the manufacturing sector, and accordingly, only 90 percent of the benefits from the reduction of foodborne illness costs have been included as benefits in the analysis.

FSIS expects it to take about five years from the publication of the final rule for the proposed interventions and HACCP to reach the risk minimization goal. By that time, all establishments will have implemented effective pathogen reduction interventions and will have been systematically controlling their processes for from 2 to 4 years. Although there is reason to believe that during the first five years, significant benefits will be generated by the interventions and controls in place, there are no data to estimate these benefits.

Sensitivity Analysis for Table 1

The calculation of benefits in table 1 assumes benefits are zero for years 1 to 4 and the maximum possible (i.e., 100 percent of the 90 percent attributable to contamination in the inspected plants) for years 5 to 20. Given achievement of the estimated benefits in years 5 through 20, actual benefits to society would likely exceed these benefit estimates for several reasons. These reasons include the conservative valuation of a human life, no consideration of consumers' willingness to pay for avoidance of illness, and the assumption of zero benefits from near-term interventions and early implementation of HACCP. The achievement of maximum benefits is also subject to uncertainty.

In order to account for the possibility of positive benefits in years 1 through 4 and the uncertainty of benefits in years

5 through 20, an analysis was performed to examine the sensitivity of the cost-benefit analysis to changes in the estimated stream of benefits. The results of this analysis are presented in table 1A, and a discussion of the assumptions used in this analysis follows.

First, the assumption of zero benefits until year 5 is replaced by the assumption that benefits grow linearly starting from zero and reach the undiscounted maximum of $0.99–$3.7 billion in year 5. Thus, the low and high end estimates of undiscounted benefits in the first year are $0.198–$0.74 billion. Benefits increase in year 2 to $0.396–$1.48 billion and increase at the same rate until year 5. The discounted value of benefits for years 1 to 4 is $1.733 to $6.478 billion. The discounted value of benefits over 20 years becomes $8.155–$30.413 billion.

SENSITIVITY ANALYSIS OF ALTERNATIVE BENEFIT LEVELS

	Added benefits, years 1–4 [1]		Baseline benefits [2]		Reduced benefits, years 5–20 [3]	
	Low	High	Low	High	Low	High
Year	Billion dollars, discounted at 7 percent					
1	0.20	0.74	0	0	0	0
2	0.37	1.38	0	0	0	0
3	0.52	1.94	0	0	0	0
4	0.65	2.41	0	0	0	0
5	0.76	2.82	0	0	0	0
Sum of benefits, years 1–4	1.73	6.48	0	0	0	0
Sum of benefits, years 5–20	6.42	23.94	6.42	23.94	5.78	21.54
Total benefits, years 1–20	8.16	30.41	6.42	23.94	5.78	21.54
Benefit-cost ratio [4]	3.5	13.2	2.8	10.4	2.5	9.4

[1] Assumes benefits start at 0 and increase linearly to base level benefits in year 5.
[2] Base level of benefits are those presented in table 1.
[3] Assumes 90 percent of base level of benefits.
[4] Assumes costs presented in table 1.

Alternative assumptions regarding the size of benefits are possible. The linear assumption is arbitrary; the purpose is to demonstrate that any benefits in years 1 to 4 will increase the 20-year total discounted value of benefits.

Second, the assumption of zero benefits until year 5 is retained but the realized benefit in year 5 and later is reduced by 10 percent, making the annual undiscounted benefits $0.89–$3.32 billion. The discounted value of benefits over 20 years becomes $5.780–$21.542 billion. The uncertainty involved in estimating the annual cost of foodborne illness is already accounted for in the range reported in table 4. The 10 percent reduction is an arbitrary assumption to demonstrate the sensitivity of the cost-benefit analysis.

In neither case are costs affected. All estimates of discounted benefits are far larger than the discounted costs for each

set of assumptions. The benefit-cost ratio ranges from 2.5:1 to 13.2:1.

Costs

Costs to meat and poultry processors across the Nation will vary according to how much improvement in process control each plant needs. Plants that now have good processing controls will have relatively few implementation costs, while plants that have little or no process control will need to spend more for implementation. A detailed analysis of industry's costs to develop, implement, and operate HACCP systems appears in Section V.

Costs to the Government would be for training FSIS employees. Existing resources would be used. No additional funding is anticipated.

Program Goals

The quantifiable benefits to society from the proposed regulation range from

$6.4 to $23.9 billion as 20 years of foodborne illness and attendant costs to society are avoided. (The wide range of benefits is attributable to uncertainties in the data used to estimate the incidence of foodborne illness.)

The predictability of foodborne illness reductions from a reduction of pathogens in meat and poultry is made difficult by the fact that little quantitative data on the relationship between these two variables exists because many of the risk assessments necessary to establish this relationship have not been undertaken. Therefore, it is not known how much pathogens need to be reduced to minimize the risk of foodborne disease from meat and poultry. One component of the proposal is the testing of product to generate data on pathogen incidence which will help to elucidate the relationship between pathogen contamination and foodborne