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FOOD SAFETY: THE CONSUMER SIDE OF THE ENVIRONMENTAL ISSUE

Carol S. Kramer

A key player in the current policy debate over chemical use in food production is the consumer. In the last few years we have witnessed that consumer activism has been able to force policy change in a number of areas important to the agricultural and food industries. Consumers' perceptions and concerns about pesticide and animal drug residues in foods can translate, in sometimes volatile and unpredictable ways, into market behavior. In addition to affecting the consumer's own satisfaction and welfare, the consumer's market behavior is obviously of major interest to agricultural producers, manufacturers, wholesalers, and food retailers. Policymakers and regulators are feeling heightened pressure to understand and respond better to consumer (and voter) concerns over pesticides and other chemicals commonly used in agriculture.

In this paper, four major points are made and then research needs are discussed. First, the weight of evidence available clearly suggests that levels of consumer concern about food safety and, particularly, pesticide residues in foods are high and have increased in recent months. Second, assessments of food safety hazards made by many food safety experts in and outside of government do not match those of consumers or many experts in public interest organizations.

Third, this divergence among consumer and expert views about the food safety risk from pesticides, animal drugs, and other agricultural chemicals is extremely important for policy purposes and needs to be addressed explicitly by policies aimed at: (1) enhancing two-way communication between consumers and their representatives and the scientific and regulatory communities; (2) strengthening public commitments to food safety-related research, data gathering, inspection, and enforcement; and (3) sustaining a commitment to relevant and effec-

tively-designed public education including basic principles of toxicology and risk assessment, agricultural production, economics, and public policy.

Finally, despite substantial uncertainty in many realms, pesticide, agricultural, and food safety policy changes will continue to be made. Thus, policy proposals need to be evaluated, among other criteria, for cost-effectiveness in reducing overall food safety and environmental risks and how well they perform in a context of endemic uncertainty, evolving knowledge, and pervasive external effects.¹ The remainder of the paper will elaborate these four points.

Point 1: The weight of evidence suggests consumers are increasingly concerned about food safety and pesticide residues. How do we know? Our evidence, which is highly incomplete, comes from three general types of information sources: consumer surveys and opinion polls, market studies, and indicators in the political arena such as the agendas of different consumer or public interest groups and Congressional legislation introduced.

In consumer surveys and opinion polls consumers are simply asked what they think or what they want in the way of market products or public policies. Sometimes consumers are asked additionally what they would be willing to pay for products of particular quality or with specific characteristics. One highly quoted example of a consumer survey including questions about food safety is published each year by the Washington-based Food Marketing Institute (FMI). The most recent edition was called *Trends: 1989 Consumer Attitudes and the Supermarket*. Because many questions are repeated each year, this survey permits tracking some responses over time. In recent years, the FMI survey has indicated that consumers were generally confident about the overall safety of the food supply; now that

¹ Food safety and environmental problems are characterized by a prevalence of external effects, meaning that frequently the costs associated with food or environmental contamination are borne by another than those who caused the contamination.

Carol S. Kramer is a Fellow at the National Center for Food and Agricultural Policy, Resources for the Future, Washington, DC. The author expresses appreciation for the help of Bobby Beamer, Virginia Polytechnic Institute and State University and Andrea Abel, University of Texas, Austin, for research assistance contributing to this paper.

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confidence has been shaken. From 1985 through 1988, over 90 percent of consumers indicated they believed that food in supermarkets is wholesome and safe to eat. This percentage dropped to 81 percent in January 1989. Subsequently, FMI conducted supplemental polling after the February 1989 release of the Natural Resources Defense Council report *Intolerable Risks: Pesticides in Our Children's Food* and the Chilean grape scare, through the spring and summer of 1989. By mid-April the number of completely or mostly confident consumers had dropped to 65 percent of the total. By August that percentage was still hovering around 67 percent.

In terms of the overall importance of food safety, polls indicate that consumers consider it very important, generally on a par with nutritional value, and even with, or a little less important than, taste. Interestingly, in many polls food costs are not rated as important as safety, taste, or nutritional quality. This is important to keep in mind.

In terms of food safety concerns, consumers generally rank pesticides at the top of their list of food safety hazards. The percentage of consumers rating pesticide residues as a "serious health hazard" has increased over time (Food Marketing Institute; food safety surveys also include Zellner and Degner; Jolly and Johal; Penner, Kramer, and Frantz; Sachs, Blair, and Richter; Ott and Haligaya). Frequently consumers have ranked risks from pesticides and environmental contaminants as more serious than microbiological contamination.

It is important to realize that consumer concern over pesticides is broader than concern over food safety alone. Other important related issues are pesticide residues in groundwater, environmental effects including those on wildlife, and impacts on applicator health. By the same token, consumer concerns over food safety are broader than pesticide concerns alone and do include concerns over spoilage, food additives, and other contaminants. However, the pesticide issue represents an intersection between environmental and food safety interests with potentially important implications for agriculture and for agricultural policy.

Consumer surveys reveal some misunderstanding of the economic effects of pesticides. In a 1984 survey conducted in Kansas, researchers found that consumers believed that pesticides raise both production costs and prices (Penner, Kramer, and Frantz). By contrast, most economists conclude that pesticides have contributed to substantially lower-priced products. To the extent that pesticides are viewed by some consumers as increasing food

prices, it reinforces their unwillingness to accept any risks from pesticide residues.

Turning to market evidence, what do we know about the demand for pesticide-free products? Briefly, at this time there are a couple of studies of consumer reaction to extraordinary contamination incidents where sales dropped precipitously (see, for example, Smith, Van Ravenswaay, and Thompson). However, there are no good studies of demonstrated routine consumer willingness to pay more for pesticide-free (or drug-free) food products. Analysis is required of actual market data that is controlled for differences in store location and store type, among other variables, as well as differences in the quality and cosmetic appearance of produce or meat products. This is necessary because, for a busy consumer, travelling to a separate "organic" store or fruit and vegetable stand has real costs associated with travel time and effort. Research should also pay systematic attention to the issue of produce quality to know what the consumer might be willing to give up in terms of product appearance to obtain reductions in pesticide residues.

We do know that a number of stores have moved to employ private testing services to certify that products have been tested for pesticide residues, in addition to Food and Drug Administration surveillance. In addition, a number of supermarkets are experimentally introducing organic produce. Properly analyzed, the sales data from such experiments will yield valuable new information about consumer demand. However, this high priority area for research awaits new resources and attention as well as industry cooperation. At this time we cannot answer the fundamental question of how much perceived risk from pesticides or animal drug residues consumers are willing to accept and how much they are willing to pay to get what they want.

Finally, consumer and citizen group agendas and policy initiatives in Congress and before state legislatures provide another indicator of consumer interest in pesticides and food safety. If the agendas of groups such as Public Voice for Food and Health Policy, Center for Science in the Public Interest, and Natural Resources Defense Council, Mothers and Others for Safe Food, and the League of Women Voters are any indication, which I believe they are, then we must conclude that pesticides and their use have become a major priority. The voters of California and other states reinforce the conclusion that the overall use of pesticide chemicals in food production is a public issue of paramount importance that will not go away any time in the foreseeable future (Kramer and van Ravenswaay).

Congress has responded to the general public turmoil over food safety with over twenty initiatives introduced in 1989 alone that address food safety concerns (Table 1). Some critical issues that major pesticide and food safety initiatives and research must address are discussed in the final section of this paper.

Point 2. Many food safety experts downplay the importance of pesticide residues as representing the highest priority food safety risks to the American public. Viewed in the context of food-borne hazards to public health, experts at the Food and Drug Administration and the Centers for Disease Control, along with food safety experts representing a variety of professional societies, consistently rate disease-causing microorganisms as presenting the greatest food safety risks to public health (Institute of Food Technologists; Roberts and van Ravenswaay). The government estimates 6.5 million to 33 million cases of food-borne illness from microorganisms occur each year in the United States, resulting in approximately 9,000 deaths annually. Following this in importance are naturally-occurring toxicants such as aflatoxin or paralytic shellfish poisons. Environmental contaminants are ranked next and much lower in importance by the experts. Pesticide residues in foods were rated orders of magnitude lower by the experts in representing risks to public health. Although the Environmental Protection Agency's worst-case estimate is that pesticide residues could cause up to 6,000 new cancers per year, the lower bound is zero (U.S. Environmental Protection Agency). As a category, pesticide residues are generally viewed as presenting negligible risks to the food-consuming public in the United States when products are used legally according to label instructions. Food and feed additives are also ranked very low in the overall scale of food-borne hazards, although the U.S. Department of Agriculture in the past has accorded animal drug residues a higher priority than pesticides.

Turning away from ingredients added to foods (intentionally or unintentionally), experts increasingly agree that overall diet over time is a far more important correlate of health status than exposure to individual food constituents or contaminants. A large body of research over the last two decades has clearly indicated that five of the ten leading causes of death today in the U.S. are linked to diet (National Research Council; U.S. Department of Health and Human Services). Specific chronic diseases in which studies have shown a relationship to diet include atherosclerotic cardiovascular diseases, cancer, diabetes, obesity, osteoporosis, dental caries, and chronic liver disease (Palmer).

The National Research Council in its 1989 report *Diet and Health* specifically recommended that individuals should eat five or more servings daily of a combination of vegetables and fruits, especially green and yellow vegetables and citrus fruit, as well as increase consumption of complex carbohydrates. A scientific consensus exists that the nutritional value of fruits and vegetables in the diet is high and that the known public health importance of pesticide residues is negligible in comparison.

Point 3: The divergence of consumer and expert opinion about relative food safety risks is extremely significant for policy purposes and needs to be addressed explicitly through a variety of policy measures.

Why? To the extent consumers misperceive real public health risks, they may emphasize less important risks at the cost of neglecting or running out of resources to address more important risks. In the example of fruits and vegetables just mentioned, the greater danger might be to cease consuming fruits and vegetables and thereby sacrifice their nutritional benefits to eliminate exposure to pesticide residues.

In the market place, consumer concerns over pesticide residues are sending strong but confusing signals to the agricultural and food industries. Fruit and vegetable producers long have had evidence that consumers respond positively to produce appearance, quality, and availability throughout the year. Achievement of many of these attributes has been facilitated with the use of pesticides. In marketing meat products, producers are learning that consumers prefer less fat, facilitated with the use of growth hormones. Both plant and livestock producers feel increasing pressure to produce products with desired traits but without the production aids they have learned to use. At the retail level, sellers gingerly walk a tightrope between making "organic" products available to those consumers who want them and not frightening other consumers who were not previously sensitized to residue issues.

Consumer action in the political arena, to the extent that there are misperceptions about relative public health risks, may divert public resources away from more serious public health priorities. Government policymakers are charged with allocating an always limited public health and food safety budget in an attempt to achieve the greatest possible improvements in public health.

However, it is important to realize that risk may be characterized and ultimately assessed differently by consumers and experts. Particular characteristics of some risky situations prove less acceptable to some consumers. In recent food safety cases, adverse consumer reaction probably has been exacerbated by

Table 1. Food Safety Bill, 1989

Bill Title	Bill Number	Sponsor	Date
Poultry Products Inspection Act	H.R.604	Smith (D-IA)	1/20/89
Mandatory Fish Inspection Act of 1989	H.R.1387	Dorgan (D-ND)	3/14/89
Daminozide, Termination of Tolerance for ... Under the Federal Food, Drug and Cosmetic Act	H.R.1508	Sikorski (D-MN)	3/20/89
Food Safety Amendments of 1989	H.R.1725	Waxman (D-CA)	4/6/89
Food Safety Amendments of 1989	S.722	Kennedy (D-MA)	4/6/89
Farm Conservation and Water Protection Act of 1989	S.970	Fowler (D-GA)	5/11/89
Conservation Enhancement and Improvement Act of 1989	S.1063	Lugar (R-IN)	5/18/89
Use of Daminozide, Prohibition	S.1061	Warner (R-VA)	5/18/89
Food Irradiation, Safety and Labeling Require- ment Act of 1989	S.1037	Mitchell (D-ME)	5/18/89
Food Irradiation, Safety and Labeling Require- ment Act of 1989	H.R.2405	Bosco (D-CA)	5/18/89
Consumer Seafood Safety Act	H.R.2511	Studds (D-MA)	5/25/89
Federal Fish Inspection Act	S.1245	Mitchell (D-ME)	6/6/89
Aflatoxin Food Safety Act of 1989	H.R.2641	Jontz (D-IN)	6/14/89
Food Contamination Protection Act	H.R.2681	Smith (R-NJ)	6/19/89
Federal Food, Drug, and Cosmetic Act, Amend- ment (cheese labeling)	S.1266	Kasten (R-WI)	6/23/89
Nutrition Labeling and Education Act of 1989	S.1425	Metzenbaum (D-OH)	7/27/89
Comprehensive Food Safety Act of 1989	H.R.3071	Penny (D-MN)	8/1/89
Food and Nutrition Labeling Act of 1989	S.1505	Hatch (R-UT)	8/3/89
Fish and Fish Products Safety Act of 1989	H.R.3155	Dingel (D-MI)	8/4/89
Pesticide Regulatory Reform Amendments of 1989	H.R.3153	Brown (D-CA)	8/4/89
Food Safety Assurance Act of 1989	H.R.3292	De La Garza (D-TX)	9/19/89
Consumer Seafood Safety Act of 1989	H.R.3481	Glickman (D-KS)	10/17/89
Federal Inspection for Seafood Healthfulness Act	H.R.3508	De La Garza (D-TX)	10/23/89
Organic Foods Act of 1989	S.1896	Leahy (D-VT)	11/16/89
Consumer Seafood Safety Act	S.1983	Leahy (D-VT)	11/21/89

the fact that the foods suspected of contamination (fruits, vegetables, poultry products, and, recently, milk) were precisely those recommended for nutritional reasons. The health-conscious consumer receives conflicting signals regarding nutritional qualities and food safety characteristics of food, neither of which can be detected.

Further, there is a real risk of oversimplification on both sides of the pesticide debate: on the one hand, that all pesticides or all synthetic chemicals are essential and perfectly safe; on the other, that food safety can only be improved by eliminating or restricting all pesticide use. It seems important that a systematic and suitably flexible approach to overall dietary risk from foods be maintained.

As to reasons for the divergence between expert and apparent consumer perceptions of the risk from pesticide residues, the following factors are important and should be further explored in trying to narrow the gap in the future.

First, for the most part customers rely on different sources of information than experts, have varying analytical frameworks for integrating new scientific information about food safety risks, and expend fewer resources in attempting to analyze this information than many food safety or public health professionals.

Furthermore, consumers are frequently not presented with the necessity or even the opportunity to trade off products with different known attributes and prices. Most food safety-related attributes are not known with certainty in the market. Certainly, consumers are not presented with the policymaker's choice of needing to reduce expenditures on *Salmonella* control, for example, in order to increase expenditures on produce monitoring for pesticide residues.

Research on consumer risk perception has suggested that consumers tend to overestimate the probability of some small risks—such as those represented by pesticide residues—while underestimating other risks associated with higher probability events (such as auto accidents or microbial contamination) (Viscusi and Magat). In many complex situations, consumers appear to have difficulty differentiating between risks of different magnitudes.

In addition, a number of attributes of risky situations particularly influence consumer risk perceptions and risk preferences. If exposure is involuntary, viewed as unnecessary, could result in a dread condition, affects children, or otherwise

seems unfair, the risks often are considered more important and less acceptable (Lowrance). When a person has no control over the exposure to a hazard or no ability to influence the outcome, these factors compound the negative assessment.

Finally, those who might decry the consumer's concern over pesticide residues should understand the perspective many consumers bring. They observe that experts often do not agree among themselves about the importance of different risks. Knowledge evolves over time, and yesterday's judgments viewed with 20-20 hindsight have proven wrong in some cases or unacceptable by current standards.

Perhaps most important of all, consumers must be convinced that sufficient resources are being allocated to issues of food and pesticide safety that the statements of experts about the theoretically minimal hazards when chemicals are used according to label instructions are backed up with adequate and ongoing research, inspection, and enforcement. When a series of reports flows from the Congress, General Accounting Office, Office of the Inspector General, and Office of Technology Assessment on various deficiencies in scientific understanding, analytical methods, or inspection resources, consumers will be justifiably concerned (see, for example, U.S. Congress, Office of Technology Assessment).

Point 4: Food safety policy choices will be made despite substantial uncertainty in many realms. Policy proposals should be evaluated, therefore, not only for cost-effectiveness in reducing overall public health and environmental risks, but also for how well they perform in a context of endemic uncertainty, evolving knowledge, and pervasive external effects.² The public pressure on policymakers to do something about food safety problems that have been highlighted by the media is currently high. A series of food safety cases in the past few years includes the controversy over use of daminozide (Alar) in apples, the scare over tainted Chilean grapes, *Salmonella* contamination in poultry, and *Listeria* contamination in dairy and other products. In addition, there have been cases of antibiotics, hormones, and other animal drugs in livestock products including milk, problems of heptachlor in milk, problems of seafood safety, fumigants in cereal products, and aflatoxin in grains.

Policy interest has materialized in recent efforts to enact a variety of legislation, including major pesticide reform bills introduced in 1989 by Waxman and Kennedy, and by de la Garza (Table 1). In addition,

²Some major points in this section are summarized from Kramer, 1990.

the Administration continues to develop its own initiative to revamp pesticide law. Table 1 lists major food safety bills introduced into Congress in 1989 that address seafood inspection, pesticide law, poultry inspection, regulation of daminozide (alar), aflatoxin contamination, nutrition claims or labeling, standardizing the definition of "organic," and encouraging "low impact" agricultural production.

The blend of policy goals and instruments included in these legislative proposals runs the gamut from a total pesticide ban, to offering financial incentives to producers to use substitute practices, to improving consumer information and labeling, to improving public food safety inspection. One taxonomy of food safety policy instruments categorizes food policy instruments according to whether they establish:

- (1) product performance standards
- (2) production or processing standards
- (3) information requirements or provisions
- (4) pecuniary measures (taxes, subsidies, fines, etc.) (Kramer, 1982).

Product performance standards refer to regulations setting specific requirements or limits for product attributes. These may include tolerance levels (maximum limits) for pesticide or animal drug residues in food products, maximum filth standards, microbiological standards, ingredient standards, and so on. *Production or processing standards* regulate the production process directly. Examples are good manufacturing practice requirements, good laboratory practice requirements, or banning or specifically regulating the use of particular agricultural chemicals or other technologies. Restricted food processing technologies include irradiation and ultra-high temperature processing. *Information policies* encompass a range of policy instruments including nutrition education, product labeling provisions, requirements that producers report pesticides application rates, advertising, and disclosure rules. Also included in the category of information policies are both the public provision or financing of research and data collection and requirements that the private sector generate and submit data on chemical safety and efficacy. The category of measures labeled *pecuniary* refers to public tax, penalty, or subsidy policies that change relative cost/price relationships and affect the use of particular production practices mainly through market incentives. Increasingly, Washington policy discussions turn to examining agricultural commodity program policies with an eye toward reversing incentives that many believe lead to undesirably heavy reliance on pesticides and other agricultural chemicals.

Taken as a group the 1989 food safety bills incorporate the range of policy instruments described above. Economists face a challenge to contribute much more to understanding better the potential problems and advantages associated with different policy approaches to ensuring food safety in particular situations.

Specific contributions awaited from the disciplines of economics and agricultural economics include the following.

- (1) Given that major uncertainties exist regarding the identification of food safety hazards, their risk to public health, and the impact and cost-effectiveness of public policies to improve public health, three principal contributions of economic theory and empirical research to reducing the uncertainties characterizing food safety policy problems include:
 - (a) economic methodologies relevant to research planning, that is, assessing the relative value of alternative projects for acquiring additional information about food safety risks, or conversely, the potential costs of insufficient information;
 - (b) economic methodologies for evaluating public policies or programs (benefit cost analysis, risk benefit analysis, program impact analysis, and so on);
 - (c) economic or political economy theories of decision making under uncertainty.
- (2) Given that a significant dichotomy exists between food safety concerns of consumers and experts, economists can contribute to understanding and reducing the divergence between expert and public opinion in two principal ways:
 - (a) first, they can investigate determinants of information search, acquisition, and use of different economic agents under different circumstances.
 - (b) second, they can assist in identifying socially desirable or cost-effective policies and policy instruments to enhance food safety understanding in both public and private sectors and reduce the gaps between them.
- (3) Given that food safety involves imperfect and asymmetrically held market information, economists can contribute to a growing understanding of the likely behavior of market participants under conditions where quality and safety infor-

mation is uncertain, asymmetrically held, costly, and where assignments of liability are unsure. They can and should continue to assist in identification of policy instruments to improve market food safety performance.

- (4) Given that food safety policy problems involve significant external effects from individual actions, economists in conjunction with physical and other social scientists can contribute much to identifying and valuing the external effects pervading food safety policy problems. Thinking through the chain of causality of food safety problems under different situations in different agricultural commodity subsectors is part of this problem (see Kramer, 1982; Roberts). Helping to value both the costs of illness due to food safety hazards (see, for example, Roberts) and benefits and costs or risks of alternative agricultural production technologies clarifies both the nature of trade offs society faces when it considers alternative policies (Archibald and Winter) and helps to illuminate control points at which policy instruments can be used to assist economic actors to take into account more fully the external costs and benefits produced by their actions.
- (5) Given that food safety policy problems involve the need to economize on resources and adopt risk management strategies, and assuming food safety policy is or should be formulated fundamentally to protect public health, then economists and scientists working together can guide policymakers toward achieving the highest attainable levels of public health. In an economist's unreal world, the marginal dollar of a given food safety budget, allocated among competing uses, should purchase the same level of public health improvement. Economists can contribute to clarifying economic trade offs inherent in allocating the public food safety, public health, and environmental budget.
- (6) Given that there is a need for social judgment as to what constitutes acceptable risk, economic analysis provides one important input into the social determination of acceptable risk. Economists' major contributions in the food safety policy area as in most other policy areas are in providing an understanding of a framework for evaluating trade offs implicit in alternative public and private choices.

SUMMARY

Consumers rank pesticide residues followed by environmental contaminants at the top of their lists of concern over food safety hazards. Having said that, however, there is much that we don't know. We don't know well enough how stated "concerns" translate into market and household behavior or into tangible preferences for policy. Fundamentally, we don't know the amount of risk consumers are willing to accept from pesticides and what they are willing to give up to get what they want. These issues provide an extremely important area for future research and should be a joint effort of government, industry, and consumers.

Food safety experts indicate that the major and most urgent known food-borne risks stem from disease-causing microorganisms, followed by nutritional imbalance or deficiency, and toxic natural constituents of foods. The importance of overall diet in influencing health status is increasingly emphasized over the risks from individual toxicants. Experts currently rank the risks from pesticide residues orders of magnitude below those from most other categories of public health hazard. The important point here is not that pesticide risks are unimportant, but rather one of context. If we are concerned about food safety and risks to public health, our knowledge suggests that as a category risks from other food safety hazards may be much more important. This is not to say that individual pesticides may not be unacceptably risky nor that continual improvement should not be sought. It also incorrectly abstracts from related pesticide concerns including contamination of water, the environment, and wildlife, as well as pesticide risks to applicators. However, in the wake of controversy over pesticides, improvements in reducing known diseases and deaths attributable to pathogenic microorganisms and overall imbalanced diets should not be sacrificed.

Finally, the divergence between public and expert assessments of risk is important to reconcile better. To the extent that consumers misperceive relative risks, two effects are probable. First, consumers may act inefficiently. Second, they may encourage policymakers to do the same. On the other hand, policymakers frequently misunderstand consumer concerns and priorities. To the extent that policymakers misunderstand the philosophical assumptions, values, and particular concerns that consumers and their representatives bring to the policy table, they will fail to address real problems and provide acceptable solutions.

REFERENCES

- Archibald, Sandra O., and Carl K. Winter. "Pesticide Residues and Cancer Risks." *California Agriculture*, 3(1989):6-9.
- Food Marketing Institute. *Trends: 1989 Consumer Attitudes and the Supermarket*. Opinion Research Corporation for the Food Marketing Institute, Washington, DC, 1989.
- Institute of Food Technologists. "Assessing the Optimal System for Ensuring Food Safety: A Scientific Consensus." Report of a workshop, Chicago, IL, April, 1989.
- Institute of Food Technologists. "The Risk/Benefit Concept as Applied to Food." A Scientific Status Summary by the Expert Panel on Food Safety and Nutrition, Chicago, IL, 1989.
- Jolly, Desmond A., and Jagjit Johal. "Consumer Perceptions of the Quality and Safety of Conventional and Organic Foods." *Papers of the Western Region Home Management Family Economics Educators*, 3(1988).
- Kramer, Carol S. "An Economic Analysis of Food Safety Regulation: The Case of Sulfa and the Swine Subsector." East Lansing, MI: Michigan State University, unpublished doctoral dissertation, 1982.
- Kramer, Carol S. "Food Safety and Public Policy: What Can Economists Contribute?" Washington, DC: National Center for Food and Agricultural Policy, Resources for the Future, 1990.
- Kramer, Carol S., and Eileen O. van Ravenswaay. "Proposition 65 and the Economics of Food Safety." *Am. J. Agr. Econ.*, 71(1989):1293-1299.
- Lowrance, William W. *Of Acceptable Risk: Science and the Determination of Safety*. Los Altos, CA: William Kaufman, 1976.
- National Research Council. *Diet and Health: Implications for Reducing Chronic Disease Risk, Executive Summary*. Committee on Diet and Health, Food and Nutrition Board, Washington, DC: National Academy Press, 1989.
- Natural Resources Defense Council. *Intolerable Risks: Pesticides in Our Children's Food*. New York, NY, 1989.
- Ott, Stephen L., and Arlyn Haligaya. "An Analysis of Consumer Attitudes Toward Pesticide Use and the Potential Market for Pesticide Residue-Free Fresh Produce." Selected paper presented at the 1989 Annual Meeting of the Southern Agricultural Economics Association, Nashville, TN., February 5-8, 1989.
- Palmer, Sushma. Testimony Before the Subcommittee on Marketing, Consumer Relations, and Nutrition of the Committee of Agriculture of the U.S. House of Representatives, Washington, DC, June 21, 1989.
- Penner, Karen P., Carol S. Kramer, and Gary L. Frantz. *Consumer Food Safety Perceptions*. Manhattan, KS: Kansas State University, Cooperative Extension Service, August, 1985.
- Roberts, Tanya. "Human Illness Costs of Foodborne Bacteria." *Am. J. Agr. Econ.*, 71(1989):468-474.
- Roberts, Tanya, and Eileen O. van Ravenswaay. "The Economics of Food Safety." *National Food Review* 12(1989):1-8.
- Sachs, Carolyn, Dorothy Blair, and Carolyn Richter. "Consumer Pesticide Concerns: A 1965 and 1984 Comparison." *J. Con. Affairs*, 21(1)(1987):96-107.
- Smith, Mark E., Eileen O. van Ravenswaay, and Stanley R. Thompson. "Sales Loss Determination in Food Contamination Incidents: An Application to Milk Bans in Hawaii." *Am. J. Agr. Econ.*, 70(1988):513-520.
- U.S. Congress, Office of Technology Assessment. *Pesticide Residues in Foods: Technologies for Detection*. Washington, DC: U.S. Government Printing Office, 1988.
- U.S. Department of Health and Human Services. *The Surgeon General's Report on Nutrition and Health*. Public Health Service. DHHS(PHS) Publication No. 88-50211. Washington, DC: U.S. Government Printing Office, 1988.
- U.S. Environmental Protection Agency. *Unfinished Business: A Comparative Assessment of Environmental Problems*. Overview Report. Washington, DC: U.S. Environmental Protection Agency, February, 1987.
- Viscusi, W. Kip., and Wesley A. Magat. *Learning About Risk: Consumer and Worker Responses to Hazard Information*. Cambridge, MA: Harvard University Press, 1987.
- Zellner, James A., and Robert L. Degner. "Consumer Willingness to Pay for Food Safety." Paper presented at the 1989 Annual Meeting of the Southern Agricultural Economics Association, Nashville, TN,