averages of each pound/day calculation (TABLE 3) and then grouping these averages using quintiles (TABLE 4).

TABLE 3: Product of Pound/Day Averages

Product of Averages	2.5	7.5	12.5	17.5	25
25	62.5	187.5	312.5	437.5	625
150	375	1125	1875	2625	3750
375	937.5	2812.5	4687.5	6562.5	9375
1250	3125	9375	15625	21875	31250
6000	15000	45000	75000	105000	150000
30000	75000	225000	375000	525000	750000
150000	375000	1125000	1875000	2625000	3750000

TABLE 4: Quintiles of Pound/Day Averages[2]

Average	Rank	Percent	Value
3750000	1	100.00%	
2625000	2	97.00%	
1875000	3	94.10%	5
1125000	4	91.10%	
750000	5	88.20%	
525000	6	85.20%	
375000	7	79.40%	
375000	7	79.40%	
225000	9	76.40%	
150000	10	73.50%	4
105000	11	70.50%	
75000	12	64.70%	
75000	12	64.70%	
45000	14	61.70%	
31250	15	58.80%	
21875	16	55.80%	
15625	17	52.90%	
15000	18	50.00%	3
9375	19	44.10%	
9375	19	44.10%	
6562.5	21	41.10%	
4687.5	22	38.20%	
3750	23	35.20%	
3125	24	32.30%	
2812.5	25	29.40%	2
2625	26	26.40%	
1875	27	23.50%	
1125	28	20.50%	
937.5	29	17.60%	
625	30	14.70%	
437.5	31	11.70%	
375	32	8.80%	1
312.5	33	5.80%	
187.5	34	2.90%	
62.5	35	0.00%	

[2] Quintiles 4 and 5 were adjusted so that the same value (375,000) would not fall into two volume categories.

Some Example Calculations

TABLE 5 below shows how we weight the hazard scores for each category of product produced in an establishment by multiplying the hazard score times the percentage of total volume accounted for by each product. This weighting allows us to distinguish between two or more establishments that produce the same multiple categories of products, but in varying proportions and amounts (Plants A and C). By multiplying the weighted hazard scores and the volume scores for each product category, we account for differing levels of total production and thus distinguish between two establishments that produce the same products in the same proportion, but in different volumes (Plants A and B). Example Plants D and E show how scores can differ between establishment that produce single, identical products in the highest and lowest volumes.

TABLE 5: Example Calculations

	Product	Inherent Risk (R)	Volume (V)	% Volume	Hazard x % Volume (RV)	Score (V x RV)
Plant A	100% Raw Ground, Comminuted, or Otherwise Not Intact Beef	20	1	0.2	4	4
	100% Raw Ground, Comminuted, or Otherwise Not Intact Pork	16	2	0.4	6.4	12.8
	Raw Intact Beef	10	2	0.4	4	8
	Sum				14.4	24.8
Plant B	100% Raw Ground, Comminuted, or Otherwise Not Intact Beef	20	2	0.2	4	8
	100% Raw Ground, Comminuted, or Otherwise Not Intact Pork	16	4	0.4	6.4	25.6
	Raw Intact Beef	10	4	0.4	4	16
	Sum				14.4	49.6
Plant C	100% Raw Ground, Comminuted, or Otherwise Not Intact Beef	20	3	0.5	10	30
	100% Raw Ground, Comminuted, or Otherwise Not Intact Pork	16	1	0.16	2.56	2.56
	Raw Intact Beef	10	2	0.33	3.33	6.66
	Sum				15.89	39.22
Plant D	100% Raw Ground, Comminuted, or Otherwise Not Intact Beef	20	1	1	20	20
Plant E	100% Raw Ground, Comminuted, or Otherwise Not Intact Beef	20	5	1	20	100