Risk Assessment

Dr. Douglas Powell
Dept. Plant Agriculture
University of Guelph
Guelph, Ont.
N1G 2W1
519-824-4120 x2506
dpowell@uoguelph.ca

Introduction

At noon on Jan. 19, 1993, William Jefferson Clinton was sworn in as the 42nd President of the U.S. A few hours later, the King County Health Department in Washington State issued the first warning linking consumption of undercooked hamburgers with an outbreak of E. coli O157:H7, sometimes known as hamburger disease. What came to be known as the Jack-in-the-Box outbreak eventually killed four young children and sickened over 700.

These two events, more than any other, have dramatically changed the public discussion of food safety in North America, and certainly underscores the importance of industry-led efforts to manage food safety risks.

The Jack-in-the-Box outbreak had all the elements of a dramatic story which catapulted it to the top of the public agenda — at least in the U.S. Children were involved; the risk was relatively unknown and unfamiliar; and a sense of outrage developed in response to the inadequacy of the government inspection system and the identifiable target in Foodmaker Inc. (for a full accounting, see Powell et al., 1997).

E. coli O157:H7 became the focus of Congressional debates on regulatory reform, tragic tales from bereaved parents, and the subject of investigative journalism. More importantly, in the wake of Jack-in-the-Box, stories about microbial food safety began appearing more frequently and more prominently in American media (Fig. 1).

This has sparked an overall increase in North American media coverage of microbial food safety, resulting in a two-fold increase from the last quarter of 1993 to mid-1994 (Fig. 2). The microbial food safety story has remained front and centre through June 30, 1998.

During this same time period, there has been a tremendous shift in public perception of foodborne risks in the U.S. When 1,000 Americans were asked, "What, if anything, do you feel are the greatest threats to the safety of the food you eat," as part of the annual survey

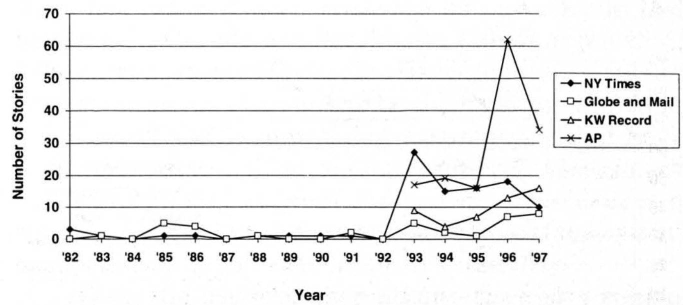

Figure 1. Number of stories about verotoxigenic E. coli collected from the New York Times and Globe and Mail (1982-1997), and Kitchener-Waterloo Record and AP (1993-1997).

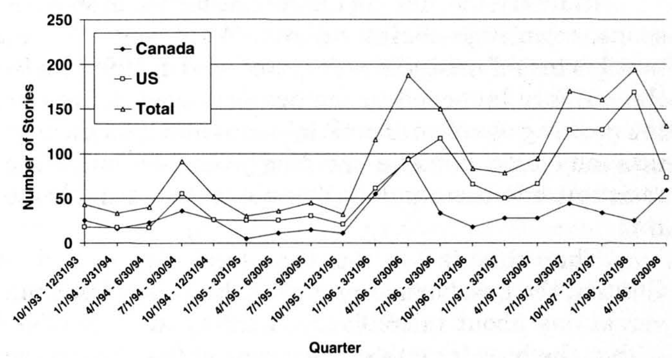

Figure 2. Quarterly review of stories retrieved for FSnet from the U.S. (AP & New York Times) and Canada (Globe and Mail & Kitchener-Waterloo Record) from Oct. 1/93 through June 30, 1998.

conducted by the Washington-based Food Marketing Institute (1997), spoilage topped the list, as it has for the past four years. Other responses included freshness/expiration dates, bacterial/germs/*E. coli*, quality control/shipping/handling/storage, spoilage/lack of refrigeration, and pesticides/residues/etc. From 1996 to 1997, the perceived threat to food safety from spoilage, *Escherichia coli* and quality control increased by 20 per cent (Figure 3).

Presented at the American Association of Bovine Practitioners 31st Annual Conference, September 26, 1998, Spokane, WA.

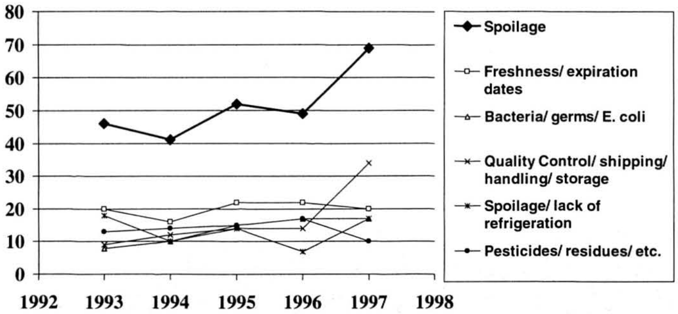

Figure 3. Perceived Threats to Food Safety(%); n=1,011 (FMI, 1997)

When American consumers were asked to rank suggested food risks, bacteria again topped the list (Fig. 4).

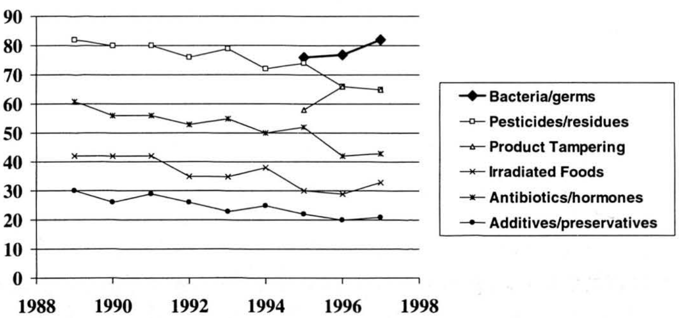

Figure 4. Consumer concern about selected food attributes, 1989-1997 (%); n = 1,011; (FMI, 1997)

Industry, too, has kept pace. Antibacterial sponges, soaps, toys, high-chairs, pillows. Whatever. 177 new "antibacterial" products were introduced in 1996, double the number launched in the previous year. Of course, the growing use of antibacterial soaps and kitchen products may make homes a breeding ground for antibiotic-resistant microbes, and may eliminate beneficial bacteria.

The other factor was the election of President Clinton, the first boomer president. Because public conversations about microbial food safety are embedded within the broader public discussion of food in general.

Whether it's excess fat leading to cancer, heart trouble and diabetes, nasty bacteria leading to food poisoning, or unknowns surrounding the use of agricultural chemicals leading to fear, people are worrying about what they eat. Meals, it seems, are no longer gatherings at which friends and family share stories and food, but a crisis of introspection and guilt.

People are concerned about the quality of the food they eat. Producers and others want to bring the best knowledge to bear on any decision or action involving food. But the ability to apply science-based solutions to food safety and other food-related challenges is intricately dependent on issues of public perception, the regulatory environment, fairness, accountability and, most importantly, trust.

Food Safety, Global Trade and Risk Analysis

Lammerding and Paoli (1998) note that the changing epidemiology of foodborne diseases is a result of complex interactions and changes in pathogens, foods, food distribution, food consumption, and population immunity. Predicting the impact of a trend in one part of the food continuum presupposes understanding of the whole system. Aspects of the food processing and distribution system can amplify or attenuate the trend as it grows into a potential health hazard. While a full understanding of pathogen contamination, infection, and survival is difficult, a systematic approach to assessing the impact of the pathogen on health may improve the quality of public health decisions (Rodricks, 1994; Foegeding et al., 1994).

From a domestic perspective, science-based arguments of excess risk associated with an imported product may be the only means to protect public health. From an exporter's perspective, science-based arguments of decreased or equivalent risk may be the only defense against arbitrarily applied restrictions in international trade (Smith, 1996). One estimate places the value of questionable technical barriers to U.S. agricultural exportation at $5 billion (United States Department of Agriculture, 1997). The problem becomes then: what is a science-based argument?

The World Trade Organization (WTO, formerly GATT) agreement contains sub-agreements dealing with Sanitary and Phytosanitary (SPS) Measures. These agreements came into effect on January 1, 1995 and are designed to curb the use of unjustified sanitary measures for the purposes of trade protection. For the purpose of the SPS, "a sanitary measure is defined as a measure applied to protect human or animal life or health within the territory of the member from risks arising from food additives, contaminants, toxins or disease-causing organisms in food, beverages and feedstuff" (World Health Organization, 1995)

The agreements apply to all regulations and procedures including end-product specifications, processing and production methods, sampling procedures and risk assessment methods, and packaging and labeling requirements directly related to food safety.

The basic principles espoused in the WTO SPS agreements state that Sanitary and Phytosanitary Measures:

- must be the least trade-restrictive in accomplishing their objectives;
- must be subjected to risk assessment to demonstrate that the measure does not exceed an appropriate and consistent national level of protection; and,

• cannot be more stringent for imports than for agricultural goods and food products of domestic origin (World Health Organization, 1995).

Scientific standards, guidelines and recommendations for some SPS measures are established by the Codex Alimentarious Commission (food safety), the International Office of Epizootics (animal health), the International Plant Protection Convention (plant health), and other international organizations identified by the WTO Committee on Sanitary and Phytosanitary Measures.

More concretely, there is an explicit linkage between the standards, guidelines and recommendations of the Codex Alimentarius Commission and the WTO SPS agreements. In effect, if a member nation of the WTO complies with a relevant Codex standard, guideline or recommendation, the product shall be presumed to have met its health and safety obligations and should not be denied market access. The SPS agreements preserves the rights of sovereign nations to set their own level of protection which may be more stringent than that of Codex. However, the specific requirements which stem from this raised level of protection can be challenged on the basis of their scientific justification, or if a lesser standard is applied to domestic products.

Nations have the right to protect their agricultural systems, health and well-being of their citizens, and their physical environments, but these protective measures can be interpreted as non-tariff trade barriers. The SPS agreement focuses on science and risk assessments as central to SPS decision making. A key feature for meeting this goal is a notion of establishing safety equivalency among signatory nations.

Risk assessment is a component of risk analysis which was first formalized by the U.S. National Academy of Sciences—through its U.S. National Research Council—in 1983, in a publication commonly referred to as, The Red Book.

Covello and Merkhofer (1994) define risk as a combination of something that is undesirable and uncertain. More specifically, "the possibility of an adverse outcome, and uncertainty over the occurrence, timing or magnitude of that adverse outcome."

The 1983 NAS-NRC model explicitly distinguished between three stages of risk analysis: risk assessment, risk management and risk communication. Risk assessment, it was argued, is a scientific assessment of the true risk; risk management allowed for the incorporation of non-scientific factors to reach a policy decision; and risk communication involved the communication of a policy decision.

The NAS-NRC model of risk assessment consists of:

• hazard identification—the determination of whether a particular chemical is or is not causally linked to particular health effects;

• dose-response assessment—the determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question;

• exposure assessment—the determination of the extent of human exposure before or after application of regulatory controls; and,

• risk characterization—the description of the nature and often the magnitude of human risk, including attendant uncertainty.

These components of risk assessment have been endorsed and incorporated into the principles of risk assessment adopted by the U.S. National Advisory Committee on Microbiological Criteria for Foods (1998).

Despite such endorsements, the NAS-NRC paradigm has recently been criticized as unworkable and unrealistic. Covello and Merkhofer (1994) argue that, "The current state of the art of risk assessment does not permit questions of science to be clearly separated from questions of policy. In practice, assumptions that have potential policy implications enter into risk assessment at virtually every stage of the process. The ideal of a risk assessment that is free, or nearly free, of policy considerations is beyond the realm of possibility."

Even the use of conservatism—the risk assessor errs on the side of safety—is a value judgment deliberately introduced into risk assessments to account for uncertainty which can produce highly distorted risk assessments which affect the pattern of regulation, preventing limited resources for health and safety from being efficiently allocated.

Soby et al. (1993), in a review of risk communication research and its applicability for managing food-related risks, developed the concept of the risk management cycle. In this model, public and other stakeholder concerns are actively sought at each stage of the management process—including assessment. "Unless the risk assessment procedure involves an element of interactive public participation and mutual questioning the decisions and conclusions reached may be more likely to be challenged" (Simpson, 1994).

This integrative approach to risk analysis was recently endorsed in a report by the U.S. National Academy of Sciences' National Research Council Committee on Risk Characterization (1996), which urged risk assessors to expand risk characterization beyond the current practice of translating the results of a risk analysis into non-technical terms. This limited approach is "seriously deficient" and should be replaced with an analytical-deliberative approach that involves stakeholders from the very inception of a risk assessment, the report advocates. The report reframes risk characterization from an activity that happens at the end of the risk assessment process, as many people understand it, to a continuous, back-and-forth dialogue between risk assessors and stakeholders that allows the problem to be formulated properly, and depends on an iterative, analytic-deliberative process.

Similarly, the U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management (1997) developed an integrative framework to help all types of risk managers—government officials, private sector businesses, individual members of the public—make good risk management decisions. The framework has six stages (Fig. 5):

- define the problem and put it in context;
- analyze the risks associated with the problem in context;
- examine options for addressing the risks;
- make decisions about which options to implement;
- take actions to implement the decisions; and,
- conduct an evaluation of the action's results.

Of particular importance is that the framework is conducted in collaboration with stakeholders and using iterations if new information is developed that changes the need for, or nature of, risk management. As Pollak (1996) has argued, due to the inadequacy of scientific knowledge and the lack of public trust in government and in experts, risk regulators should be concerned both with creating institutional arrangements likely to foster trust and mechanisms for providing concerned individuals with credible reassurance.

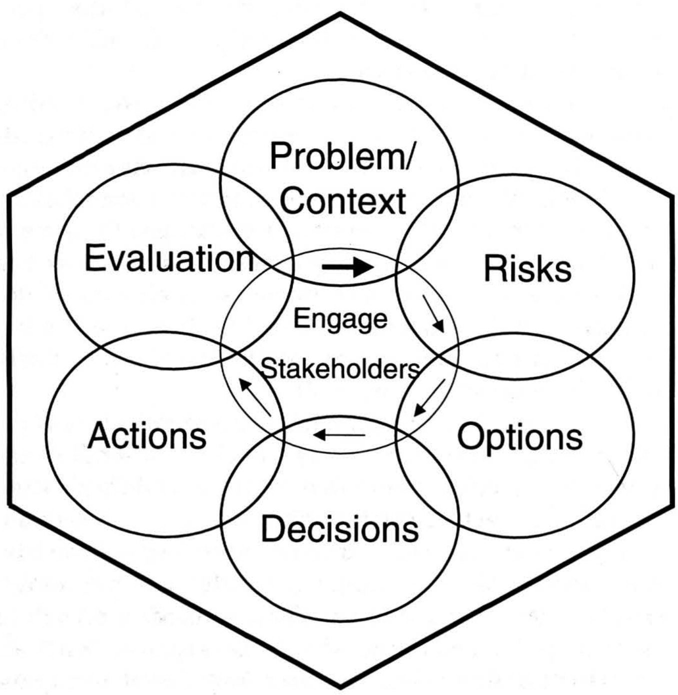

Figure 5. The risk management cycle. U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management (1997).

In 1997, the United Nations Food and Agriculture Organization and the World Health Organization hosted a joint Expert Consultation on the Application of Risk Management to Food Safety Matters at which the ultimate objective of food safety standards were again reiterated: first, consumer protection; second, facilitation of global trade (World Health Organization, 1997).

Risk management is defined within Codex as the process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control options, including regulatory measures. The outcome of the risk management process, as undertaken by Committees within the Codex Alimentarius system, is the development of standards, guidelines and other recommendations for food safety. In the national situation it is likely that different risk management decisions could be made according to different criteria and different ranges of risk management options.

However, the committee seemed to move toward at least a recognition of the integrative model when it concluded that a review of current Codex standards and related texts suggested that in many cases there is insufficient quantitative information to translate requirements for "safety and wholesomeness" into a definitive quantitative assessment of the risks to human health in consumer populations. The inevitable default to more qualitative assessments of "safe and wholesome" is likely to be challenged as a basis for international trade restrictions, especially in an increasingly risk-based international trade environment. The development of Codex-wide principles and strategies for risk management requires that explicit attention be given to the concept of "safe and wholesome." Further, the committee said that although Codex standards and related texts are generally aimed at the reduction of risks in food, these risks can rarely be quantified and any balancing of the risk reduction against other factors, such as costs and benefits of risk reduction, is normally a matter of judgment. Although industry and national regulators strive for production and processing systems which ensure that all food be "safe and wholesome", complete freedom from risks is an unattainable goal. Safety and wholesomeness are related to a level of risk that society regards as reasonable in the context, and in comparison with other risks in everyday life.

There was also an explicit recognition by the committee that risk assessment policy — the guidelines for value judgment and policy choices which may need to be applied at specific decision points in the risk assessment process — is a risk management responsibility, which should be carried out in full collaboration with risk assessors, and which serves to protect the scientific integrity of the risk assessment. The guidelines should be documented so as to ensure consistency and transparency. Examples of risk assessment policy setting are establishing the population(s) at risk, establishing criteria for ranking of hazards, and guidelines for application of safety factors.

The committee also defined risk profiling as the process of describing a food safety problem and its context, in order to identify those elements of the hazard or risk relevant to various risk management decisions. The risk profile would include identifying aspects of hazards relevant to prioritizing and setting the risk assessment policy and aspects of the risk relevant to the choice of safety standards and management options. For example, the committee wrote that a typical risk profile might include: a brief description of the situation, product or commodity involved; the values expected to be placed at risk, (e.g. human health, economic concerns); potential consequences; consumer perception of the risks; and the distribution of risks and benefits. When reviewing the complete details of the 1997 joint risk management framework, it becomes apparent that the model is much more similar to the integrative models incorporating risk assessment, management and communication as a functional entity.

The Codex Alimentarius Commission (CAC) has concluded that the microbiological safety of foods is principally assured by control at the source, product design and process control and the application of good hygienic practices during production, processing (including labeling), handling, distribution, storage, sale, preparation and use, preferably in conjunction with the application of the Hazard Analysis and Critical Control Point (HACCP) system. This "preventive" system offers more control than end-product testing, because the effectiveness of microbiological examination in assessing the safety of food is limited (FAO/WHO. 1996).

Quantitative risk assessment of microbiological hazards provides a focus for discussions among workers from diverse disciplines: farmers, veterinarians, food-processing experts, microbiologists, and consumer behavior experts. The model also allows for consideration and comparison of control strategies in a simulated environment (Lammerding and Paoli, 1998). Further, microbial risk assessment based on a model provides a repository of knowledge describing health risk outcomes and control strategies which can be iteratively updated and adapted. Nevertheless, the large amount of scientific uncertainty inherent in quantitative risk assessment means that an integrative approach incorporating management and communication considerations must be included in any policy about a particular food source, as well as a full and transparent accounting of the factors and uncertainties included in a specific risk assessment.

Risk Communication and Food Safety

Risk communication, the science of understanding scientific and technological risk and how it is communicated within a socio-political structure, is a relatively new scientific endeavor, dating back to Starr's 1969 paper which attempted to offer a scientific basis for thresholds of risk which would be accepted by the public. As public concerns regarding nuclear power gained prominence in the 1970s, investigators tried to establish general principles of public risk acceptability, usually based on mortality statistics and the *de minimis* risk principle, which argued that if a risk can be effectively lowered to less than one additional fatality per million citizens, the risk is effectively zero (U.S. National Research Council. 1989). Such an approach was uniformly unsuccessful.

In the 1980s, several groups developed models that incorporated the value systems of individuals, peer groups and societies into risk communication theory (Vlek and Stallen, 1981; Douglas, 1986; Slovic, 1987) resulting in broad agreement that risks are viewed according to their perceived threat to familiar social relationships and practices, and not simply by numbers alone. The psychometric paradigm (Slovic, 1987) described risk from a psychological perspective, drawing on various characteristics or dimensions which may be important in influencing risk perceptions. Douglas and Wildavsky (1982) first described the cultural theory of risk in which individuals can be allocated into cultural groups based on shared values and beliefs. Whereas the psychometric paradigm holds that risk itself is deterministic in generating perceptions, the cultural theory holds that the characteristics of the perceiver—rather than the risk itself—are central to an understanding of risk perception. Kasperson et al. (1988) developed the social amplification of risk theory, which suggested a way to integrate the aforementioned frameworks into a comprehensive accounting of the social, cultural and individual characteristics which tend to magnify or amplify one risk over another.

According to a U.S. National Research Council committee on risk perception and communication (1989), risk communication is now defined as, "An interactive process of exchange of information and opinion among individuals, groups and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management." In essence, risk communication must be treated as a reciprocal process—not simply those with a vested interest in a message developing more effective techniques to sell their side of the story.

A body of knowledge has been created over the past decade which can assist in the understanding of public perceptions of microbial food safety risk, how the media translates this information, and how government, industry and other organizations can better relate risk information over a wide range of disciplines. This approach to communicating technological risk has been successfully applied in a number of sectors, especially in the chemical industry (Covello, et al., 1988).

The growth of interest in risk communication is driven by four motivations:

• a requirement for—or desire by—government to inform in the participatory democracies of Western politics, from informal consultation to legislated accountability (such as the U.S. Administrative Procedures Act of 1946 and the Community Right to Know provisions of Title III of the Superfund Amendments and Reauthorization Act of 1986);
• desires to overcome opposition to decisions;
• a desire to share power between government and public groups; and,
• a desire to develop effective alternatives to direct regulatory control (U.S. National Research Council, 1989).

Underlying these motivations is a general recognition that decision-making in democratic societies is becoming more public and is increasingly driven by non-experts. Thus, the need for a paradigm or system, such as the risk communication framework, which acknowledges this transition.

Sandman (1987) notes that the public generally pays too little attention to the hazardous nature of risks, and experts usually completely ignore those factors which fuel consumer unrest or outrage. These are two very different starting points and not surprisingly, experts and consumers often rank the relative importance of various risks very differently (Sandman, 1987; Slovic, 1987). Scientists, in general, define risks in the language and procedures of science itself. They consider the nature of the harm that may occur, the probability that it will occur, and the number of people who may be affected (Groth, 1991). Most citizens, in contrast, seem less aware of the quantitative or probabilistic nature of a risk, and much more concerned with broader, qualitative attributes, such as whether the risk is voluntarily assumed, whether the risks and benefits are fairly distributed, whether the risk can be controlled by the individual, whether a risk is necessary and unavoidable or whether there are safer alternatives, whether the risk is familiar or exotic, whether the risk is natural or technological in origin, and so forth (Sandman, 1987).

According to Covello (1992a; 1983), research in the psychological sciences has identified 47 known factors that influence the perception of risk; issues like control, benefit, whether a risk is voluntarily assumed and, the most important factor, trust. These factors can help explain why consumers are concerned about food safety issues that scientists deem trivial. The actual risk does not change, but the perception can; and in the domain of public policy, perception is reality (Covello, et al., 1988; U.S. National Research Council, 1989). People also judge risk according to their perception of its controlling agents: if these controlling agents have a track record of secrecy, or they dominate supposedly independent regulatory bodies and the public policy process, then people magnify the perceived risks (Hamstra, 1992; Covello, 1992b).

Other factors modulating risk perception, as cited by Covello and Merkhofer (1994) include:

• catastrophic potential—people are more concerned about fatalities and injuries that are grouped in time and space (airplane crashes; outbreaks of foodborne illness) than about fatalities and injuries that are scattered or random in time and space (auto accidents; sporadic incidents of foodborne illness);
• familiarity—people are more concerned about unfamiliar risks (ozone depletion) than familiar risks (household accidents);
• understanding—people are more concerned about poorly understood activities (exposure to radiation) than those that may be understood (slipping on ice);
• scientific uncertainty—people are more concerned about risks that are scientifically unknown or uncertain (recombinant DNA) than risks well known to science (car crashes);
• controllability—people are more concerned about risks not under personal control (pesticides on food) than those under personal control (driving a car);
• voluntariness of exposure — people are more concerned about risks that are imposed (residues in food) rather than voluntarily accepted (smoking cigarettes);
• impact on children — people are more concerned about risks perceived to disproportionally affect children;
• dread — people are more concerned about risks that have dreaded results (Creutzfeldt-Jakob disease is perceived as an undesirable way to die);
• institutional trust;
• media attention;
• accident history;
• clarity of benefits;
• reversibility;
• personal stake; and,
• attributability.

Problems in communicating about risks originate primarily in the marked differences that exist between the two languages used to describe risk: the scientific and statistical language of experts, and the intuitively-grounded language of the public (Fig. 6).

The expert assessment of risk is essential to the making of informed choices in everyday life: to ignore the results of scientific risk assessments (ever-changing as they are) is to merely substitute an informal deliberative process for a formal one (Powell and Leiss, 1997). At the same time, citizens in a democratic society cannot allow experts to dictate lessons in risk management to them; on the contrary, their informed consent must form the basis for the collective allocation of

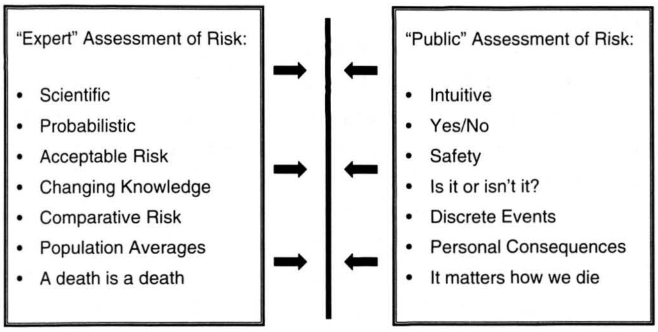

Figure 6. Some characteristics of the two languages of risk communication (Powell and Leiss, 1997)

resources for risk control and risk reduction. In general, therefore, society must manage the tension between these two profoundly different ways of representing risk, rather than try to eliminate the difference itself.

Therefore, both languages for describing risk are necessary, because the daily business about managing risks – both the personal business of individuals and the social allocation of risk reduction resources — cannot be conducted in either language alone. At the same time, the strong differences between the two languages constitute barriers to dialogue and co-operative understanding. Good risk communication practice seeks to break down those barriers and facilitate the productive exchanges between the two spheres. information, skills, and participatory opportunities.

Powell and Leiss (1997) have located the work of risk communication in the gap that separates the evolving scientific description of risks and the public understanding of those same risks (Fig. 7). Further, they suggest that the competing "expert" and "public" understandings of the same risks are equally legitimate and necessary.

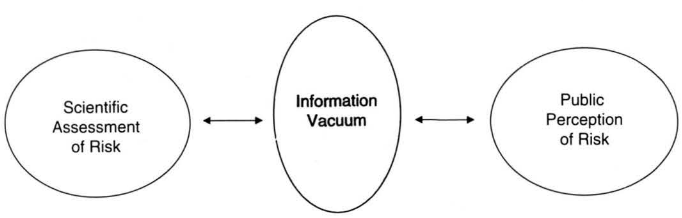

Figure 7. The risk communication vacuum (Powell and Leiss, 1997).

In many cases regarding publicly-debated risks, the gap cannot be closed appreciably because the scientific and public apprehensions of a risk are framed by fundamentally different assumptions or values. But in all risk situations where some public policy response is called for – to ban a substance, to control emissions, to warn consumers about food safety hazards — what occurs in that gap can have significant consequences for institutions and the public alike. One of the most serious manifestations of these "gap dynamics" is the emergence of a risk information vacuum.

The risk information vacuum arises where, over a long period of time, those who are conducting scientific research and assessments for high-profile risks make no special effort to communicate the results, regularly and effectively, to the public. Instead, partial scientific information dribbles out here and there and interpreted in apparently conflicting ways, all of which is mixed with people's fears. The failure to implement good risk communication practices gives rise to a risk information vacuum.

Society as well as nature abhors a vacuum; it is therefore filled from other sources. For example, events reported in the media (some of which are alarming) become the substantial basis of the public framing of these risks; or an interest group takes up the challenge and fills the vacuum with its own information and perspectives; or the intuitively-based fears and concerns of individuals simply grow and spread until they become a substantial consensus in the arena of public opinion; or the vacuum is filled by the soothing expressions beloved of politicians: "There is no risk of.... [fill in the blank]." Confused, complex messages about scientific risk, technical uncertainty, and prevailing climate of mistrust are just some of the factors that make effective risk communication difficult; not impossible, but difficult. Covello and Allen (1988) have summarized the seven cardinal rules of risk communication, as follows:

• accept and involve the public as a legitimate partner;
• plan carefully and evaluate performance;
• listen to your audience;
• be honest, frank and open;
• co-ordinate and collaborate with other credible sources;
• meet the needs of the media; and,
• speak clearly and with compassion.

Several collections, guides and reviews of risk communication have been published over the past 10 years (Powell and Leiss, 1997; Lundgren, 1994; Morgan, 1993; Morgan, et al., 1992; U.S. National Research Council, 1989; Leiss, 1989; Covello, et al., 1988; Hance, et al., 1988; Covello, et al., 1986).

Baruch Fischhoff of Carnegie-Mellon University (1995) says that over the past 20 years, risk communication has evolved by acquiring new skills, "only to discover that there were additional, more complicated problems to solve. " He goes on to offer a sardonic view of the developmental stages in risk management, which he subtitles, Ontogeny Recapitulates Phylogeny:

• all we have to do is get the numbers right;
• all we have to do is tell them the numbers;
• all we have to do is explain what we mean by the numbers;
• all we have to do is show them that they've accepted similar risks in the past;

• all we have to do is show them that it's a good deal for them;
• all we have to do is treat them nice;
• all we have to do is make them partners; and,
• all of the above.

Or, as Thomas Jefferson wrote in a letter to William Charles Jarvis, dated Sept. 28, 1820, "I know of no safe depository of the ultimate powers of society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion" (U.S. National Research Council, 1989, p.14).

Scientists and journalists both use explanatory devices to convey the meaning of their work. Science is about models, explanation and representation, while journalists often resort to metaphors. According to Layoff and Johnson (1980), a metaphor is not just a rhetorical flourish, but a basic property of language used to define experience and to evoke shared meanings. Nelkin (1987) argues that the use of metaphors in science writing is particularly important in the explanation of technical detail, to define experience, to evoke shared meanings and to allow individuals to construct elaborate concepts about public issues and events.

Public communication about issues of technological risk often involves messages from diverse individuals or communities that are translated and synthesized by media outlets and other members of the public. At each step, message providers, journalists and audience members are framing a specific event using their own value systems, constraints and the filters of experience and expectation in a way that makes the most sense to a particular individual. Different people use different sources to collect information related to issues of scientific and technological risk. It is therefore incumbent on the provider of risk messages to determine how a specific target audience receives and perceives risk information.

Schanne and Meier (1992), in a meta-analysis of 52 studies of media coverage of environmental risk, concluded that journalism constructs a universe of its own, a "media reality" which does not mirror actual reality. Specifically, the journalistic construction of environmental issues and environmental risk mirrors, only partially, or not at all, the scientific construction of environmental issues and risk. While the professional isolation of both scientists and journalists presents an on-going impediment to communication, it is mistaken to view journalists and the media always as significant, independent causes of problems in risk communication (U.S. National Research Council 1989). Further, many media analysts, who may never actually write for public media, often fail to recognize the chaos of everyday life (especially that of a newsroom), fail to acknowledge the constraints imposed by a media industry which is geared for profit, and fail to acknowledge the critical faculties of any particular reader. Rather, the assumption seems to be that an uncritical public is waiting to be filled with educational material from a variety of media—residual effects of the hypodermic needle model—and that media is more influential than common sense and practical experience may suggest. Many problems in scientist-journalist interactions and pronouncements can be traced to the myth of objectivity resident in both disciplines. Scientists and journalists who acknowledge that a degree of bias is normal are likely to be better prepared to distinguish facts from value judgments in both expert statements and media accounts of food safety debates (Groth, 1991).

The role of the media in shaping public perceptions in technological controversies has been well-documented (Molitor, 1993). Yet the actual impact of media coverage on citizen decision with respect to a particular risk remains unclear. Protess et al. (1987) found that when examining the impact of reporting on toxic waste controversies media disclosures had limited effects on the general pubic but were influential in changing the attitudes of policy makers. Dunwoody (1993) argues that while mass media tells people something about the risk present in a society, interpersonal channels are used to determine the level of risk to individuals. How much information these secondary sources originally receive from media stories has not yet been determined.

There is a growing realization that there will be no quick fix to the inherent difficulties in communicating about food safety risks. Fischhoff and Downs (1997) note that the food industry, like many others, has a risk communication problem, manifested in the public's desire to know the truth about outbreaks of foodborne diseases; ongoing concern about the safety of foods, additives, and food-processing procedures; and continued apathy regarding aspects of routine food hygiene. Because citizens are ill-equipped to discriminate among information sources, the food industry as a whole bears responsibility for the successes and failures of its individual members.

Powell and Leiss (1997) stress the need for a long-term institutional commitment to the gradual development and application of good risk communication practices, using the following guidelines.

Risk Communication is serious business—failures can be costly.

The financial cost of the BSE crisis in the U.K. is currently pegged at some $5 billion, a cost which could have been substantially reduced with more effective risk management and communication practices. Outbreaks of foodborne illness routinely cost industry millions of dollars.

Regulators are responsible for effective risk communication

Governments, and in particular those agencies of governments which have regulatory authority over a broad range of health and environmental risks, have— or are capable of acquiring (through enabling legislation) — the legal authority to manage risks.

Industry is responsible for effective risk communication

It is now generally accepted that industry must take primary risk communication responsibility for product-related risks and workplace hazards, as well as for community awareness in the vicinity of facilities where hazardous materials and processes are employed. But with the rationalization of government services, industry is assuming more responsibility for the delivery of food inspection services (under government auditing) and therefore is assuming more of the risk communication responsibility.

If you are responsible, do it early and often.

Timeliness is everything in effective risk communication: overcoming entrenched perceptions that are broadly dispersed in the social environment is a thankless task with almost no chance of succeeding. Further, doing good risk communication early is of little benefit if it not also done often, as often and as long as is needed to prevent a risk issue from being put into play by other interested parties.

There is always more to a risk issue than what science says.

Public perceptions, values and opinion all enter into characterizations of risk.

Always put the science in a policy context.

Almost any type of risk issue can turn into a seemingly intractable risk controversy, and it is the nature of such controversies inevitably to give rise to demands on governments to "do something" about controlling or eliminating the risks in question. In other words, although the scientific description of the hazards and probabilistic risk assessments can be matters of widespread public interest, in the final analysis the competing choices among risk management options—banning or restricting a substance, say—make up the contents of letters and calls to politicians. This means that the contents of effective risk communication cannot be limited to the scientific description of hazards or the risk numbers. Rather, the science should be put into a policy (action) context, which in the early stages of an emerging risk controversy might take the form of forecasting a range of policy options—including the "do nothing" option—and of exploring their consequences in terms of implications for economic and social interests, international developments, and obligations for environmental protection (all in the context of the risk management cycle, mentioned earlier). Responsible agencies and industries ought to begin discussing the possible policy responses to emerging risk controversies as soon as they arise, and continue to do so throughout their life history.

"Educating the public" about science is no substitute for good risk communication practice.

Sanctimonious urgings for new programs designed to increase the public's awareness about the inner mysteries of scientific research are encountered frequently. What appears to sustain this mission is the curious belief that the citizenry's ignorance of scientific method can best explain the observed differences between the expert assessment of risk and the public perception of the same. This rhetorical strategy has been advocated by technology promoters in discussions of technological risk for the past 200 years. More recently, promoters of agricultural chemicals in the 1960s and nuclear energy in the 1970s have embraced the public education model. It has failed. Today, the notion of public education is the basis of dozens of communications strategies forwarded by government, industry and scientific societies, in the absence of any data suggesting that such educational efforts are successful.

What is known is that levels of perceived trust in technology promoters and regulators is a better predictor of consumer support. Several surveys in North America and the U.K. have found that perceptions of trust in government regulation (and industry), regarding either pesticides (Dittus and Hillers, 1993) or the products of agricultural biotechnology (Frewer, et al., 1994) is the strongest predictor for consumer support. People either trust that pesticides and the products of agricultural biotechnology are adequately regulated or they do not. Those with low trust have the highest concern about possible risks. Those with high trust perceive greater benefits from both products. van Ravenswaay (1995) concluded that trust in government and industry may be a more important influence on risk perception than the inherent safety or the danger of a particular agrichemical. There is no reason to believe that the same would not hold true for microbial food safety risks.

If trust is a better predictor of consumer support, then what factors influence perceptions of trust? Lynn Frewer and colleagues at the U.K. Ministry of Agriculture, Fisheries and Food's Institute of Food Research in Reading have conducted the most comprehensive work toward understanding food-related risk perception. Frewer et al. (1996) conducted two sets of in-depth interviews with about 45 people each, and then a larger quantitative survey to better understand the formation of trust. Overall, there were many findings of relevance to effectively communicating about food-related risks, including:

- the most important and frequently cited source of information about food-related information was the media, far ahead of any other source;
- while scientists and medical sources were rated as trusted but not distrusted (media were often trusted and distrusted), they were infrequently named as sources of food-related information;
- the single most important determinant of gain or loss of trust in a source is whether the information is subsequently proven right or wrong, and that the source is subsequently demonstrated to be unbiased;
- information about natural toxins, genetic engineering and pesticide residues was more distrusted than information about high fat diets, microwave ovens, etc.;
- medical sources are likely to be viewed as expert in medically-related areas, but to have little knowledge in technological risk assessment and therefore poor sources of information about technological hazards;
- trust is clearly multidimensional and cannot be predicted by single items or psychological constructs (i.e. surveys which ask respondents to rank social actors — doctors, farmers, environmentalists, government — in terms of levels of trustworthiness are somewhat meaningless in the absence of context)
- trust appears linked with perceptions of accuracy, knowledge and concern with public welfare;
- if government sources and risk regulators are seen to be proactive in their interactions with the media and other trusted sources—including discussions of risks—this may positively influence the way in which risk information is reported, as well as increasing trust in government regulation;
- admitting to uncertainty, or facilitating public understanding of science as a "process" could increase communicators trustworthiness; and,
- people seem to be adverse to ambiguous risks and trust is all the more likely to be important where there is a perception that accurate estimates of risk are not available, like genetically-engineered foods.

If trust is the key component in public perception of risk scenarios, what other guidance exists to build trust and credibility? Hance, et al. (1988) offer the following:

- be aware of the factors that inspire trust;
- pay attention to process;
- explain agency process;
- be forthcoming with information and involve the public from the outset;
- focus on building trust as well as generating good data;
- follow up;
- only make promises you can keep;
- provide information that meets people's needs;
- get the facts straight;
- try to co-ordinate with other agencies;
- make sure to co-ordinate within your agency;
- don't give mixed messages;
- listen to what various groups are telling you;
- enlist the help of organizations that have credibility with communities; and,
- avoid secret meetings.

Banish "No risk" messages

Ironically, although citizens and environmentalists are often taken to task by government and industry officials for advocating "zero risk" scenarios, pronouncements of the "there is no risk" variety are a favourite of government ministers and sometimes of industry voices as well. In fact, at least some business sectors—the chemical industry in particular—do this less and less, which is a sea-change from what used to be their standard public relations practice.

Risk messages should address directly the "contest of opinion" in society.

There is a curious reluctance, especially on the part of government risk managers, to avoid addressing directly the alternative representations of risk issues as they form and re-form in dialogue among interested parties in society. Quite simply, if government regulators and industry have the primary responsibility for effective risk communication, these officials cannot avoid confronting the issues as they are posed in the society.

Communicating well has benefits for good risk management.

Good risk communication practice should be regarded as of equal importance to the other key elements—risk assessment and the evaluation of risk control options—in the overall risk management process. In fact, good risk communication practice can be regarded as the causeway that links all the organizational elements in a well-functioning risk management process, especially in the face of scientific uncertainty.

The current state of risk management and communication research suggests that those responsible with food safety risk management must be seen to be reducing, mitigating or minimizing a particular risk. Those responsible must be able to effectively communicate their efforts and they must be able to prove they are actually reducing levels of risk. As Slovic (1997) has noted, "We live in a world in which information, acting in concert with the vagaries of human perception and cognition, has reduced our vulnerability to pandemics of disease at the cost of increasing our vulnerability to social and economic catastrophes of unprecedented scale. The challenge before us is to learn how to manage stigma and reduce the vulnerability of important products, industries, and institutions to its effects, without suppressing the proper communication of risk information to the public."

Stigma is a powerful shortcut consumers may use to evaluate foodborne risks. Gregory, et al. (1995) have characterized stigma as:

- the source is a hazard;
- a standard of what is right and natural is violated or overturned;
- impacts are perceived to be inequitably distributed across groups;
- possible outcomes are unbounded (scientific uncertainty); and,
- management of the hazard is brought into question.

Certainly the outbreak of bovine spongiform encephalopathy (BSE, or mad cow disease) could be characterized as a stigmata using the evaluative criteria listed above. There have been dozens of other, well-publicized outbreaks since Jack-in-the-Box. For example, in the spring and summer of 1996, some 1,465 people across North America were stricken with *Cyclospora cayetanensis*, a parasite initially linked to the consumption of California strawberries. However, the common vehicle was later thought to be Guatemalan raspberries (Hofmann, et al., 1996). Most citizens did not hear the correction, and the California Strawberry Commission estimates it lost $20 to $40 million in sales. Yet despite increased surveillance and risk management of Guatemalan raspberries, cyclospora emerged again in 1997, associated not only with consumption of fresh fruits but with mesclun lettuce in Florida and fresh basil in Washington, D.C. Sales of fresh herbs immediately dropped (Masters, 1997).

In these cases and dozens of others, there is an enormous potential for economic damage, even damage to health as consumption of nutritious foods may decline. The potential for stigmatization of food is enormous.

The same criteria can be applied to other outbreaks. For example, in the Odwalla outbreak, the increased and more effective attention of the Seattle-King County Health Unit — the same one involved in the Jack-in-the-Box outbreak — toward *E. coli* O157:H7 resulted in rapid identification of the Odwalla outbreak. The company exercised exemplary risk communication. Odwalla officials responded in a timely and compassionate fashion, co-operating with authorities after a link was first made on Oct. 30, 1996 between their juice and an illness which was eventually linked to 65 people in four U.S. states and B.C. Upon learning of the child's death, company chairman Greg Steltenpohl issued a statement which said, "On behalf of myself and the people at Odwalla, I want to say how deeply saddened and sorry we are to learn of the loss of this child. Our hearts go out to the family and our primary concern at this moment is to see that we are doing everything we can to help them" (Odwalla, 1996).

Yet despite the comforting words, the company failed to acknowledge the existence of risk, let alone efforts to reduce levels of risk. Steltenpohl told reporters at the time that the company did not routinely test for *E. coli* because it was advised by industry experts that the acid level in the apple juice was sufficient to kill the bug. Because they are unpasteurized, Odwalla's drinks are shipped in cold storage and have only a two-week shelf life. Odwalla was founded 16 years ago on the premise that fresh, natural fruit juices nourish the spirit. And the bank balance: in fiscal 1996, Odwalla sales jumped 65 per cent to $60 million (U.S.).

Odwalla insisted the experts in this case were the U.S. Food and Drug Administration. The FDA isn't sure who was warned and when. However, researchers from the U.S. Centers for Disease Control and Prevention wrote in the May 5, 1993 Journal of the American Medical Association that a 1991 outbreak of *E. coli* O157:H7 which struck 23 people in Fall River, Mass. — and was well-publicized at the time — was caused by unpasteurized, unpreserved cider. The story received national media attention and noted that researchers had found that *E. coli* could survive for 20 days in unpreserved, refrigerated cider. Further, the authors cited two previously reported outbreaks of illness associated with drinking apple cider.

In Dec. 1994, the Columbus Salami Co. of South San Francisco recalled 10,000 pounds of salami after health officials linked the product to at least 18 cases of *E. coli* O157:H7 in California and Washington. The bacterium was not supposed to survive the acidic environment of salami, and again the story received national coverage. In this case, the industry immediately pledged to test whether *E. coli* O157:H7 could survive the process used to make dry sausages like salami, which only involves meat curing, not cooking.

And earlier in Oct. 1996, fresh (unpasteurized) apple cider produced at the Notch Store and Cider Mill in Cheshire, Connecticut was linked to an outbreak of *E. coli* O157:H7 in at least seven people. For Odwalla to say it had no knowledge that *E. coli* O157:H7 could survive in an acid environment is simply unacceptable in a global food manufacturing and distribution system, especially one becoming increasingly vulnerable to outbreaks of foodborne illness.

Stigmatization is becoming the norm for food and water linked to human illness or even death. That is because stigma is a warning-system — one that is often erroneous but in these cases extremely valuable — that something is wrong. If trust is the most important component of consumer confidence in the food supply, then how to establish trust? For a while, in the early 1990s, right after the Alar episode, many producers sought public salvation in the language of persuasion: that if we talk nice to people, we can establish trust; we can resolve conflict. Happy talk is important, but as Nancy Donley, president of Safe Tables Our Priority, and whose six-year-old son died from E. coli O157:H7 in 1993 says, "We need sound science rather than soundbites."

How then to reduce stigma? The components for managing the stigma associated with any food safety issue seem to involve all of the following factors:

- effective and rapid surveillance systems;
- effective communication about the nature of risk;
- a credible, open and responsive regulatory system;
- demonstrable efforts to reduce levels of uncertainty and risk; and,
- evidence that actions match words.

On-farm food safety programs are an action, an appropriate risk management strategy, to demonstrate to consumers that producers are cognoscent of their new found concerns about microbial food safety, and to demonstrate that producers and others in the farm-to-fork continuum are working to reduce levels of risk. Because when the next outbreak comes — and microorganisms can adapt and evolve to any food production and distribution system that is created — producers need to demonstrate due diligence to minimize potential losses.

References

1. Covello, V. 1992a. Risk communication: An emerging area of health communication research **in** Communication Yearbook 15 ed. by S. Deetz. Newbury Park and London, Sage Publications. pp. 359-373.
2. Covello, V.T. 1992b. Trust and credibility in risk communication. Health Environ. Digest **6:** 1-5.
3. Covello, V.T. 1983. The perception of technological risks: a literature review. Tech. Forecasting Social Change **23:** 285-297.
4. Covello, V.T. and Merkhofer, M.W. 1994. Risk Assessment Methods. Plenum Press, New York. 319 pp.
5. Covello, V., Sandman, P. and Slovic P. 1988. Risk Communication, Risk Statistics and Risk Comparisons: A Manual for Plant Managers. Chemical Manufacturers Association, Washington, D.C.
6. Covello, V.T., von Winterfeldt, D. and Slovic, P. 1986. Risk communication: a review of the literature. Risk Abstracts **3:** 171-182.
7. Dittus, K.L. and Hillers, V.N. 1993. Consumer trust and behavior related to pesticides. Food Technol. **477:** 87-89.
8. Douglas, M. 1986. Risk Acceptability According to the Social Sciences. Russel Sage, New York.
9. Dunwoody, S. 1993. Telling public stories about risk **in** Agricultural Biotechnology: A Public Conversation About Risk. National Agricultural Biotechnology Council 5, Ithaca, New York pp. 97-106.
10. FAO/WHO. 1996. Report of the twenty-eighth session of the Codex Committee on Food Additives and Contaminants. Manila, 18 - 22 March. FAO. Rome.
11. Fischoff, B. and Downs, J.S. 1997. Communicating foodborne disease risk. Emerging Infectious Diseases 34.
12. Fischhoff, B. 1995. Risk perception and communication unplugged: twenty years of process. Risk Analysis **15:** 137-145.
13. FMI, 1997. Trends, consumer attitudes and the supermarket. Food Marketing Institute. Washington, D.C.
14. Foegeding, P.M., Roberts, T., Bennett, J.M., Bryan, F.L., Cliver, D.O., Doyle, M.P., et al. 1994. Foodborne pathogens: risks and consequences. Council for Agricultural Science and Technology Task Force Report No. 122, Ames, Iowa
15. Frewer, L.J., Howard, C., Hedderley, D. and Shepherd, R. 1996. What determines trust in information about food-related risks? Underlying psychological constructs. Risk Analysis **16:** 473-486.
16. Frewer, L.J., Shepherd, R. and Sparks, P. 1994. The interrelationship between perceived knowledge, control and risk associated with a range of food-related hazards targeted at the individual, other people and society. J. Food Safety **14:** 19-40.
17. Gregory, R., Slovic, P. and Flynn, J. 1995. Risk perceptions, stigma, and health policy. Health and Place 2(4): 213-220.
18. Groth, E. 1991. Communicating with consumers about food safety and risk issues. Food Technol. **455:** 248-253.
19. Hamstra, A. 1992. Consumer research on biotechnology **in** Biotechnology in Public: A Review of Recent Research. Science Museum, London. pp. 42-51
20. Hance, B.J., Chess, C. and Sandman, P.M. 1988. Improving dialogue with communities: A Risk Communication Manual for Government. Environmental Communication Research Program, Rutgers University, New Brunswick, NJ. 83 pp.
21. Hofmann, J., Liu, Z., Genese, C., Wolf, G., Manley, W., Pilot, K., Dalley, E., Finelli, L. 1996. Update: Outbreaks of Cyclospora cayetanensis infection — United States and Canada, 1996. CDC MMWR 611 Vol. 45 / No. 28
22. Lammerding, A.M. and Paoli, G.M. 1998. Quantitative risk assessment: an emerging tool for emerging foodborne pathogens. Emerging Infectious Disease.
23. Layoff, G. and Johnson, M. 1980. Metaphors We Live By. University of Chicago Press. Chicago.
24. Lundgren, R. 1994. Risk Comunication. A Handbook for Communicating Environmental, Safety and Health Risks. Battelle Press, Columbus, Ohio. 175 pp.
25. Masters, B.A. 1997. Tainted basil shows the challenges of tracking a microbe. Washington Post. July 28, B1.
26. Molitor, F. 1993. Accuracy in science news reporting by newspapers: the case of aspirin for the prevention of heart attacks. Health Comm. **5:** 209-224.
27. Morgan, M.G. 1993. Risk analysis and management. Sci. Am. **July:** 32-41.
28. Morgan, G.M., Fischhoff, B., Bostrom, A., Lave, L., Atman, C.J. 1992. Communicating risk to the public. Env. Sci Tech. **26:** 2048-2056.
29. Nelkin, D. 1987. Selling Science: How the Press Covers Science and Technology. W.H. Freeman and Company. New York. 224 pp.
30. Odwalla, 1996. Odwalla expresses condolences to Denver family. Odwalla press release, Half Moon Bay, California. Nov. 8.
31. Pollak, R.A. 1996. Government risk regulation. Annals Am. Acad. Pol.Soc. Sci. **545:** 25-34.
32. Powell, D.A. and Leiss, W. 1997. Mad Cows and Mother's Milk: The perils of Poor Risk Communication. McGill-Queen's University Press. Montreal. 308 pp.
33. Powell, D.A., Harris, L.J. and Leiss, W. 1997. Hamburger hell: better risk communication for better health **in** Mad Cows and Mother's Milk by D. A. Powell and W. Leiss. McGill-Queen's University Press. Montreal. pp. 77-98.
34. Protess, D.L., Cook, F.L., Curtin, T.R., Gordon, M.T., Leff, D.R., McCombs, M.E. and Miller, P. 1987. The impact of investigative reporting on public opinion and policymaking. Public Opinion Q. **51:** 166-185.
35. Rodricks, J.V. 1994. Risk assessment, the environment, and public health. Environ Health Perspect **102:** 258-64.
36. Sandman, P.M. 1987. Risk communication: facing public outrage. EPA Journal **13:** 21.
37. Schanne, M. and Meier, W. 1992. Media coverage of risk **in** Biotechnology in Public: A Review of Recent Research. Science Museum, London. pp. 142-168.
38. Simpson, A.C.D. 1994. Integrating Public and Scientific Judgments into a Tool Kit for Managing Food-Related Risks, Stage II: Development of the Software. A report to the U.K. Ministry of Agriculture, Fisheries and Food. ERAU Research Report No. 19, University of East Anglia, Norwich.
39. Slovic, P. 1987. Perception of risk. Science **236:** 280-285.

40. Smith, J.L., Fratamico, P.M. 1996. Factors involved in the emergence and persistence of food-borne diseases. Journal Food Protection **58:** 696-708.
41. Soby, B.A., Simpson, A.C.D. and Ives, D.P. 1993. Integrating Public and Scientific Judgments into a Tool Kit for Managing Food-Related Risks, Stage 1: Literature Review and Feasibility Study. A report to the U.K. Ministry of Agriculture, Fisheries and Food. ERAU Research Reoprt No. 16, University of East Anglia, Norwich.
42. Starr, C. 1969. Social benefit versus technical risk. Science **165:** 1232-1238.
43. U.S. National Academy of Sciences' National Research Council Committee on Risk Characterization. 1996. Understanding Risk: Informing Decisions in a Democratic Society. NAS press. Washington.
44. U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management. 1997. Framework for Environmental Health Risk Management. Final Report Volume 1. Washington. http://www.riskworld.com.
45. U.S. National Research Council. 1989. Improving Risk Communication. Committee on Risk Perception and Communication. National Academy Press, Washington, D.C. 332 pp.
46. U.S. National Research Council. 1983. Risk assessment in the federal government: managing the process. National Academy Press. Washington.
47. World Health Organization. 1997. FAO/WHO Expert Consultation on the Application of Risk Management to Food Safety Matters. Rome.
48. U.S. National Advisory Committee on Microbiological Criteria for Foods. 1998. J. Food Protect.
49. van Ravenswaay, E.O. 1995. Public perceptions of agrichemicals. Council for Agriclutural Science and Technology task force report. Ames, Iowa. 34 pp.
50. Vlek, C. and Stallen, P. 1981. Rational and personal aspects of risk. ACTA psychologique **45:** 275-300.
51. World Health Organization. 1995. Application of risk analysis to food standards issues. Report of the Joint FAO/WHO Expert Consultation. WHO/FNU/FOS/Report No.95.3.

Other References

An annotated bibliography on Food Safety Risk Assessment, Management and Communication is available on the USDA/FDA Foodborne Illness Education Information web site at:
http://www.nal.usda.gov/fnic/foodborne/risk.htm

Food Safety Network (FSnet), Agriculture Network (Agnet) and AnimalNet Backgrounder

FSnet, Agnet and AnimalNet are electronic communications tools to assist in risk analysis activities, to rapidly identify issues for risk management and communication activities, to promote awareness of public concerns in scientific and regulatory circles, and to exchange timely and current information for direction of research, diagnostic or investigative activities. These listserves provide current, generalized, public risk perception information about rapidly changing issues, culled from journalistic and scientific sources around the world and condensed into short items or stories that make up the daily postings. All three nets are distributed daily by electronic mail to thousands of individuals from academia, industry, government, the farm community, journalism and the public at large.

Material related to food safety — including microbial hazards, nutritional issues and regulatory issues — is included in FSnet. Material related to plant agriculture — food biotechnology, chemical hazards, productivity and sustainability — is included in Agnet. Material related to animal agriculture — including new diseases, susttainability and animal welfare — are included in AnimalNet.

To receive FSnet, Agnet or AnimalNet, send an electronic mail message to: listserv@listserv.uoguelph.ca
leave subject line blank
type
subscribe fsnet-L firstname lastname
i.e. subscribe fsnet-L Doug Powell
for agnet, substitute fsnet-L with agnet-L
for animalnet, substitute fsnet-L with animalnet-L

For more information about the FSnet/Agnet/AnimalNet research program, please contact:
Dr. Douglas Powell
Department of Food Science
University of Guelph
Guelph, Ont.
N1G 2W1
tel: 519-821-1799
fax: 519-824-6631
e-mail: dpowell@uoguelph.ca
http://www.uoguelph.ca/~dpowell