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Although most of the information presented in the Journal refers to situations within the United States, environmental health and protection know no boundaries. The Journal periodically runs an International Perspectives Column to ensure that issues relevant to our international constituency, representing over 60 countries worldwide, are addressed. Our goal is to raise diverse issues of interest to all our readers, irrespective of origin. Also, by offering perspectives from abroad, whether research or commentary, this column helps keep our U.S. members informed about international environmental health concerns—and their solutions.

# Risk Communication and Public Response to Industrial Chemical Contamination in Sydney, Nova Scotia: A Case Study

## Abstract

The town of Sydney, located on the north coast of Nova Scotia, is Canada's most contaminated community. The local tidal estuary, called the tar ponds, was used as a receptacle for industrial waste from a century of coke production and steel making and is estimated to contain more than 700,000 metric tons of polycyclic aromatic hydrocarbons, 50,000 metric tons of polychlorinated biphenyls, and many other residuals including arsenic, naphthalene, and toluene. Many residents have expressed consternation over the potential for exposure and subsequent health effects from the ponds. Recent epidemiological studies estimate a 30 to 40 percent increased incidence in several types of cancer within the community. This paper examines the claims and responses made by a variety of interested parties about the chemical contamination in Sydney. It also considers how those claims, in addition to a number of other mediating factors, may have influenced the local community in the mobilization of a response to the contamination.

## Introduction

Chemical contamination and toxic waste resulting from industrial processes figure prominently on a growing list of health hazards faced by communities in Canada. Although research with attention to such health hazards is on the rise, the understanding of individual, local, and community responses to such hazards is limited. Nowhere is this more apparent than in Sydney, Nova Scotia, Canada's most contaminated community. Using a constructivist approach, this

paper examines the array of claims and responses made to widespread chemical contamination and how those responses have influenced the community to mobilize in reaction to perceived health impacts.

The town of Sydney located on the northern tip of Cape Breton, Nova Scotia, is a culturally rich but economically poor and government-dependent community. The physical geography of the Sydney area boasts rich deposits of coal and iron ore, and the town's proximity to the sea has enabled Sydney's

citizens to supplement their incomes from an abundant and resilient fishery. Sydney's shape is influenced by a large tidal estuary that has historically been used as a launch site for fishing vessels, an ocean playground for adjacent residents, and, more recently, a dump for the waste from steel-making processes (Figure 1). With a current population of approximately 26,000, Sydney is Nova Scotia's third largest city ("Sydney: The History," 2000).

## Contamination in the Making

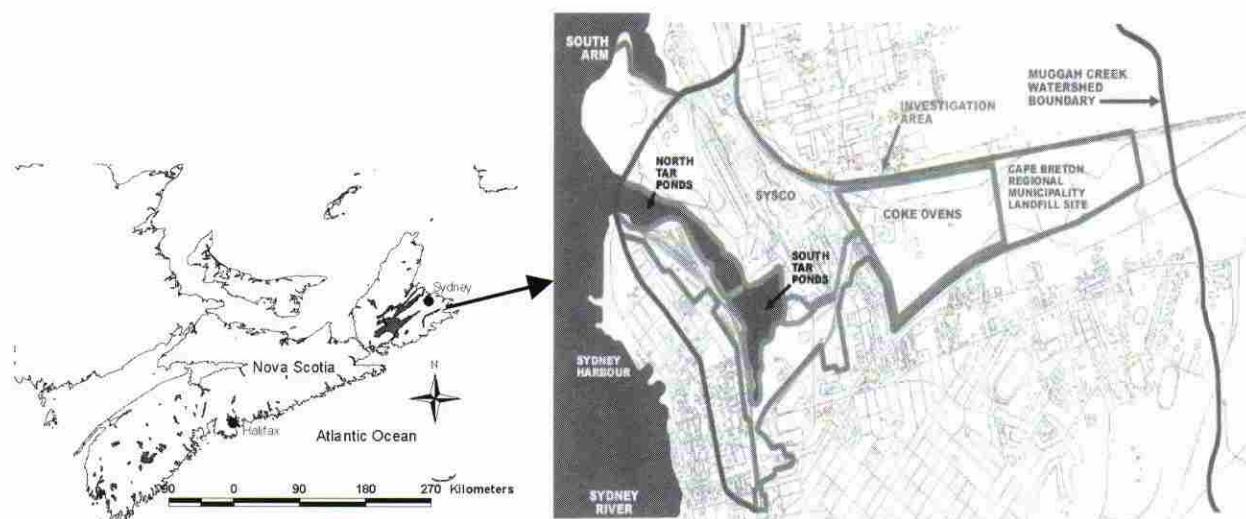
Since the beginning of the last century, Sydney has flourished as the economic base of northern Nova Scotia. Large-scale mining and processing of coal in and around the Sydney area occurred most substantially after the arrival of the Dominion Coal and Steel Company in 1899 (Earle, 1991). Large groups of immigrants settled in the Sydney area seeking opportunity and employment, and helped to produce nearly half of all the steel made in Canada in 1921. At the height of production in the 1940s, the steel plant and its associated operations had acquired much of the land situated next to the estuary, and many workers and residents built houses close to the operations.

In the 1960s, after many successful years of production and profitability, the Dominion Steel Company started to suffer, mainly as a result of weak world steel mar-



# FIGURE 1

Map of the Tidal Estuary and the Town of Sydney, Nova Scotia



SYDNEY, CAPE BRETON

Source: Joint Action Group, Sydney, Cape Breton (1999).

kets. Periods of decline in demand for steel made Sydney's residents fully aware of the town's economic dependence. This awareness of susceptibility gave rise to worker demands for increased stability and assurance of sustainable employment and was reinforced by disgruntlement among coal mine workers who found working conditions to be particularly unacceptable. Nevertheless, Sydney residents generally accepted the side effects of steel making and mining as an aspect of prosperous industrialization (Lavigne, 1987). Residents of Sydney were willing to accept industry and the potential degradation of their environment and health for perceived economic returns.

The scientific community was first alerted to Sydney and the area around the estuary in the early 1980s after a succession of resident complaints about noxious fumes and respiratory difficulties. A series of federal and provincial studies revealed the presence of carcinogens, including some species of polycyclic aromatic hydrocarbons (PAHs) (Environment Canada, 1988). A subsequent decision by the Department of Fisheries and Oceans to close the lobster fishery in 1981 because of elevated PAH levels did nothing to alleviate community fears. It is currently estimated that the tar ponds site contains 700,000 metric tons of PAH-filled tar, about 50,000 metric tons of which is heavily laced

with polychlorinated biphenyls (PCBs) (Gjertsen, 1997). The emergence of the Sydney tar ponds as an extreme example of environmental contamination is as much a by-product of Cape Breton's economic history as a by-product of manufacturing steel and mining for coal.

## From Contamination to Mobilization

In contrast to many instances of environmental contamination in which a community may have little warning about the existence of an environmental contaminant, the short-term and chronic health effects of industrial chemical exposures have been an issue in Sydney since mining and steel production began in the 19th century (Havlock, 1973). Concerns about lowered respiratory function among both miners and steel factory workers and the downplaying of mine disasters have played an important role in emphasizing the dangers of the industry to local residents. In addition, decades of relentless economic recession and unemployment have hindered growth and socio-economic development in the region (Pennock, 1996).

In the mid-1980s, chronic environmental contamination in Sydney developed into a public-health issue. Rumors and first-hand accounts of friends and family dying from

cancer, media stories about residents who border the old steel mill, and a federal-provincial agreement to clean up the area did much to alert the town, the province, and the rest of Canada to the issue. The most recent public-opinion poll confirms that a broad interest in the cleanup still exists today and that demands for investigations into human health effects from the tar ponds contamination remain unwavering (Marketing Research Council, 1998).

In an attempt to understand the impact of chronic environmental contamination at the community level, this paper explores the multiple factors that influence community responses and methods of dealing with the perceived problem, also known as community mobilization. Using interpretations derived from epidemiological philosophies of causality, the culture of risk perception and management, and community-based environmental decision making, this paper seeks to explore the factors mediating the process of response to widespread environmental contamination in a small community.

The focus of this discussion is primarily on the emergence and construction of the Sydney community, their elected representatives at both the federal and provincial levels, and the media. The paper will also illustrate ways in which social actors who have a

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political or economic stake in the social response to calls for environmental remediation attempt to shift the perception of environmental contamination as a major public-health concern to a perception of it as an economic opportunity.

## Theoretical Context

Social constructionism provides a useful conceptual framework for this discussion. Using a construction agenda, Best (1987) suggests that claims—whether they are scientific or something else—should be analyzed contextually and in terms of the claims themselves, the claims makers, and the claims-making process. Constructivist research often reveals that what appears to be most obvious or intuitive is nevertheless false. This approach is certainly pertinent to research on the impacts that the social visibility of environmental contamination has on local community mobilization in Sydney, Nova Scotia.

Community mobilization resulting from environmental hazards is a nonlinear and relatively dynamic process (Edelstein, 1988). The process includes initial reaction, thoughts, and feelings about the contamination (interpretations) and actions taken to alleviate fears and to correct environmental quality (actions). Cognitive responses incorporate perception of the hazard (possible risk identification) and alteration of emotional responses to the negative stimulus. For example, a person may change the way he or she thinks about a situation in order to feel better about it or to justify its existence (Portney, 1991). Initial responses and subsequent actions are, however, mediated by the influences of contaminant literacy (that is, how much those potentially affected know about the contaminant), the claims made by stakeholders who are potentially involved or are involved in the issue, and perceptions of risk (Schnaiberg, 1980). Subsequent actions include pressure for dynamic changes in the situation, such as mobilization, to reduce the impacts of adverse outcomes.

Adverse effects on well-being and health, and subsequently on both cognitive and behavioral responses, tend to interact with reconciling factors related to the potentially affected population and mediating influences. These factors may include characteristics such as education, current health status, outlook on individual health, occupation, and length of residence (Cohen, Evans,

Stokols, & Krantz, 1986). Characteristics of the environmental contaminant, such as the duration of threat, observability, and claims of risk associated with the contaminant, are also important mediating factors (Cutter, 1993; Slovic, 1987).

Societal attentiveness to environmental problems varies independently of the actual extent of environmental degradation (Crenson, 1971). Thus, a genuine disjunction between visible environmental contamination and public consciousness of contamination is possible. In Sydney, for example, the level of public upheaval around environmental contamination does not hinge on social visibility or on the contamination *per se*. Mediating factors other than the extent and nature of the contamination are more important determinants of action and mobilization.

The visibility of an environmental problem involving large-scale contamination can be defined according to the ability of the senses to detect the phenomenon. The ability of the community to sense an environmental health problem gives the possibility of contamination more social visibility than when environmental problems are less readily detectable (Gould, 1993). For example, it is difficult to comprehend and mobilize against contamination when it may lead to such things as the potential to experience neurological damage from eating contaminated fish over a long period of time. The scale of the contamination, however, also plays an important role in terms of mobilization. According to Bates (1994), local health impacts, rather than larger ecosystem impacts, form the basis on which potentially affected citizens or communities mobilize for specific action.

Moreover, community mobilization derived from the visibility of a particular environmental contaminant can be catalyzed by increased access to certain information and exposure to facts put forth by a narrative media framework. For example, the media generate the capacity for community responses by allowing people to recognize the existence or impacts of particular environmental threats. Being informed increases the visibility and subsequent mobility of a perceived affected population (Singer, 1990). Further information indicating that a contaminant has been associated with specific health problems also increases social visibility and, subsequently, solidifies the social definition of the contamination (a claim that the contamination results in health effects) as an

environmental problem warranting mobilization (Levine, 1982).

In the early 1990s, public and media attention in Sydney turned to the increasing incidence of cancer and detection of chemical contaminants in the local watershed. Unlike the eutrophication of lakes and the visual effects of acid rain, chemical contamination is often only detectable through scientific testing and subsequent symbols such as warning signs and the reports created by media, consultants, and public-health authorities. This relative invisibility of chemical contaminants makes it difficult for local groups (designed to mobilize around the issue) to draw attention to, and gain support for, remediation (Soliman, 1996).

The theoretical model described above recognizes that any complex event, such as the possibility of toxic exposure, has impacts at various levels of a community and results in the potential for varied outcomes. The events will be evaluated and examined in light of the social and environmental dimensions of claims—the Sydney “story.” The analysis that follows will shed light on a system of past response and an elucidation of the historical influences responsible for future action. This article will first examine the evidence for environmental contamination, the effects on human health, and the efficacy of environmental epidemiology for the study of environment and health associations. Second, it will identify issues of perceived and actual risk. Third, it will investigate claims reported by the media and look at how those claims can influence the perceptions of stakeholders in Sydney. Last, it will examine how stakeholders framed the problem of large-scale environmental contamination.

## Identification of Health Effects with Epidemiology

Generations of Sydney residents have been occupationally and environmentally exposed to the by-products of local coal mines and steel mills since the end of the 19th century (Havlock, 1973). These exposures have been magnified by economic decline and the identification of extreme health differences among socioeconomic components of the community. Years of industrial labor and exposure to industrial residues have contributed to an increase in the incidence of cancer and other physical anomalies (Marketing Research Council, 1998). Contrary evidence in the debate has been



constructed by industry, primarily although not only, by the steel manufacturers and coal mine owners. To complicate the debate further, the provincial and federal governments assumed ownership of the mines and the steel production facilities. At the heart of the debate is the argument that residues from industry have had profound and severe health effects on the population. One approach to investigating this claim is a review of the scientific evidence, which in this case is based mainly on studies that use environmental epidemiology.

Environmental epidemiology comprises the study of more than just physical and chemical agents, and influences psychosocial factors and environmental exposures beyond the control of the individual (Rothman, 1993). Environmental epidemiology is a relatively new science about which there are methodological concerns, mainly because of the uncertainty associated with risk estimation. For example, previous investigations of community health exposures to unknown contaminants have led to uncertain conclusions and community angst (see, for example, the story of McFarland [Setterberg & Shavelson, 1993]). Epidemiological evidence of health effects from environmental contamination in Sydney has attracted similar scrutiny because of confounding variables such as the prevalence of smoking and other lifestyle factors that could interfere with measurable health-risk associations.

A large body of evidence links steel making, mining, and associated industries with human morbidity, specifically a variety of respiratory disorders, cancers, and impairments. For example, a longitudinal study identified severe reductions of lung function even after controlling for individual factors of smoking, occupational exposures, and other physical attributes (Wang et al., 1996). There is also evidence pointing to excess cancers (Dong, Redmond, Mazumdar, & Constantino, 1988; Finkelstein, 1994; Lloyd, 1971) and increased respiratory disease (Pope, 1989) among workers in mines and steel factories and members of the local communities who are subjected to ambient concentrations of community air pollution.

Recent ecologic studies have noted associations between local environmental conditions and health impacts. One recent study found that life expectancy for male and female Sydney residents was up to five years lower than that of the Canadian population as a whole. Cancer and cardiovascular dis-

ease were the most statistically significant contributors to excess loss of life (Veuglers & Guensey, 1999). Increased occurrences of cancer have been found in the Sydney population over a 45-year period (Band & Camus, 1998). Mao, Morrison, and Semenciw (1985) identified above-normal mortality rates, particularly for cancer, for the period 1979–1983. A study of cancer incidence stratified by gender revealed a significantly increased risk for cancers of the breast and cervix among women, and for cancers of the colon, rectum, and prostate among men (Guernsey, Dewar, Weerasinghe, Kirkland, & Veugelers, 2000). The same paper described elevated but not significantly higher rates of stomach, lung, bladder, brain, and kidney cancer. Contamination has also been linked to adverse fetal development and birth outcomes. The results of another study suggest that rates of major birth anomalies are higher among Sydney residents than in the rest of Nova Scotia (Dodds, 1999). The results of the latter study were not, however, statistically significant. Although ecologic in design, these screening-type studies reveal an elevated prevalence of cancer in Sydney and indicate that more detailed studies (such as case-control or spatial studies) should be performed.

As with many stories of community environmental contamination, epidemiological evidence of negative health effects can be supported by individual testimony and personal experience. Eric Brophy, a resident of Sydney, claimed that almost everyone he knows has had or has died from cancer. "Two years ago my wife died of cancer.... And next door, my neighbor in the lime-green house there, Wally, died of cancer. And around the corner ... Mrs. MacEachern used to live there. She died of cancer. And across the street from her another woman died of cancer." (Lahey, 1998, p. 37). Personal claims of health effects from carcinogens were congruent with the epidemiological evidence. Nevertheless, politicians and industry representatives dismissed these concerns as a general conspiracy to stop steel production. The response of the government was to downplay the potential health effects and degrade the reputations of those behind the research.

### **Mobilizing Around a Perceived Risk**

The community of Sydney may have tolerated pollution from steel and mining industries in the belief that the benefit of the

industry outweighed the risks or costs of emissions. In many one-industry communities, emissions are a by-product of prosperity and indicative of a willingness of the community to tolerate odors or unsightly emissions (Gould, 1991). Sydney residents opposed to more stringent environmental restrictions on the steel-making operation favored economic benefit over personal health impacts: "It's a choice between eating today and possibly getting cancer years from now" (Schneidereit, 2001). If, however, a community feels that the negative impact of the industry outweighs the benefits, concerns will be expressed and public outrage may result (Sandman, 1991).

Control capacity, used as a tool to influence the context in which conflict surrounding environmental contamination occurs, was widely adopted by local government and industry officials to question the credibility of actions perceived to inhibit economic prosperity. Schnaiberg (1991) defines control capacity as composed of the social, political, and economic resources that may be used as leverage in persuading public and regulatory bodies. In Sydney, control capacity appeared as claims by local health officials and provincial politicians who ardently refused the possibility that chemical pollution would affect human health. One citizen was quoted as saying, "It's absolutely incredible when you hear public health officials dismiss levels of arsenic that are 18 times higher than the guidelines, naphthalene levels up to 8.9 times higher and molybdenum and benzopyrene levels that are six times the limit" (MacInnis, 1998, p. 1). Local politicians were more concerned that citizen identification of pollution would deteriorate the value of land and housing prices, and, for that reason, citizens were frequently labeled as extremist and lacking any sort of credibility.

One of the largest stumbling blocks to successful risk management in Sydney has been the dichotomy between actual and perceived risks. In practice these risks have been respectively characterized as the scientific and psychological risks. Management of such risks in a community contamination situation has often shown to be a contentious affair (Leiss & Chociolko, 1994), and this is no less so in Sydney. Perceived risks from contamination were rampant throughout the Sydney community (Mersereau, Dugandzic, Campbell, & MacIntyre, 1999). Toxicological assessments had found exceedances of

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Canadian guidelines for arsenic, lead, manganese, PAHs, and benzene, mainly from soil samples taken from properties adjacent to the steel mill. Previous research has shown that government officials, and even environmental scientists, are trained to favor maximum use of scientifically derived knowledge in resolving environmental debates (Hrudy & Light, 1996). The use of scientifically derived knowledge in risk analysis supports the notion that perceived risks will be reduced once proper information is made available. In attempts to allay public concern and reduce perception of health risks from the contamination, however, a few health officials and scientists tended to downplay results from toxicological studies. The result was little comfort to residents who were notified of unacceptable levels of more than 20 chemicals in their yards and basement. Instead of revealing the true extent and potential impact of chemical contamination, the actions of health officials and scientists managed to increase perceived risks to health already harbored by local residents.

### Unknown Risks and the Media

Media formats, specifically newspapers, enable the recognition of various frames that give a general definition of what is perceived to be factual (Erickson, 1998). Seeking to clarify the process by which the media presents messages of danger and risk, the approach taken here essentially asks how events and issues are packaged and presented to audience members who may interpret the messages in a variety of ways. In Sydney, news reports represent a major source of information for most citizens about the tar ponds and related issues, as well as opinion surveys and announcements from stakeholders.

It is apparent that the media plays an essential role in drawing attention to health hazards and in urging government to take some action. It is also equally apparent, however, that the media becomes selective of facts that might customarily be ignored. According to Erickson (1998), the intent of the media is to frame a particular event as deviant from normality. In Sydney, numerous newspaper articles about the tar ponds referred to specific health abnormalities experienced by young adults and children: "Larissa Boone was a healthy girl until she moved into a purple clapboard home beside the old coal processing plant. Now the rambunctious toddler squirms beneath a plastic

respirator tied to a whirring machine that sprays medicine into her ailing lungs" (Toughill, 1998, p. A12). In another article, a resident was quoted as saying, "We are hoping that none of this stuff (toxic chemicals) shows up in any of us, especially the children" (Munroe, 1998, p. 1). According to much of the scientific and epidemiologic evidence, however, a majority of the health risks have affected adults, with specific studies addressing concerns of chronic cancer mortality and reduced life expectancy (Lavigne, 1987). Thus the media helped to perpetuate potentially illegitimate claims about acute or short-term health effects in children as a rather large concern resulting from the tar pond contamination.

The media also reports claims developed by stakeholders and thus can influence the direction and shape of debates surrounding community contamination. For example, the media can be used to situate responsibility or lay blame. As one citizen remarked, "The guidelines were set up to protect the public and twice the results have come over the limits ... why has Premier Russell MacLellan been so silent?" (Camus, 1998, pp. C4-C5). Elected officials will provide carefully crafted claims to support political agendas or reassign blame to the political opposition. A past federal environment minister described the contamination as "horrific ... it's a national issue and, quite frankly a bit of a national shame ... Forget who's fault it is" (Environment Minister Promises to Clean Up, 1998, p. A3). It took almost another two years, however, before the federal government committed funding for cleanup activities. The media also may be used to draw attention to personal aggravations with political processes: "I know five more guys who are dying, all of them under 50, and maybe another five who don't have it terminal (cancer). And tonight, we just spent another hour arguing about the memorandum of understanding. It's driving me crazy" (Toughill, 1998, p. A12).

By being selective about which claims it reports, the media has the ability to influence perceptions of risk according to what is alleged to be factual and what is alleged to be false information.

### Framing Contamination in Sydney

Applying theories of framing to the analysis of public-health risks can provide the theoretical components required to shed light on

the disjunction between perceptions of risks and actions taken to remediate them. In Sydney, the framing of risks and perceptions of risk is still entrenched in social, political, and economic structures (and their institutions). Dake (1992) claims that cultural biases account for constructions of risk based on patterns of social relationships. Although Sydney is not culturally homogenous *per se*, there certainly exists a homogenous culture of trust in technologies to provide economic independence. Closure of the steel factory in 1999, for example, ruined all prospects of maintaining economic independence for Sydney. Identification of potential technologies for environmental remediation, along with the potential for subsequent employment, resonated well among unemployed workers in the area. Actions taken to introduce alternative technological dependencies, however, would do nothing to prevent catastrophes like the tar ponds from occurring in the future. The culture of trust among Sydney residents will, it is hoped, turn to a set of diverse opportunities, opportunities that do not impose trust in any single technology.

Stakeholder dynamics and diagnoses of both problems and opportunities by stakeholders can play an important role in understanding how the issue of environmental contamination in communities is framed and managed (Garvin, 1998). The Sydney issue is characterized by two core groups: stakeholders who believe that the community contamination poses serious risks to human health and stakeholders who believe that the community contamination is both contained (a necessary result of supposed economic prosperity) and negligible (in terms of risk to human well-being). For example, the provincial medical officer of health claimed, "I would live on Frederick Street ... and would be happy to bring my pregnant wife to a circus adjacent to the tar ponds" (Munroe, 1998, p. 1). That statement implies that the contamination poses no threat to human health, even to more susceptible individuals. Although the two groups diverge on the types and extent of risks associated with the community contamination, they both frame the issue using claims derived from similar toolboxes. These battles between stakeholders give credibility to Burger's (1990) argument that initial policy responses are based on perceptions about potential health risk impacts and hinge on very little epidemiological evidence.



## Implications and Conclusions

The remarkably enormous size of environmental contamination in Sydney, Nova Scotia, is a product of historical, economic, and technological achievement. It offers the potential to address some difficult problems facing small communities who have for years been susceptible to economic dependency, subsequent environmental contamination, and the legacy of those conditions. Evidence has shown that the chronic environmental contamination in Sydney may have multiple impacts and present a number of uncertainties. One question that remains unanswered is the ability of the community to mobilize around this acute environmental concern.

The evidence presented in this paper supports the hypothesis that mobilization depends on a number of mediating factors, each having a discrete and uncertain influence on the ability to predict outcomes. The interactions among claims and interpretations of evidence provided by empirical study and scientific assessment indicate that there indeed exists an inherent complexity and uncertainty surrounding the understanding of health effects from chemical exposures from environmental contamination. Epidemiology, historically viewed as a parsimonious social science, seems to lose credibility and power when questions of causality arise, and its ability to generate meaningful change in Sydney is questionable.

The legitimacy of genuine concerns about health risks in Sydney seems to be heavily dependent on risk perceptions. The potential health impacts of local contamination have been apparent for many years, but the linkage between contamination and health problems was made more apparent to citizens as a result of social visibility provided by 1) the efforts of the Joint Action Group and 2) increasing news coverage. The framing of risk seems to also be highly manipulatable. Industry, environmental organizations, and various levels of government have attempted to manipulate public perceptions of risk to promote their own political or economic agendas. Nowhere was this clearer than in attempts to conceal or, alternatively, disclose support for the various alternatives to environmental remediation plans. For example, the provincial government was an avid promoter of the cover-and-bury option for remediation, which is compatible with its clear rejection of potential health effects.

Finally, attempts by various stakeholders to frame the issue of environmental contamination in Sydney only served to arouse fear and anxiety, facilitated by the media and subsequently expressed within the local population as frustration. These reactions are compatible with a concept proposed by Wisaeth (1994) that communities dealing with chronic environmental contaminants experience difficul-

ties when attempting to mobilize, mainly by having to respond to conflicting framings of the issue (whether they typify some sort of acceptance, action, or conflict). Public concerns and attempts at mobilization, initiated by the framing of the environmental contamination as directly responsible for the public-health effects in Sydney, were illegitimated by responses from the provincial government emphasizing the uncertainties of science. This level of government downplayed any harmful health effects and minimized the situation, most likely so that the community 1) would relinquish attempts to mobilize or voice concern about the issue of contamination and 2) could be dealt with on an individual rather than collective basis, with a consequent reduction in the ability to mobilize effectively. Although the framing of environmental contamination has at present become a political issue away from the town of Sydney, it still continues to linger in the basements and minds of Sydney residents. 🐸

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