Environment Canada

Inland Waters Directorate

Ontario Region

A SYNTHESIS OF SOCIAL AND PSYCHOLOGICAL EFFECTS OF EXPOSURE TO HAZARDOUS SUBSTANCES

by

Urmas Madisso

January, 1985

Direction générale des eaux intérieures

Région de l'Ontario

Canada

A SYNTHESIS OF SOCIAL AND PSYCHOLOGICAL EFFECTS OF EXPOSURE TO HAZARDOUS SUBSTANCES

by

Urmas Madisso

January, 1985

In fulfilment of Contract No. TOB84-106311

Planning Division
Water Planning and Management Branch
Inland Waters Directorate,
Ontario Region
Burlington, Ontario.

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

Extensive monitoring programs exist in the Great Lakes Basin to tell us how much toxic substances are present in the water, fish, wildlife, and even people living in the basin. But the very important question which these studies cannot answer is: What are the toxics doing to people? Epidemiological studies focusing on cancer cannot answer this question either because they are hampered by many confounding factors, (i.e. smoking, diet, lifestyle) as well as latency periods of 20 to 40 years.

The purpose of this project, then, was to look at human health impacts from another perspective, that of mental health. The question posed was, "In cases where people have been exposed to relatively high levels of toxic substances via air or water, what has happened to them psychologically and socially?" These types of impacts have a much shorter latency period than physical diseases like cancer, and they can be observed and described qualitatively.

This investigation explores the social and psychological dimensions of exposure to hazardous substances according to the experiences of citizens at the following locations: Stouffville, Ontario; Upper Ottawa Street, Hamilton, Ontario; Perkinsfield, Ontario; Love Canal, Niagara Falls, New York; Legler, New Jersey; and Three Mile Island, Pennsylvania. While it is based primarily on an extensive literature review (see Appendix), interviews undertaken by the author with residents, on-site researchers, scientists, government officials, and representatives of public interest groups have played important roles in shedding further light on the problems and issues involved.

Part 1: SUMMARY OF MAJOR EVENTS

This section contains background information on the events which led to human exposure to toxic substances in the the six situations examined, for the benefit of readers who may not be familiar with the incidents.

(1) Stouffville, Ont.

In this town 30 miles north of Toronto, controversy has centered over whether or not a 20 year-old dump, which has received toxic liquid waste and is located one-half mile from two town wells, has contaminated municipal water. Provincial officials maintain the water is safe and have rejected the validity of all investigations done by or for the Concerned Citizens of Whitchurch - Stouffville, a local environmental group. These include health surveys which indicated high rates of miscarriage, cancer, and other illnesses among residents, and independent testing of private wells which revealed the presence of toxic chemicals in varying concentrations. In 1982, the province agreed to close the dump by June 1983, but later extended that deadline to June or September 1985. It plans to undertake its own health survey of residents.

Emotions have been at a high pitch throughout the duration of the dispute and there is continuing bitterness within the citizens' group towards provincial and town authorities who are seen as irresponsible and indifferent to people's welfare.

(2) Upper Ottawa Street, Hamilton, Ontario

From 1978 to 1980, the Upper Ottawa Street Resident's Assocation waged a successful campaign to close down an adjacent 40-acre toxic waste dump. A health survey conducted by the association uncovered a higher incidence of illnesses and various ailments than in a control group.

The major pathways of exposure were from polluted air around the site and from gases entering basements. There was also concern about water contamination from leachate which turned nearby Redhill Creek black and killed all the fish.

A provincially funded committee was established in 1981 to examine the site's impacts on the environment and public health; its final report is due in the near future. Additionally, the province is sponsoring a health study of residents to be completed in 1985.

Although the dump was closed in 1980, concern remains that air contamination, through continued volatilization of dump contents, poses a long-term threat to residents and that continued pollution of the Redhill Creek which flows through an adjacent conservation area could endanger visitors, especially children, who use the water for cooking and swimming.

(3) Perkinsfield, Ont.

Beginning in the late 1970's, a 30-acre dump near the village of Perkinsfield in Tiny Township, 10 kilometres west of Midland, has been used for the disposal of liquid toxic industrial waste. To date, leachate from this dump is known to have contaminated at least three wells in the area and the contaminant plume is moving westward toward Georgian Bay. Families with polluted wells have been receiving bottled water from the Ontario Ministry of the Environment since December 1982.

Concern for water quality spurred the creation of the Tiny Ratepayers Against Pollution (TRAP). Mediation between the Ministry of the Environment and the citizens has resulted in a decision that will allow the dump to remain open another three years to receive garbage only and the provincial government has agreed to provide some 100 homes in Perkinsfield with an alternative supply of water.

(4) Love Canal, Niagara Falls, New York.

Over an eleven-year span (1942 to 1953), the Hooker Chemical Co. disposed of nearly 22,000 tons of surplus chemicals and waste products in the Love Canal landfill site. It was then covered over and in 1953 deeded to the Niagara Falls Board of Education which built an elementary school on the site. As a large, primarily working class residential area developed around the Canal, complaints mounted about seepage of chemicals and their odours onto the land and into some homes. Government investigations increased until August 1978 when the New York State Commissioner of Health recommended the temporary evacuation of pregnant women and children under two years of age from the immediate area and advised residents to avoid the use of their basements and not to consume products grown in their gardens. A week later, the State authorized the purchase of 239 homes to permit the permanent relocation of the families in an area that came to be known as the inner ring or rings I and II.

About this time, the Love Canal Homeowners' Association came into being. Its members believed the chemicals had migrated to the outer ring which did not directly abut the dump. The Association pressed for the relocation of people in this zone as well. After some two years of controversy and struggle, the citizens succeeded in having 550 families in the outer ring declared eligible for relocation and financial assistance.

No long-term health studies of Love Canal area residents are being carried out by any level of government.

(5) Legler, New Jersey

Legler is a suburban-style development in Jackson Township, N.J. Its citizens were exposed to a variety of toxic wastes when their wells were contaminated by a municipal landfill established on an abandoned mine site. Dumping of toxic wastes began in 1972. In 1978 the township notified the residents that their water was unsafe and began delivery of water to those affected.

The crisis prompted the formation of the Concerned Citizens' Committee of Legler which campaigned successfully for the installation of a municipal water supply system to the area and in 1982 won a class action suit of $15.8 million against Jackson Township: $5.5 million for lifestyle impact, $3.5 million for psychological damage, and the remainder for health screening to deal with long-term effects.

(6) Three Mile Island, Pennsylvania

In March 1979, a combination of mechanical malfunctions and human errors brought one unit of the Three Mile Island nuclear plant to within 30 to 60 minutes of a core meltdown. Although the utility as well as local, state, and federal officials claim radiation releases were negligible, there is evidence that contradicts that assertion (see Appendix A: Pawlick, 1980; Pawlick and Lawrence, 1980; pp. 54-59).

Because of the official stance taken that radiation emissions during this incident were insignificant, epidemiological studies have not been carried out.

Part 2: IMPACTS ON PEOPLE

This section describes what happened to people who were exposed to toxic substances in the six situations described previously. Similar social and psychological impacts were observed in many of the cases.

Loss of Control and Helplessness

Feelings of helplessness and hopelessness lead to demoralization in people trapped by a situation exposing them to toxic substances. The most important predictor of demoralization is a perceived threat to physical health and the inability to do anything about it, i.e., a lack of control.

The impact of an event is influenced by its perceived controlability, that is, if one believes one has control, even if this is not so or never used, there is less stress. Technological disasters which expose people to toxic substances threaten control because they are not anticipated in the same way as natural disasters. People expect to encounter storms and floods from time to time, but man-made facilities are not supposed to break down and when problems do occur, people expect them to be readily resolved. Thus, technological disasters demonstrate the loss of control of something that at one point seemed under control.

At Three Mile Island, fear from past exposure to radiation and worry about future exposure arising from cleanup operations and further accidents have resulted in long-term cognitive and motivational deficits among residents and lower persistence and tolerance for frustration which are associated with learned helplessness (Davidson, Baum, Collins, 1982). Studies have reported increased physical complaints, anxiety, depression, behavioural difficulties, and higher physiological arousal among people living within 5 miles of the crippled reactor than among control groups (Baum, Gatchel and Schaeffer, 1982; Collins, Baum, Singer, 1982; Fleming, Baum, Gisriel, Gatchel, 1982; Davidson, Baum, Collins, 1982).

At the same time, feelings of control have diminished stress: Three Mile Island residents who had lower expectations for control also reported greater symptom distress, displayed poorer task performance, and higher levels of physiological arousal than residents who had greater expectations for control. The latter did not differ significantly from comparison subjects (Davidson, Baum and Collins, 1982).

Uncertainty about one's own future and especially that of one's children intensified feelings of helplessness and loss of control. Not only did parents feel unable to protect themselves, they also felt they had imperilled future generations. They bore a heavy burden of guilt for purchasing properties dangerous to their children and many were trapped, unable to leave without bankrupting themselves.

Loss of Trust and Depression

The belief that their lives have been considerably shortened due to toxics exposure can cause some people to become pessimistic about future prospects for themselves and their families. As a result of this they may adopt a short-term perspective on the future.

As the crisis drags on, disillusionment with government can set in, and particularly at Love Canal and Legler, a loss of trust in people overall became evident among many residents. This alienation or estrangement from society may abate with time, but for those predisposed to depression, anxiety, and hostility, it may not. In the latter case this can be of great consequence. Persons who are cynical and mistrusting and thus experience less social support from contact with others are more susceptible to severe coronary heart disease, cancer (arising from weakening of the immune function), and other disorders, and thus have higher rates of mortality (Barefoot et al., 1983; Williams et al., 1984; Toronto Star, 1984).

Effects on Children and Adolescents

Children are the most vulnerable, not only to physical injury, but also to social and psychological damage following a technological disaster. They are exposed to all the insecurities, tensions and health worries of their parents, but lack the sophistication to deal with them and hence, the entire experience is much more frightening for them. Children may also be confronted with adults' loss of faith in institutions they had once trusted.

Trauma was especially evident at Love Canal where children were forced to grow up quickly and were thereby deprived of some of the pleasures of childhood. Young children suffered most. Unable to understand what they couldn't see or touch, but at times could smell, they knew chemicals were so powerful that even their parents cried whenthey talked of them and could not protect them from their dangers. Some became obsessed with fears of premature death and had nightmares of toxins oozing from their bodies.

Insecurity was heightened by being moved in and out of hotels and relatives' homes, having to adjust to several different schools, and losing friends and the complete attention of their parents. The latter were also harried, insecure, and demoralized and neglected and even abused their children. However, it was also true at Love Canal and elsewhere that the presence of children, by providing a reason to go on, enabled parents to cope, though they worried constantly about them. Some small children became shy and disoriented, acquired behavioural problems in school, and regressed to thumb-sucking, bed-wetting, baby talk, and clinging to mothers. A number of youngsters were ostracized by their peers who labelled them contaminated and warned them to stay away, while others were subject to unwelcome attention at school through questioning and teasing.

The Love Canal crisis added to the typical stresses of adolescence and made growing up that much more difficult. In a community where most married after high school and immediately began families, the prospect of sterility or inability to have normal children was particularly devastating to teenage girls.

Overall, the time spent in a dangerous situation and the role of parents in shielding their young from stress will likely prove crucial in determining the ultimate impact on children caught up in a technological disaster. In general, the more protracted and stressful the period of exposure, the greater the potential for long-term effects.

Social Variables

While there is evidence from various sites that families who were young, well-educated, often white collar, and had small children, were most likely to perceive a threat (Levine and Stone, 1984; Houts and Goldhaber, 1981), generalizations are risky at best. For instance, in the Ring III area of Love Canal, Fowlkes and Miller (1982) discovered a link between some college education and the belief in widespread contamination, but they also found that in Rings I and II a perception of danger was more often held by families where high school completion was the greatest level of educational attainment. Morevover, in a study on attitudes towards water quality along the Canadian side of the Niagara River, Sudar and Jones (1983), revealed that satisfaction with drinking water, perceptions about health hazards, views on Niagara River water quality, and overall concerns about water pollution varied only slightly across occupational, educational, income, and age categories.

Gender has proven to be a key and sometimes overlooked variable in perception of risk and stimulus to political protest. The citizens' movements in Love Canal, Stouffville, Upper Ottawa Street, and Perkinsfield were generally initiated and led by housewives and mothers.

For example, at Stouffville, the Concerned Citizens Group was begun by young, well-educated, middle class mothers. At Love Canal activists were young to middle-aged, with good educations and had husbands who earned moderate incomes from outside the chemical industry.

Possibly the most crucial factor in determining the perception of risk was the presence of pregnant women and young children in the home. Love Canal furnished the most graphic illustration as the majority of families still remaining had no children at home at the time of eligibility for relocation. In contrast, very few relocated households were without children during the evacuation (Fowlkes and Gibbs, 1982).

Notwithstanding the desire of many parents to leave, the intensity of reactions has differed considerably from one site to the next. Overall, in those places where exposure occurred primarily through the air (Love Canal, Three Mile Island, Upper Ottawa Street) the impetus to move has been much more marked than in those locations where exposure has taken place from drinking water (Stouffville, Perkinsfield). The most probable explanation is that, unlike atmospheric contamination, hazards from consuming polluted drinking water can be controlled through an alternative supply. Legler may have been an exception to this tendency, as dissatisfaction and the spur to move was magnified by high charges for municipal water.

Age has also been an important (though less crucial) factor in hazard perception. Older people were more likely to believe nothing was wrong, or even if they did recognize some danger, felt powerless to effect political change and lacked the financial resources to move. Moreover, moving would have resulted in the dispersion of friends and neighbours, loss of residential security, and decline in a sense of well-being (Levine, 1982; Fowlkes and Miller, 1982). However, it is interesting to note that whenever older couples had grandchildren living with them, they felt great concern for the health of children who had been exposed.

Since risk perception was determined by the diverse perspectives of the people involved, differences in social and psychological effects were inevitable. But generalizations are becoming more difficult to make and perhaps ill-advised, for awareness of toxic substances has become so pervasive that socio-economic considerations are increasingly less valid in assessing reactions to toxic exposure or the threat of such exposure.

Behavioural Toxicity

It is difficult to distinguish between the physical toxic effects of hazardous substances and the psychological reaction or stress arising from exposure. Before overt clinical signs of toxic poisoning develop, vague, subjective, nonspecific psychological complaints appear that vary from person to person. Because of their subtle nature, early symptoms do not tend to arouse suspicion. Moreover, the typical neurological or medical examination is directed toward the diagnosis of disease rather than the detection of subtle impairments. Even at high levels of exposure, some people do not display overt clinical signs of poisoning, but instead show unobtrusive behavioural alterations and emotional or sensorimotor difficulties that are perceptible only after the person has been observed systematically over time. However, other more susceptible people may suffer major impairment because of genetic or other factors. Chemically induced behavioural changes (e.g. hyper-or hypo- irritability) in children may make them difficult to care for, thereby generating parent-child conflicts that intensify over time.

Studies on environmental and occupational exposure (e.g. Brown and Nixon, 1979; Fein et al., 1983; Anger and Johnson, 1984; Baker and Smith, 1983) have revealed the psychological/behavioural toll exacted by toxic substances and may help explain at least part of the stress experienced by people at such places as Love Canal and Stouffville. It is known that some chemicals (eg. benzene, carbon tetrachloride, chloroform, hexachlorobenzene, lead, various organic solvents, styrene, trichloroethylene) which were found at the various sites, can trigger depression and anxiety.

These symptoms were in fact frequently exhibited by the residents concerned. It should also be noted that unlike occupational exposures, which occur only during working hours, environmental exposures are continuous.

At Three Mile Island, where great trauma has been apparent, anxiety-related symptoms include nausea, stomach upset, cramps, diarrhea, restlessness, sleeplessness, nightmares, and general nervousness. Many, perhaps most, are anxiety-provoked, but they are also similar to those resulting from radiation exposure (Pawlick, 1980).

Exposure to hazardous substances does exact unmistakable psychological and behavioural penalties. At least some of these are incurred from the actions of the poisons on the body, particularly on the central nervous system.

Effects on Marital Relations and Concept of Home

(a) Marital Relations

Marriages experienced varying degrees of strain. Many couples shared a heavy burden of guilt for moving into a threatening area and exposing their children to danger; when this was further accompanied by one mate blaming the other for the move, tensions were exacerbated. In order to protect their children, one spouse (often the wife), wanted to leave immediately, while the other was opposed, as it would mean financial ruin. At Love Canal constant moving in and out of hotels/motels with continually sick children intensified feelings of frustration; husbands especially felt helpless to protect their families, and their conservative values which prevented them from picketing or protesting added to their sense of defeat. In some cases, wives simply took the initiative and moved out along with the children.

A major cause of marital strife was the involvement of one partner (usually the wife) in the concerned citizens' movement, either as an active member or leader. The other partner resented the disruptions of family life arising from the mate's frequent absence and the intrusion of the movement's activities and pressures into the home.

Another source of conflict, especially marked at Love Canal, arose from personal changes that took place in women activists and the way they felt about their role in marriage. Husbands who still adhered to traditional values and prejudices were unable to adjust to their newly self-confident, politicized wives who sought jobs or other pursuits outside the home. Divorce was often the result.

The question of whether or not to have more children also generated friction between spouses as one was unwilling to run the risk of producing deformed offspring. This continues to be an important source of anxiety and disagreement.

Long-term effects are difficult to predict. The crises at the various sites appear instrumental in leading to the dissolution of some relationships, particularly at Love Canal where 40% of the marriages of the original 237 families evacuated ended in divorce or separation (Holden, 1980). The figure for the outer ring may be even much higher (George, 1982). In contrast, the need to cooperate and lend each other moral support united some couples. Overall, after some form of solution was found for the toxic problem, tensions between most mates did subside and new methods developed to handle disputes. But, at Three Mile Island where there has been no real resolution to the crisis and stress continues, one may expect the continuation of some discord between partners. And of course, given the nature of technological catastrophes with their potential for long-term health effects, many couples will likely never be free of worry.

(b) Concept of Home

For many, a key impact of technological disasters was the destruction of the ideal of home ownership which was transformed from stability and status into insecurity and uncertainty. This called into question some basic beliefs which governed people's lives. There was a sense of loss of feelings about the home as the centre of family life, and love of home turned to hatred. The home lost its meaning as a source of refuge and sound financial investment; instead, as owners felt increasingly under siege, it became a trap, a commitment to a place one could not escape. However, among the inner ring population at Love Canal who were evacuated promptly in August 1978, following the state's acknowledgement of the danger to them, the reverse took place. Here the evacuees came to idealize and cherish their former residences once they were gone.

Methods of Coping

There are two basic approaches to coping with difficulties: (1) the use of denial or problem-oriented modes in which the individual alters or directly addresses the situation causing stress in order to reduce or remove the threat that is posed and (2) the management of emotional response to the source of stress. At Three Mile Island, the use of the latter approach has been more effective in reducing psychological and behavioural consequences of stress (Collins, Baum, Singer, 1983; Baum, Fleming, Singer, 1983).

For people exposed to toxics, participation in concerned citizens' groups was an important factor in furnishing a sense of control and thus in coping. By learning to fight for their interests and to be assertive, people felt they were contributing to the resolution of the crisis.

The Significance of Social Support

Studies at Three Mile Island have revealed both the contributions and limitations of social support in alleviating stress (Baum, Gatchel, Schaeffer, 1983; Fleming et al., 1982). Two years after the accident Three Mile Island residents continued to exhibit greater psychological, behavioural, and biochemical stress than comparison subjects. In addition, among Three Mile Island people alone, those with medium or high levels of social support displayed fewer psychological and behavioural difficulties than those with low orders of support. However, social support did not affect biochemical or physiological stress as revealed by urinary catecholamine concentrations or self-reported, physical symptoms. Thus, because social support enhances the ability to cope, it moderates the incidence of psychological and behavioural effects, but does not alter physiological arousal.

Additional Stressors

A number of factors serve to remind citizens of their plight and help reinforce fears. Many of those near active landfills such as Upper Ottawa, Stouffville, and Legler have had to contend to a varying extent with odour, truck traffic, and noise. Residents of Legler were also subjected to litter, blowing refuse, and concern over large numbers of rats that invaded the dumpsite. The actual delivery of water to people with contaminated or believed to be contaminated wells or the installation of filters or purifiers, reminds people about pollution and long-term health risks. At Love Canal probably the greatest stressor was witnessing the abandonment, boarding up and fencing off of 237 homes in Rings I and II which underscored the destruction and uninhabitability of their neighbourhood. For citizens of Three Mile Island the giant cooling towers symbolize the danger to which they have already been subjected and fear could be again.

Lawsuits

Lawsuits have been or will be undertaken by citizens of nearly all sites mentioned. Their completion is often seen by residents as the time at which their crisis will formally be over and a semblance of normalcy can return. They are regarded as a way of legitimizing and authenticating hardship and suffering which residents believe have not been comprehended by government, business, and society as a whole. At the same time, they are a considerable source of stress as people have great anxiety over reliving experiences they urgently want to forget, testifying in court, and worrying over the final outcome. It is worth noting that in its class action against Jackson Township the Concerned Citizens Committee of Legler was awarded $15.8 million: $5.5 million for lifestyle impact, $3 million for psychological damage, and the rest for health screening to deal with long-term health effects.

The Role of Mental Health Professionals

Although there is a lack of information on the extent to which psychologists and psychiatrists were consulted by Canadians exposed to toxic wastes, descriptive accounts of the use of community mental health centres in the U.S. are instructive.

Overall, few professional helpers appear to have played active roles in aiding citizens to cope. At Love Canal for example, mental health facilities were little used, at least initially, as there was a stigma attached to mental problems. People felt that their problems were due to the physical undermining of their health and financial difficulties and were put off by the claims of state agencies that residents' problems were entirely psychosomatic, arising from overcharged emotions and hysteria. When people finally did begin to seek professional help, the interested professionals were either gone, replaced, or disinterested. This in conjunction with a lack of funding has prevented long-term followup.

Assistance is still needed by many who suppressed most of their psychic traumas while battling governments. After evacuation when these people could focus attention on themselves, they experienced a delayed reaction to stress and now feel frustrated, anxious and depressed. Unless these emotions decrease with time, they are likely to cause bodily dysfunctions.

Role Played by Friends and Relatives

The reaction of friends and relatives to the plight of the people at the different sites ranged from support and sympathy to outright scorn. Some relatives furnished financial support, and in Legler and Stouffville, friends and relatives brought water. In Legler acquaintances also offered the use of showers and babysitting services and provided sympathy, but did not really know what to do to help, and residents felt much the same. Despite the support given, most residents felt others could not really understand what they had gone through, that it had to be experienced personally.

For all those receiving assistance in one form or another, there were many, especially at Love Canal, that were bitterly disappointed by the lack of help from family and friends. At Love Canal, residents were accused of publicity-seeking, creating a stir over nothing, and profiting from the state's purchase of their homes. In all locations, some residents were blamed for moving into their area in the first place while others with children were made to feel guilty for simply not leaving. Fear of exposure and the residents' preoccupation with their problems induced many friends and relatives to stay away.

For the most part, personal networks failed as sources of effective assistance in time of need.

Role Played by Concerned Citizens' Groups

Community groups served as significant sources of social and emotional support that enhanced residents' coping ability. By focussing anger and frustration and encouraging people to fight for their interests, they helped overcome a sense of powerlessness and gave a feeling of some control which was of major importance in alleviating stress and protecting mental health. For example, at Love Canal, Levine and Stone (1984) found that activists in particular felt better about themselves and believed that the emergency had produced positive personal changes and favourable changes in relations with others.

Community groups also functioned as mental health crisis centres where the frightened and confused could call or visit for sympathy, support and hope and get the information needed to understand what was happening and why.

Despite internal dissent and opposition from some residents, the citizens' movements generally united people in the face of technological disaster. Paradoxically, at Love Canal neighbourhood cohesiveness grew at the same time as families split; people who had never socialized began to share problems and local quarrels disappeared. And although all citizens' organizations could point to some success in influencing government policy, it was the Love Canal Homeowners' Association which proved most effective in maintaining pressure on officials and ultimately achieving its goal of evacuation and resettlement.

Attitude of the Community at Large

As was true with friends and relatives, the attitude of the community at large to those exposed varied considerably. People in Niagara Falls, N.Y. and Jackson Township, N.J. were hostile and unsympathetic to the residents of Love Canal and Legler respectively.

They were faulted for moving to these areas, giving the municipality a bad name, hurting business, being publicity-hungry, and greedy for government money, and therefore undeserving of assistance. In addition, residents of Love Canal were feared as contaminated carriers of strange diseases and were denied accommodation by many hotelowners and innkeepers.

Sympathy in Hamilton for the people of Upper Ottawa Street was minimal initially, but as greater awareness of the dangers of toxic chemicals increased, so did public support, though there was little direct involvement by the public in helping the residents.

In Stouffville where concern over pollution of municipal water has affected the community as a whole, a split developed when the town council, backed by businessmen apprehensive of a loss of business and development, reached a settlement with the provincial government and the dumpsite owner. This was done without the participation of the citizens' association and led to anger and frustration among many townspeople.

Co-workers of those who had been exposed were often sympathetic, but were unable to really appreciate their problems and concerns and in some instances took pleasure in teasing and harassment.

Churches furnished valuable assistance at two locations. Love Canal residents benefitted from the establishment in 1979 of an Ecumenical Task Force of 16 churches which provided counsel and aid. Clergy in Stouffville played not only an important role in counselling worried parishioners, but also established a pact to force the municipal and provincial governments to close the dump.

Role of Governments

(a) Perception of Officialdom as Uncaring

Governments on the whole were unable to deal with the deep-rooted fears of the people and appeared uncaring and untrustworthy. Most officials denied there were significant problems while others were alarmed, but failed to offer help or advice. What was most frightening for people was the possibility that authorities did not know what was wrong or would not help even if they did know. At Love Canal the reluctance of the state to acknowledge a threat to the health of residents in the outer ring was interpreted as a desire to resell homes in the area (Gibbs, 1982).

People expected government research to provide them with information about their health that would enable them to alleviate or live with their problems, and became angry and frustrated when this need was ignored.

Other factors leading to a breakdown of public trust in government include a perception of governments as unreliable, contradictory behaviour by government officials, and government entanglement in apparent conflicts of interest.

There was and still is a widespread feeling among residents at all sites that governments cannot be trusted, that promises will be ignored unless people apply constant pressure and fight for their rights. Officials heighten fear and frustration and erode their credibility through frequent contradiction and misjudgement. Government studies which lacked thoroughness have been used to dismiss health claims as the products of overwrought imaginations and in general, officials have appeared evasive, saying only what was politically expedient.

Government officials may also be perceived to be compromised by various conflicts of interest that serve to arouse citizen suspicions about authorities' commitments to resolving problems. Politicians and upper echelon bureaucrats can be viewed as wanting to minimize expenditures and avoid setting expensive precedents that would arise from conducting thorough cleanup, providing alternative water supplies, or resettling those in danger.

(b) Lack of Consultation

Residents felt they were considered responsible for their problems and were treated as an inconvenience, an enemy, or young children undeserving of any explanation of their plight. At public meetings people were informed of government plans, but not asked to contribute their knowledge about the area, their experiences, or their ideas on matters that required investigation. On the contrary, their suggestions were dismissed out of hand.

Citizens viewed government secrecy and exclusion from decision-making as a coverup. And in fact, there may have been considerable truth to this: for example, at Love Canal the health of residents was not always important in policy determination as decisions were made before preliminary health and environmental studies and more detailed reviews had been completed (Levine, 1982). Moreover, people learned of decisions through press releases, commonly issued in Albany, 300 miles distant, on Friday afternoons when no one was available to answer follow-up questions.

(c) Antagonism Between Government Experts and Citizens

Prior to the Love Canal experience, government scientists were not used to working directly with the public and with some exceptions this remains true today. In general, scientists use technical language incomprehensible to residents. Their formal manner is sometimes perceived as cold, impersonal, and condescending. At Love Canal for instance, government scientists recommended in August 1978 that pregnant women and small children in some areas evacuate, that people stay out of their basements, and not eat their garden produce. The social repercussions of this recommendation were very traumatic for many people. This triggered frustration, anger, and anxiety and helped create a wedge between the two sides. Moreover, citizen criticism of government personnel helped widen the gulf as researchers felt misunderstood and unappreciated and came to see the people as 'the enemy'. This collapse of trust made any further research which required the citizens' cooperation impossible. A similar collapse of trust occurred in Stouffville where the province reversed its decision to close down the dump and announced it would stay open another three years (Toronto Star, December 13, 1982).

The public's suspicions were also fed by the perceived close relationships between governments on one side and corporations on the other.

In Ontario, for example, the Government of the day appears to have maintained close ties with waste management firms including Waste Management Inc. (WMI), the parent company of York Sanitation, which owns the Stouffville dump. During Environmental Assessment Board hearings on expansion of the STouffville dump in 1981, Ministry of the Environment personnel sat directly behind the York Sanitation team and appeared to be on a first-name basis with them (Toronto Star, June 1, 1981). Moreover, the technical advisor to the Board, a provincial official, once worked for a consulting firm hired by York Sanitation and discussed development of the site in the early 1970's (Toronto Star, June 1, 1981).

Heavy-handed government threats and actions against community organizations caused further alienation. At Stouffville Ontario's Minister of the Environment dismissed the findings of scientists hired by the concerned citizens' group that indicated local water supplies were contaminated. In addition, he threatened to sue the citizens' group for slander because it refused to accept the validity of Ministry test results which indicated the water was safe (Globe and Mail, March 10, 1981).

(d) The Effects on Citizens of Government Behaviour

The general public in all locations displayed extreme disappointment and disillusionment with scientists, elected and appointed officials at all levels of government, and the operation of the political system. Their experiences told them that science was inseparable from politics, that no government could be trusted, and that the sole concern of officials and experts was protecting governmental, corporate and professional interests. For some, cynicism was accompanied by apathy and alienation from the political system, while for others it highlighted the need for vigilance and direct involvement in the political process to ensure the public's protection.

For more information on the Canadian situation, see Appendix pp 80-93.

Part 3: CONCLUSION

Because even minute quantities of toxic substances can inflict injury that takes years or generations to appear, technological disasters lead to long-term feelings of helplessness and loss of control. Hazardous materials can generate a broad array of diseases and ailments, and as these can be blamed on other factors, the burden of evidence usually falls upon citizens to prove that problems exist. Moreover, slowly developing, man-made cataclysms give time for constituencies likely to be blamed to take measures to protect themselves and thereby deny the consensus necessary for effective response. Since experts disagree on the risks involved, only the exercise of great caution in assuming there is no danger will protect public well-being.

Many who have endured exposure to poisonous substances have become more fearful, pessimistic, and suspicious of people in general. They feel the environment is no longer safe; that there is no place to escape toxic waste dumps or nuclear power plants; that governments cannot be trusted; and that their lives and those of their children have been placed in jeopardy. Starting over and putting the past behind has also been made more difficult by broken marriages, major financial losses, and decline in standard of living incurred from the sale of homes. At Legler, for example, over one-half of residents report being unable to live in peace. Some want to leave, but cannot, trapped by mortgages, reduced property values, or disability (Edelstein, 1982).

It is apparent that the effects of toxic disasters are often momentous. But because it may be years after exposure that carcinogens and other substances exact their final toll, fewer resources are directed to their control than to more immediately obvious perils such as floods, highway and air traffic safety. Consequently, the merits of expending vast sums on cancer and other medical research while permitting the proliferation of injurious materials in the environment may well be open to question.

In the final analysis, while the physical aftermath of toxic exposure can be severe, the social and psychological impact could prove more critical. Technological catastrophes may produce a "crisis of confidence" in society's ability to control what it has created and lead to lasting traumas.

"The toxic chemicals that are now lodged in the bloodstream of the earth leave ugly traces on human tissues and may mar generations of people yet to come. That, surely, is a major health problem. But, the traces they leave on the human mind - the anxiety, the sense of defeat, the feeling that the world is no longer a reliable place in which to live and to raise children - may constitute an even greater health problem .... a dark and abiding fear may turn out to be the most serious heritage (of toxic disasters) and that matter deserves a prominent place in our thinking about the larger issue" (Erikson, 1980).

Part 4: RECOMMENDATIONS FOR ENVIRONMENT CANADA

Some Guiding Principles

(a) The Need for Credibility

Governments require a comprehensive, fully coordinated policy to deal with hazardous substances, one that is attuned not soley to technical matters, but embraces the entire range of ecological, social, and psychological questions. A key test of policy effectiveness is the extent to which it can achieve and maintain the people's trust. The credibility of authorities is essential, for without it there will be no public cooperation or participation in programs of involvement or acceptance of official information.

(b) Promotion of Public Participation

Genuine public participation in the decision-making process generates benefits for both regulators and citizens. Where government credibility has not already been badly tarnished it can allay people's suspicions of coverup or lessen opposition to proposed facilities. Even if a site is safe, the validity of residents' fears must still be recognized and addressed. Otherwise, distrust, anxiety, and a sense of loss of control will remain. Such feelings can be countered, long-range cost-effectiveness enhanced, and the scientific quality of studies improved by directly involving the affected community. Local people are apt to know more about the geography and history of the area such as frequency and extent of flooding, and are often the first to notice unusual occurrence of disease, have greater awareness of possible continuing routes of exposure, can point out the implications of alternative interpretations of results, and can be helpful in the design, conduct and analysis of epidemiological studies.

(c) Safety Over Dollars

Lacking knowledge about the precise effects of hazardous substances, authorities are confronted by an ethical dilemma when dealing with technological hazards. They can err on the side of safeguarding human health or on the side of conserving financial resources. Because of scientific uncertainty, officals should assume the worst and minimize public exposure. And where there is any evidence of possible contamination, the boundaries for investigation should be sufficiently broad to include all those who might be affected.

(d) Early Resolution

If long-term stress and feelings of helplessness and loss of control are to be alleviated, victims of technological disasters must be dealt with promptly and efficiently. People will still worry about future miscarriages, birth defects, cancer, and effects on children, but slowness in remedying exposure whether by evacuation or providing alternative water supplies will reinforce fears and deepen anxieties. As many problems may emerge only years later from quilt and recrimination due to delay in moving, long-range followup studies are necessary. At the same time, people must have the option of leaving, with government funding, over a period of time, for if they are forced out of their homes additional stress is introduced.

Recommendations

1. Collaborate with provincial officials to investigate promptly and thoroughly the concerns of residents near a landfill, nuclear plant or other hazardous operation in order to limit contamination, and inform complainants of results of investigation.

2. Assist communities victimized or endangered by technological disasters through underwriting the services of a consultant or advocate selected by the residents to coordinate and pressure regulatory agencies, furnish information and support, and create trust.

3. Promote controversy resolution between government/business and citizens by:
   (a) environmental mediation in those circumstances where there are no major value differences and where both sides can afford to participate and have sanctions they can apply against each other;

   (b) appointment of an independent advisory panel with community representation where a more comprehensive approach is necessary. The panel would operate under specified rules of procedure and a carefully reasoned means of conflict resolution.

4. Make certain helping agencies have on staff people who are sensitive to the stress experienced by victims and are able to communicate effectively with them.

5. Incorporate long-term health studies and compensation into the siting of all hazardous facilities such as uranium mines, nuclear plants, and toxic waste dumps with the burden of proof falling on the generator of the hazard to demonstrate that no harm, physical or psychological, has occurred to workers or people in the surrounding area.

6. Develop expertise in ecotoxicity in order to contend with problems of long-term exposure of humans and other species to trace amounts of chemical complexes.

7. Promote the removal and destruction of toxic chemical wastes as cheaper in the long run and environmentally superior to perpetual care.

8. Act in consort with the Ontario Ministry of the Environment and U.S. Federal and State authorities in the Great Lakes Basin to develop and implement a program that would:

   (a) institute mandatory provisions for reclamation, reuse, and recovery of chemical wastes to the maximum extent feasible;

   (b) provide industry with economic incentives and disincentives to conduct a vigorous search for alternatives to toxic chemicals now in use (e.g., a disposal tax based on a product's environmental and health burden; banning non-essential hazardous substances);

   (c) adhere to a "closed-loop" standard for essential chemicals in which production, use and disposal is carefully monitored and controlled.

9. Initiate research into means by which people cope with technological disasters in order to better aid future victims.

REFERENCES

Abe, S., Inoue, Y., and Takamatsu, M. Polychlorinated biphenyl residues in plasma of Yusho children born to mothers who had consumed oil contaminated by PCB. Acta Medica Fukuoka. 1975. 66: 605-609.

Ader, R. Psychoneuroimmunology. Academic Press, N.Y. 1982.

Alternatives. Special Double Issue on Toxic Wastes. Fall-Winter 1982. Vol. 10, Numbers 2/3.

Arlien-Soborg, P. et al. Vestibular dysfunction in occupational chronic solvent intoxication. Clin. Otalaryngol. 1981. 6: 285-290.

Arlien-Soborg, P. et al. Cerebral blood flow in chronic toxic encephalopathy in house painters exposed to organic solvents. Acta Neurol. Scand. 1982. 66: 34-41.

Berkman, L. and Syme, S. Social networks, host resistance, and mortality: a nine-year followup study of Alameda County residents. Am. J. Epidemiol. 1979. 109: 186-204.

Bromet, E. Three Mile Island: Mental Health Findings. Pittsburgh: Western Psychiatric Institute and Clinic, October 1980(a).

Bromet, E. Preliminary report on mental health of Three Mile Island residents. Pittsburgh: Western Psychiatric Institute. 1980(b).

Bruhn, P. et al. Prognosis in chronic toxic encephalopathy. A 2-year followup study in 26 house painters with occupational encephalopathy. Acta Neurol. Scand. 1981. 64: 259-272.

Cherry, N. et al. An investigation of acute behavioural effects of styrene on factory workers. Brit. J. Ind. Med. 1981. 37: 234-240.

Cory-Slechta, D.A. and Weiss, B. Delayed behavioural toxicity of lead with increasing exposure concentration: a systematic replication. The Toxicologist. 1982. 2: 81 (abstract).

Davies, K. and Campbell, J. Toronto's Drinking Water: A Chemical Assessment. City of Toronto Dept. of Public Health. 1984.

Doern, G.B. Politics of Risk: Identification of Toxic and Other Hazardous Substances in Canada. Prepared for Royal Commission on Asbestos in Ontario. Toronto, 1982.

Doern, G.B. Regulatory Processes and Jurisdictional Issues in the Regulation of Hazardous Products in Canada. Science Council of Canada Background Study, No. 41. Ottawa, 1977.

Dohrenwend, B.P., Dohrenwend, B.S., Kasl, S.W., and Warheit, G.J. Report of Task Group on Behavioural Effects to President's Commission on the Accident at Three Mile Island. U.S. Gov't Printing Office, Washington, D.C. 1979.

Edelstein, M.R. Statement Before New York State Assembly Environment and Conservation Committee, April 14, 1983. President, Goshen Area Resources Assoc., Town of Goshen, N.Y.

Edelstein, M.R. A Psychological Perspective on Community Health Information on Toxic Sites. Testimony Before the New York State Assembly Standing Committee on Environmental Conservation, May 4, 1984, NY, NY. School of Environmental Studies, Ramapo College of N.J. and Orange Environment, Inc.

Edelstein, M.R. Disabling Communities: The Impact of Regulatory Proceedings. In: Melser, P. and Bowles, R. Social Impact and Social Change Processes. In press.

Elofsson, S. et al. Exposure to organic solvents: a cross-sectional epidemiological investigation on occupationally exposed car and industrial spray painters with special reference to the nervous system. Scand. J. Work, Environ., Health. 1980. 6: 239-273.

Environment Council of Alberta. Public Hearings on Hazardous Waste Management in Alberta. Report and Recommendations. Edmonton, 1980.

Epstein, S.S. The Politics of Cancer. Sierra Club Books. San Francisco. 1978.

Flynn, C.B. Three Mile Island Telephone Survey. Preliminary Report on Procedures and Findings. Mountain West Research Inc. Prepared for U.S. Nuclear Regulatory Commission NUREG/CR-1093. Washington, D.C. October 1979.

Foster, H.D. and Sewell, W.R.D. Water: the Emerging Crisis in Canada. James Lorimer and Co. Toronto. 1981.

Funatsu, I., Yamashita, F., et al. Polychlorobiphenyls (PCB) - induced fetopathy. Kurume Med. J. 1972. 19: 43-51.

Gamberale, F. Behavioral effects of exposure to solvent vapors. Experimental and field studies. In: Horvath, M. (ed.) Adverse Effects of Environmental Chemicals and Psychotropic Drugs. 1976. Vol. 2: 111-133.

Gass, G.H., Coates, D., and Graham, D. Carcinogenic dose-response curve to diethylstilbestrol. J. of National Cancer Institute. 1964. 33: 971-977.

Graves, P.L. and Thomas, C.B. Themes of Interaction in Medical Students' Rorshach Responses as Predictors of Mid-Life Health or Disease. Psychosom. Med. 1981. 43: 215-226.

Great Lakes Science Advisory Board. A Perspective on the Problem of Hazardous Substances in the Great Lakes Basin Ecosystem. Int. Joint Commission. Windsor, 1981.

Hall, R.H. and Chant, D.A. Ecotoxicity: Responsibilities and Opportunities. Cdn. Environ. Advisory Council Report No. 8. Ottawa, 1979.

Hanninen, H. Psychological picture of manifest and latent carbon disulfide poisoning. Brit. J. of Ind. Med. 1971. 28: 374-381.

Hanninen, H., Hernberg, S., Mantere, P., et al. Psychological performance of subjects with low exposure to lead. J.O.M. 1978. 20: 683.

Hanninen, H., Mantere, P., Hernberg, S., et al. Subjective symptoms in low-level exposure to lead. Neurotoxicology. 1979. 1: 333.

Harada, M. Intrauterine poisoning: clinical and epidemiological studies and significance of the problem. Bulletin of Institute of Constitutional Medicine, Kumamoto University (Japan). 1976. 25: 38-55.

Harada, M. Congenital alkyl mercury poisoning (congenital Minamata disease) Paediatrician. 1977. 6: 58-68.

Houts, P., Miller, R.W., Tokuhata, G.K., and Hans, K.S. Health-related behavioral impact of Three Mile Island nuclear accident. Report submitted to Three Mile Island Advisory Panel on health-related studies. Pennsylvania Dept. of Health, Hershey, Penn. 1980.

Jacobson, S.W., Jacobson, S.L., Fein, G.G., Schwartz, P.M. and Dowler, J.K. Prenatal exposure to an environmental toxin: a test of the multiple effects model. Developmental Psychology, in press.

Johnson, B.L., Burg, J.R., Xinteras, C., et al. A neurobehavioral examination of workers from a primary nonferrous smelter. Neurotoxicology. 1980. 1: 561.

Juntunen, J. et al. Neurological picture of organic solvent poisoning in industry. Int. Arch. Occup. Environ. Health. 1980. 46: 219-231.

Kase, S., Chisholm, R., and Eskenazi, B. Impact of Accident at Three Mile Island on Behavior and Well-Being of Nuclear Workers. Report of Task Force on Behavioral Effects of President's Commission on Accident at Three Mile Island, 1979.

Krawetz, M.N. Hazardous Waste Management: A Review of Social Concerns and Aspects of Public Involvement. Staff Report #4. Research Secretariat, Dept. of Environment. Edmonton, Alta. 1979.

Levine, A.G. and Stone, R.A. Reaction to Collective Stress: Correlates of Active Citizen Participation at Love Canal (Abstract). Paper given at Amer. Psych. Assoc. Symposium - Three Mile Island and Love Canal: Human Consequences and Prevention. APA. 92nd Annual Convention, Aug. 24-28, 1984, Toronto, Ont.

Lilley, J. Management and Disposal of Hazardous Waste. Background Information. Bulletin No. 1. Environment Council of Alberta. Edmonton, 1980.

Lindstrom, K. Pscyhological performance of workers exposed to various solvents. Scand. J. Work, Environ. Health. 1973. 10: 151.

Lindstrom, K. Changes in psychological performances of solvent-poisoned and solvent-exposed workers. Amer. J. Ind. Med. 1980. 1: 69-84.

Mikkelson, S. A cohort study of disability pension and death among painters with special regard to disabling presenile dementia as occupational disease. Scand. J. Soc. Med., suppl. 1980. 16: 34-43.

Nelson, B.K., et al. Prenatal interactions between ethanol and industrial solvent 2-ethoxyethanol in rats: neurochemical effects in offspring. Neurobehav. Toxicol. Terat. 1982. 4: 395-401.

Neutra, R.N. Epidemiology For and With a Distrustful Community. Dept. of Health Services, Berkeley, CA. 1984. 8 pp.

Ollendick, D.G. and Hoffman, M. Assessment of Psychological Reactions in Disaster Victims. J. Comm. Psych. 1982. 10: 157-167.

Peters, J.M., Preston-Martin, S., and Yu, M.C. Brain tumors in children and occupational exposure of parents. Science. 1981. 213: 235-237.

Raitta, C. and Tolonen, M. Microcirculation of the eye in workers exposed to carbon disulfide. In: Merrigan, W.H. and Weiss, B. (eds.). Neurotoxicity of the Visual System. Raven Press, N.Y. 1980.

Repko, J.D., Jones, P.D., Garcia, L.S., and Schneider, E.J. Behavioral and Neurological Effects of Methyl Chloride. U.S. Dept. of Health, Educ., and Welfare (NIOSH) Pub. No. 77-155. Washington, D.C. 1977.

Repko, J.D., Morgan Jr., B.B., and Nicholson, J. Behavioral Effects of Occupational Exposure to Lead. DHEW Pub. No. (NIOSH) 75-184. Washington, D.C. U.S. Gov't Printing Office.

Rice, D.C., Gilbert, S.G., and Willes, R.F. Neonatal low-level lead exposure in monkeys: locomotion activity, schedule-controlled behavior, and effects of amphetamine. Toxicol. and Applied Pharmacology. 1979. 51: 503-513.

Riihimaki, V., Savolainen, K. Human exposure to m-xylene, kinetics, and acute effects on central nervous system. Ann. Occup. Hyg. 1980. 23: 411-422.

Savolainen, K. and Linnavuo, M. Effects of m-xylene on human equilibrium measured with a quantitative method. Acta Pharmacol. Toxicol. 1979. 44: 315-318.

Savolainen, K., Riihimaki, V., Seppalainen, A.M. and Linnoila, M. Effects of short-term m-xylene exposure and physical exercise on the central nervous system. Int. Arch. Occup. Env. H. 1980. 45: 105-121.

Schrecker, T. Risk/Benefit. infoetox. 1984. Vol. 1, C2.

Science Council of Canada. Policies and Poisons. Report No. 28. 1977. Ottawa.

Seppalainen, A.M., Husman, K. and Martenson, C. Neurophysiological effects of long-term exposure to a mixture of organic solvents. Scand. J. Work Env. Health. 1978. 4: 204-211.

Singer, G.L. ....Nor any Drop to Drink! Public Policies Toward Chemical Contamination of Drinking Water. PU/CEES Report No. 140. Center for Energy and Environmental Studies, Princeton, Univ.

Strauss, M. Laws on pollution favor large firms, reform study finds. Globe and Mail. August 14, 1984. p. M3.

Takeuchi, T. Biological reactions and pathological changes in human beings and animals caused by organic mercury contamination. In: Hartung, R. and Dinman, B.D. (eds.). Environmental Mercury Contamination. Ann Arbor Science, Ann Arbor, Michigan. 1972.

Toxic Substances Committee. Toxic Substance Control Programs in Great Lakes Basin. Int. Jt. Commission. Windsor. 1981.

Valciukas, J.A., Lilis, R., Anderson, H.A., Wolff, M.S. and Petrocci, M. Neurotoxicity of polybrominated biphenyls: results of a medical field survey. Ann. N.Y. Acad. Science. 1979. 320: 337.

Valciukas, J.A., Lilis, R., Wolff, M.S., and Anderson, H.A. Comparative neurobehavioral study of a polybrominated biphenyl-exposed population in Michigan and non-exposed group in Wisconsin. Environ. Health Perspectives. 1978. 23: 199.

Weiss, B. and Spyker, J.M. Behavioral implications of prenatal and early postnatal exposure to chemical pollutants. Pediatrics. 1974. 53: 851-859.

BIBLIOGRAPHY

W.K. Anger and B.L. Johnson. Chemicals Affecting Behavior. In: J.L. O'Donoghue (ed.). Neurotoxicity of Industrial and Commercial Chemicals. To be published by CRC Press.

J. Barbanel. For One Love Canal Family, the Road to Despair. New York Times. May 19, 1980. A1, B3.

J.C. Barefoot, W.G. Dahlstrom, R.B. Williams. Hostility, CHD Incidence, and Total Mortality: a 25-Year Follow-Up Study of 255 Physicians. Psychosomatic Medicine. V. 45(1) March 1983. 59-63.

A. Baum, R. Fleming, L.M. Davidson. Natural Disaster and Technological Catastrophe, Environ. and Behaviour. V. 15(3), May 1983. 333-354.

A. Baum, R. Fleming and J.E. Singer. Coping With Victimization by Technological Disaster. J. of Social Issues. V. 39(2), 1983. 117-138.

A. Baum, R.J. Gatchel, M.A. Schaeffer. Emotional, Behavioral, and Physiologic Effects of Chronic Stress at Three Mile Island. J. of Consulting and Community Psychology. V. 51(4), 1983. 565-572.

Brown M. Laying Waste: The Poisoning of America by Toxic Chemicals. Pantheon Books, NY, 1979 & 1980.

Cancer and Stress Linked, Scientists say. Toronto Star. June 30, 1984.

D. Clendinen. Love Canal is Extra Tough on Children. New York Times. June 19, 1980. B1, B4.

M. Clugston. Life on the Rim of a Chemical Stew. Maclean's. July 17, 1980. P. 13.

L.M. Davidson, A. Baum, D.L. Collins. Stress and Control-Related Problems at Three Mile Island. J. of Applied Social Psychology. V. 12(5), 1982. 349-359.

F.M. Eckman. Our Fear Never Ends. McCall's. June 1980. V. 107. P. 94-95, 134-140.

M.R. Edelstein. Social and Psychological Impacts of Groundwater Contamination in the Legler Section of Jackson, New Jersey. 1982.

I. Fleming and A. Baum. Chronic Stress in Residents Living Near a Toxic Waste Site. Paper given at 1984 Meeting of Eastern Psychological Association.

R. Fleming, A. Baum, M. Gisriel, and R.J. Gatchel. Mediating Influences of Social Support on Stress at Three Mile Island. J. of Human Stress. September 1982. 14-22.

M.R. Fowlkes and P.Y. Miller. Love Canal: The Social Construction of Disaster. Federal Emergency Management Agency. Washington, DC. 1982.

T.F Freedman. Leftover Lives to Live: Love Canal Children. The Nation. May 23, 1981. 624-627.

L.N. George. Love Canal and the Politics of Corporate Terrorism. Socialist Review. V. 12(6), November-December 1982.

L.M. Gibbs. The Need for Effective Governmental Response to Hazardous Waste Sites. J. of Public Health Policy. March 1981.

L.M. Gibbs. Love Canal: My Story. State University of New York Press, Albany. 1982.

L.M. Gibbs. Community Response to an Emergency Situation: Psychological Destruction and the Love Canal. American Journal of Community Psychology. V. 11(2). 1983.

R.H. Hall. Quality of Existing Water Systems and Public Perception. In: Critical Issues - Drinking Water. National Conference on Critical Issues in Drinking Water. February 6-7, 1984, Ottawa, 46-49.

C. Holden. Love Canal Residents Under Stress. Science. V. 208. June 13, 1980LUSION. Houts and M.K. Goldhaber. Psychological and Social Effects on the Population Surrounding Three Mile Island After the Nuclear Accident on March 28, 1979. In: S.K. Majumdar (ed.), Energy, Environment and the Economy. Penn. Acad. of Science 1981. 151-164.

A.G. Levine. Love Canal: Science, Politics and People. Lexington Books. D.C. Health and Co. Toronto. 1982.

A.G. Levine. Psychosocial Impact of Toxic Chemical Waste Dumps. Environ. Health Perspectives. V. 48. 1983. 15-17.

M. Lystad. Mental Health Studies of Emergencies: Where We Are and Where We Need To Go. Natural Hazards Observer. May 1984. V. 8(5). 1-2.

Ontario Hydro, Social and Community Studies Section, Route and Site Selection Division. Social and Economic Impacts Associated with the Three Mile Island Incident. Report #8008. January 1980.

R. Paehlke. Guilty until proven innocent: Carcinogens in the Environment. Nature Canada. April-June 1980. V. 9(24). 18-24.

B. Paigen. Controversy at Love Canal, Hastings Center Report. June 1982.

T. Pawlick. The Silent Toll. Harrowsmith. V. 4, June 1980.

T. Pawlick and J. Lawrence. The Silent Toll, Part II. Harrowsmith. August 1980.

J. Raloff. The Human Cost of Love Canal. New Scientist . July 3, 1980. V. 87(7).

K. Schaar. Crisis. APA Monitor. September/October 1980. V. 11. 14-16.

R.W. Schwartz and N.B. Stewart. Psychological Effects of Diethylstilbestrol Exposure. J. of American Medical Assoc. Jan. 17, 1977. V. 237(3). 252-254.

A. Sudar and C. Jones. A Survey of Attitudes Towards Water Quality in Communities Along the Canadian Side of the Niagara River. Inland Waters Directorate, Ontario Region, Environment Canada. 1983.

Toronto Star Cancer and Stress Linked, Scientists Say. June 30, 1984.

C. Trost. Mailman wears a gas mask in chemical horror area. The Montreal Gazette. August 11, 1978.

D. Weinberg. Breakdown: Love Canal's Walking Wounded. Village Voice. September 9-15, 1981.

R.B. Williams, J.C. Barefoot, R.B. Shekelle. Health Consequences of Hostility. In: M.A. Chesney, S.E. Goldston, R.H. Rosenman (eds.). Anger, Hostility and Behavioral Medicine. Hemisphere/McGraw-Hill, NY. In press 1984.

25362