NOTICE

**CERTAIN DATA
CONTAINED IN THIS
DOCUMENT MAY BE
DIFFICULT TO READ
IN MICROFICHE
PRODUCTS.**

NUCLEAR WASTE PROJECT OFFICE

NWPO-SE-045-92

SOCIAL IMPACTS OF HAZARDOUS AND NUCLEAR FACILITIES AND EVENTS: IMPLICATIONS FOR NEVADA AND THE YUCCA MOUNTAIN HIGH-LEVEL NUCLEAR WASTE REPOSITORY

BOB MILLER
Governor

ROBERT R. LOUX
Executive Director

RECEIVED

MAY 18 1993

OSTI

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

**STATE OF NEVADA
AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT**

NWPO-SE-045-92

**SOCIAL IMPACTS OF HAZARDOUS
AND NUCLEAR FACILITIES AND EVENTS:
IMPLICATIONS FOR NEVADA
AND THE YUCCA MOUNTAIN
HIGH-LEVEL NUCLEAR WASTE REPOSITORY**

**INTRODUCTION BY:
WILLIAM R. FREUDENBURG**

CONTRIBUTORS:

**LEWIS F. CARTER
WILLIAM WILLARD
DORA G. LODWICK
RONALD A. HARDERT
ADELINE GORDON LEVINE
STEVE KROLL-SMITH
STEPHEN R. COUCH
MICHAEL R. EDELSTEIN**

MASTER

MAY, 1992

THE NEVADA AGENCY FOR NUCLEAR PROJECTS/NUCLEAR WASTE PROJECT OFFICE (NWPO) WAS CREATED BY THE NEVADA LEGISLATURE TO OVERSEE FEDERAL HIGH-LEVEL NUCLEAR WASTE ACTIVITIES IN THE STATE. SINCE 1985, IT HAS DEALT LARGELY WITH THE U.S. DEPARTMENT OF ENERGY'S SITING OF A HIGH-LEVEL NUCLEAR WASTE REPOSITORY AT YUCCA MOUNTAIN IN SOUTHERN NEVADA. AS PART OF ITS OVERSIGHT ROLE, NWPO HAS CONTRACTED FOR STUDIES OF VARIOUS TECHNICAL QUESTIONS AT YUCCA MOUNTAIN.

THIS STUDY WAS FUNDED BY DOE GRANT NUMBER DE-FG08-85-NV10461.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

LIST OF THE STUDIES

Trustworthiness and Institutional Performance: An Introduction to the Case Studies, *by William R. Freudenburg*

Scope, Stakeholder Groups and Impact Issues Raised by the Proposed Hanford, Washington High-Level Nuclear Waste Repository Site, *by Lewis F. Carter and William Willard*

Rocky Flats, Colorado: A Case Study, *by Dora G. Lodwick*

The Feed Materials Production Center in Fernald, Ohio: A Case Study, *by Ronald A. Hardert*

Love Canal 1978 - 1991: A Case Study of the Social Impacts of Hazardous Wastes, *by Adeline Gordon Levine*

Social Impacts of Toxic Contamination, *by Steve Kroll-Smith and Stephen R. Couch*

Mitigating Environmental Stigma and Loss of Trust in the Siting of Hazardous Facilities, *by Michael R. Edelstein*

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

ABOUT THE AUTHORS

William R. Freudenburg is a Professor of Sociology at the University of Wisconsin at Madison and president of Social Science Research Associates, Inc.

Lewis F. Carter is a professor of sociology and William Willard is a professor of anthropology at Washington State University.

Dora G. Lodwick is an assistant professor in the Department of Sociology and Anthropology at Miami University in Oxford, Ohio.

Ronald A. Hardert is a professor of sociology at Arizona State University in Tempe, Arizona.

Adeline Gordon Levine is Professor Emeritus, Department of Sociology at the State University of New York at Buffalo.

Steve Kroll-Smith is a professor of sociology at the University of New Orleans and Stephen R. Couch is a professor of sociology at Pennsylvania State University.

Michael R. Edelstein is a professor with the Institute for Environmental Studies and School of Social Sciences and Human Services at Ramapo College in Mahwah, New Jersey.

**TRUSTWORTHINESS AND INSTITUTIONAL PERFORMANCE:
AN INTRODUCTION TO THE CASE STUDIES**

BY

WILLIAM R. FREUDENBURG

TRUSTWORTHINESS AND INSTITUTIONAL PERFORMANCE: AN INTRODUCTION TO THE CASE STUDIES

The Background: The Importance and the Sensitivity of Trust

The interrelated issues of trust and trustworthiness are becoming increasingly central to understanding the socioeconomic impacts of a proposed repository for high-level nuclear wastes. Both in the surveys that have been commissioned by the State of Nevada and in analogous work being done by other researchers, there is a growing convergence on this point; at the U.S. Department of Energy's (DOE's) 1991 meeting on the management of high-level nuclear wastes, for example, researchers from around the country, basing their analyses on at least four independent data sets, all concluded that the issues of trust and trustworthiness provided the key to understanding the reactions inspired by the repository. A representative from the U.S. Department of Energy who was on the same panel agreed about the importance of the trust issue, but argued that trust levels would improve over time, as the public learned more about the repository and the DOE. Since that time, the Secretary of Energy has established an Advisory Committee on Trust and Credibility, headed by the well-known social scientist, Dr. Daniel Metlay.

In some respects, the focus on trust and trustworthiness represents a new departure. The early speculation about public reactions to potentially risky technologies tended to focus on entirely different issues, often involving arguments that low levels of trust "simply" involved ignorance and/or irrationality (for a classic statement, see Tversky and Kahneman, 1974; for reviews, see Mitchell, 1984; Lopes, 1989; Freudenburg, 1988). In response, a series of research efforts have focused on the roles played by ignorance and/or irrationality, but one result of the research is an increasing consensus in the scientific community that the early speculation was wrong. With the exception of one study funded by the Department of Energy, where all of the "knowledgeable" responses in the survey happened also to be the lowest-risk options offered (Jenkins-Smith et al., 1991; survey items reported on p. 66), more recent studies are consistently pointing in a very different direction. While both ignorance and irrationality are most certainly present in the world, they do not appear to offer a useful explanation for risk-related impacts.

In study after study, both in psychological laboratory settings (e.g. Fischhoff et al., 1981; Slovic et al., 1984; Slovic, 1987; Lopes, 1989) and survey research involving representative samples of the general public (e.g. Dunlap and Olsen, 1984; Edelstein, 1988; Freudenburg and Jones, 1991; Gould et al., 1988; Mitchell, 1984; Rosa and Freudenburg, 1984), there is growing consensus that neither ignorance nor irrationality can offer significant power in explaining the difference between supporters and opponents of nuclear or other risk-related facilities (see also Dietz et al., 1989; Fiorino, 1989;

ity, who can tend to become extremely defensive when the issue comes up. One line of work on trustworthiness, for example, has gone so far as to use the little-known term of *recreancy* to refer to the failure of specialized organizations (as well as of individuals) to carry out their duties with the degree of vigor that might be desired (see especially Freudenburg, 1990, 1991b). This work takes pains to note that the failures often involve no ill intent and are often quite understandable, but even so, the unusual term has proved to be necessary precisely because better-known or alternative terms tend to carry such heavy emotional loadings.

An example of the problem comes from the same recent meeting on high-level waste where the technical sessions on socioeconomic impacts were pointing to the trustworthiness issue. While the social scientists were using language that was careful and precise, the not-so-technical sessions received a great deal more media coverage, and a significant fraction of that coverage revolved around charges and denials by the Governor of Nevada and officials from the Department of Energy over the degree to which repository-related efforts could be said to resemble "an episode from *Keystone Cops*." Given the level of concern among most social scientists that their careful, analytical work should in no way be confused with such inflammatory exchanges, a number of social scientists who have done work on the proposed nuclear waste repository have stated privately that they have stayed away from the trust issue, even though they have suspected it would prove to be important, because they did not want to be accused of "DOE-bashing."

The issue, however, can be avoided no longer. As is shown consistently, not only by state-sponsored reports, but by independent research as well, public views toward the U.S. Department of Energy have come to reflect a distrust that is extensive and apparently intense. Particularly in trying to assess the socioeconomic impacts that are ultimately likely to be created by a nuclear waste repository, it is difficult to overstate the significance of trust and trustworthiness. Everything from investment decisions and job opportunities, to levels of conflict and community stress, to the ability of governmental bodies to carry out their duties (both on the repository question and more generally) will be affected by the level of trust ultimately inspired by DOE activities. It should come as little surprise, accordingly, that a good deal of attention has now come to focus on the interrelated issues of trust and trustworthiness. The level of attention is bound to increase in the future.

While this topic is inherently a sensitive one, it is *not* one that involves any necessary implication of "bashing" the scientists or even the policymakers who currently work within the Department of Energy. To the contrary: It is only by focusing on the actual track record of nuclear materials management, over time, that it starts to become possible to move the debate toward a factual focus, and away from charges and denials about the extent to which repository activities do or do not resemble an episode from *Keystone Cops*. If the focus on the actual track record is supplemented by at least a limited comparative study of the ways in which other

Freudenburg and Pastor, in press; Johnson and Covello, 1987; Kraft and Clary, 1988; Kasperson, 1986). During the past year, moreover, comparable real-world evidence came from a privately funded "public information campaign" that was intended to overcome public opposition to the proposed repository in Nevada; as even an article in the *Wall Street Journal* noted, the campaign quickly became an example of "How Not to Sell a Nuclear Waste Dump," particularly after some of the "public information" that became available included information about the campaign itself (Flynn, 1992).

If anything, in fact, particularly in the more detailed studies of the specific social groups that have organized in response to technological hazards, researchers have found increasing evidence that the *supporters* of the technologies were the ones who, "by their own accounts, were noticeably and—in many cases—intentionally uninformed" (Fowlkes and Miller, 1987: 64; see also Brown, 1987; Brown and Mikkelsen, 1990; Edelstein, 1988; Freudenburg, 1984; Krauss, 1988; Levine, 1982; Stoffle et al., 1988). Intriguingly, the studies suggest that many opponents respond by trying to learn more about the facilities and the organizations that operate them, while supporters often tend instead to ignore such facts and to focus instead on trying to discredit the persons who express concerns (Fowlkes and Miller, 1987; Freudenburg, 1984; for a summary and analysis, see Freudenburg and Pastor, 1991).

In many respects, it is surprising that it would have taken so long for the issues of trust and trustworthiness to come to the forefront. Not just the nuclear industry in general, but federal nuclear installations in particular, have suffered problems with hazard management, quality control, and the initial denial of serious charges that were later found to be true (for a summary of the ongoing problems at the defense complex, see U.S. Office of Technology Assessment, 1991). These problems have received wide coverage in the national media (see for example Jones, 1989; Marshall, 1983; Penciak, 1982; Wald, 1988a; Schneider, 1989), but were slow in receiving systematic attention from social scientists.

Particularly given that studies of the nuclear waste issue have now started to provide such consistent evidence for the importance of trust and trustworthiness (for summaries, see Flynn et al., 1991; Krannich et al., 1991), there is reason to wonder why attention would have been so slow to turn to the issue. Many possibilities exist, but perhaps the key reason that the issue of trust and trustworthiness would have been avoided for so long has to do not with the *relevance* of the issue, but with its *political sensitivity*.

Like their colleagues in other scientific disciplines, social scientists are often wary of topics that are emotionally sensitive, and many have been apprehensive that even to raise the question of trust might be to raise the level of emotionalism and irrationality in the ongoing debate. In this case, however, the emotionalism would involve not just members of the general public, but members of the technical commun-

hazardous materials have been managed by other relevant organizations, in fact, it becomes possible to throw light on one of the key, underlying issues in the entire debate over nuclear waste management—albeit an issue on which independent scientists (see especially Lawless, 1985, 1991) have expressed considerable concern—the issue of institutional performance.

In important respects, moreover, the issue of institutional performance is one that goes well beyond the current officials of DOE, focusing instead on the broader risk-management culture of the agency. There is virtually no chance that any significant fraction of the ongoing management of any actual high-level radioactive waste repository will be under the control of *current* officials of the U.S. Department of Energy. Even if repository construction were to be moving forward at a much faster pace than has been the case to date, many of the key questions would still have to do with actions that would be taken by many successive sets of officials in future Departments of Energy, or in whatever successor agencies will ultimately bear responsibility for the safe operation of a facility, many decades into the future.

To put the matter in context, Ronald Reagan is the only President in more than three decades to have held that office for as much as eight years, and even the most optimistic of projections would not lead to the conclusion that and repository would begin accepting nuclear materials until well after President Bush would leave office, even under the assumption that his 1992 re-election bid would succeed. Particularly for the top-level positions of DOE, which involve presidential appointments, there is virtually no possibility that the current holders of those offices would still be in office by the time a repository would begin operation. Even at lower or more technical levels within the agency, it is extremely unlikely that any significant fraction of the current personnel of DOE would still be within the agency by the time another three or four decades have passed—and those same four decades will involve ten more Presidential elections, providing more than ample opportunity for future Presidents to appoint whatever kinds of officials they choose.

What is needed, in short, is neither an indictment nor a defense of the current employees of the Department of Energy. Instead, we need a broader set of studies that can begin to provide broader guidance about the types of pressures, tendencies, and conditions that are likely to shape the overall level of trust and trustworthiness that the overall body of experience with a repository will be likely to inspire, over a period of years, decades, and even centuries into the future. We also need empirical guidance on the types of socioeconomic impacts that are likely to result.

The Problem: Seeing into an Uncertain Future

One of the few points of agreement in the ongoing debate is that all of the decisions being confronted today will need to be dealt with in a context of considerable uncertainty. Perhaps inevitably, one of the key areas of uncertainty has to do

with the degree of vigor that will be devoted to ensuring the safety of repository operations during the inherently unforeseeable times that stretch many decades and even centuries into the future. The key question, in essence, has to do with the actions that will be taken or will fail to be taken, by persons who are themselves unknown at this time, who will be working in an unknown agency that may be a successor to the Department of Energy, under circumstances that are inherently unknowable, and at some point in the future that is itself unknown.

Understandably, there can be considerable appeal in simply hoping for the best—embracing the assumption that literally all relevant laws and regulations will be followed, to the letter, by whatever agency(ies) may bear responsibility for repository operation in the future. Such an approach, unfortunately, fails in two ways to be scientifically acceptable. The first is that scientists have learned, for good reason, to be skeptical about such high levels of optimism except in cases where it is backed up by solid, empirical evidence. The second is that the available evidence not only fails to support such hopes, but actively contradicts it. To adopt the hope-for-the-best approach is to decide that we want to ignore what we already know about the world.

A small fraction of the relevant evidence is summarized in the accompanying reports, but even in the absence of these reports, there is ample evidence that simply *hoping* for the best outcomes tends not to be the most effective way of *achieving* the best outcomes. As is widely known even among non-specialists, agencies have almost always had difficulty in achieving ambitious goals, and the failings have often been explained by noting that budgets are too tightly constrained to permit the agencies to carry out all of the tasks that might be desirable in a world of unlimited funding. All observant citizens know that policy priorities and levels of commitments to "promises" tend to change, with changes being accelerated by turnover among the persons who hold Presidential, Congressional and agency offices. Further evidence, however, is provided by systematic studies.

Beginning decades ago, for example, studies of bureaucratic organizations have noted the tendency for such organizations to become "co-opted" by some of the very industries they are expected to regulate, particularly when those industries involve significant concentrations of economic power (Selznick, 1949; Kaufman, 1960; Galanter, 1974; West, 1982; see also Stone, 1980). In recent years, this larger body of research has been joined by studies suggesting that risk management may be particularly problematic for agencies such as DOE, where safety tends to be described as important, but where the agency's funding and "mission" tend to be tied to other goals such as weapons production (see e.g. Clarke, 1988, 1990; Vaughan, 1989, 1990). There is also growing evidence on the phenomenon known as "the atrophy of vigilance," or the tendency not just for *individuals* to become complacent over time, but also for *organizations* to become decreasingly attentive to the management of the kinds of risks involving incidents that are rare or infrequent (for a summary, see Freuden-

burg, 1992; see also Shapiro, 1987, 1990). Still other evidence suggests that problems may be especially severe in cases where probability assessments are produced by experts who in effect are specialists in hardware, while many of the real-world risks are in fact the result of human and organizational factors. One example is in the work of Paté-Cornell (1990) on quantitative estimates of the risks associated with offshore oil platforms; while many of these estimates seem on the surface to be models of quantitative precision, more careful analyses have shown that they have missed roughly 95% of the real risks to which such platforms are actually susceptible (Paté-Cornell and Bea, 1992; see also Bier and Mosleh, 1990).

In short, while it might be deceptively appealing to hope for the best, it would be far more prudent to plan for the typical. As even the initial, accompanying case studies can show, the examination of empirical cases can make it possible to know a good deal about the ways in which real risks, related to real substances, have been managed by real organizations over time. Under the circumstances, it would be unwise in the extreme to ignore the valuable data base provided by the *actual* experiences of agencies and organizations (including, but not limited to, the Department of Energy) that have at least attempted to manage hazardous materials for a period of decades—even if little information can yet be found about the likely success of such activities carried on over a period of centuries.

The Question: What Are the Likely Trends?

If it is no longer possible to ignore the importance of trust and trustworthiness for a nuclear waste repository, it is nevertheless possible to disagree on whether the DOE's current problems are likely to continue, to grow, or to decrease over time. To date, the responses of the nuclear industry, the Department of Energy, and at least some analysts, appear to have been essentially threefold. The first response has been to blame the media, arguing that DOE's current credibility problems are related to the extremely negative coverage received by repository-related activities to date. The second response has been to claim that any repository would be operated to such high standards of safety that problems of trust should be expected to subside "naturally," based on citizens' likely experiences with actually operating facilities. The third response has been, in essence, to wish the problem away, attempting to deny the reality either of socioeconomic impacts in general or, more specifically, of impacts related to the level of trust enjoyed or not enjoyed by DOE and the nuclear industry.

The case studies tend to relate only indirectly to the first of these responses, that of blaming the media, in that it is no more appropriate to engage in "media-bashing" than in "DOE-bashing." Suffice it instead to note that, at least in a free society, the empirical reality is that the effects of media coverage on the public credibility of an agency can scarcely be wished away. Instead, the fact of media coverage simply must be taken into consideration in any program of socioeconomic impact assessment that hopes to provide real as opposed to hypothetical insights. One of the contributions

that empirical case studies can make, however, is to provide insights into arguments about what might or might not happen in the future, doing so by looking at what has actually happened in the past. On this point, as shown in particular by the case study by Lodwick of media coverage at Rocky Flats, the trend was in fact for coverage to become more critical over time, not more favorable, as will be noted further below.

The case studies bear more directly on the other two common responses to DOE's current credibility problems—the arguments that the agency's actions are generally supported by those who know the agency the best, and that credibility-related social impacts are somehow not "real."

One of the problems with these responses, of course, is that they tend to be offered by persons whose political interests happen to correspond with not "seeing" any negative impacts that can be safely overlooked; that is a political reality that case studies alone are not likely to address. The case studies, however, can begin to help untangle another problem, which is that the groups seen as "most knowledgeable" about agencies such as DOE often happen in practice to be most likely to be economically dependent on the same agencies. It does appear to be true, for example, that attitudes toward nuclear facilities are far more favorable at places such as Hanford and Oak Ridge than in the nation as a whole, but critics have charged that such pockets of support show the importance of direct economic dependence on nuclear activities, rather than of "experience." In conjunction with the existing, open literature, the case studies can provide an independent approach for answering the question.

Existing Literature on Relationships Between Experience and Support. To the extent to which evidence is available from the open literature (see e.g. Clarke, 1988; Fowlkes and Miller, 1987), it tends to suggest that, as critics argue, persons who are dependent on an industry or agency may be inclined to overlook problems. The underlying causes, however, appear not simply to involve calculations of economic self-interest; instead, at least two additional factors may be involved. First, there is evidence at least from case studies (see e.g. Brown and Mikkelsen, 1990; Freudenburg and Gramling, 1991) that many citizens will refrain from criticizing industries that support their friends and neighbors, even if they, themselves, have no direct economic dependence on the industries in question. Second, there is growing evidence that the persons involved in potentially risky occupations may tend to deny *even to themselves* the risks involved; perhaps this tendency provides a way of reducing the "cognitive dissonance" (Festinger, 1957) that would otherwise be created by the knowledge that a worker is exposing him- or herself to dangers.

Newcomb (1986), for example, has found "a macho or omnipotent response ... to nuclear power plant accidents" among the persons who work in such facilities, perhaps reflecting a tendency to "deny and minimize," rather than to perceive risks accurately (Newcomb, 1986: 915-16). A study of persons who worked with radiation in

hospitals led to similar conclusions, particularly among higher-status workers (Rayner, 1986). More research needs to be done on this point, but a similar tendency to minimize or to underestimate risks has been found in a variety of other occupations that sometimes involve risks—including fishing (Tunstall, 1962), coal mining (Fitzpatrick, 1980; Lucas, 1969), offshore oil drilling (Heimer, 1988), police work (Skolnick, 1969), "high steel" iron work (Haas, 1972; 1977), and even paratrooper training (Weiss, 1967). Still other support comes from studies of non-occupational settings, involving activities that range from gambling (Downes et al., 1976) to parachute jumping (Epstein and Fenz, 1967). In an analysis prepared for *Annual Reviews*, Heimer (1988) concluded that even when workers were consciously aware of the risks they faced, one of the key factors leading to workers' willingness to take excessive risks on the job was an aversion to a different risk, namely the risk of being thrown off the job if they failed to meet production quotas. The risk of losing employment, moreover, seems to have been salient even in cases where managers did not explicitly suggest to the workers that it might be a problem; the central question, it appears, was the risk-management culture of the agency (Heimer, 1988; cf. Lawless, 1985, 1991).

When it comes to nuclear issues in particular, there is growing reason to doubt the claim that "experience," rather than factors such as economic dependence and cognitive dissonance, would be the reason why certain pockets of the population would be disproportionately supportive of nuclear activities. Enough studies have now accumulated to make it clear that attitudes toward nuclear wastes (for a summary, see Dunlap et al., forthcoming), like attitudes toward nuclear power facilities (for summaries, see Freudenburg and Rosa, 1984; Freudenburg and Baxter, 1984; 1985), have become overwhelmingly negative. Far from being concentrated in any one narrow or ill-informed segment of the population, the opposition has been found to extend relatively evenly among virtually all segments of society—with the probable exception of professions and communities that are more directly dependent on the nuclear industry (Dunlap et al., 1983; Freudenburg, 1990).

While it was once the case that studies of the host communities for nuclear power plants also found high levels of support for the local facilities, even that pattern appears to have ended more than a dozen years ago, with the accident at Three Mile Island (TMI). As of the mid-1980s, an analysis of all the then-known studies of nuclear host communities could find no study before (TMI) that had found as much as 33% of a host population to be opposed to the local facilities, but no study after the TMI accident that had found less than a 50% level of opposition (Freudenburg and Baxter, 1984, 1985). A recent study that examined attitudes toward a proposed nuclear waste repository in two regions of Michigan (Stoffle et al., 1988) found that attitudes were actually more negative in the area having had previous experience with nuclear installations, a phenomenon the authors called a "risk perception shadow" from that earlier experience.

At the national level, finally, the public had begun to turn against nuclear power several years earlier, starting in the mid-1970s, after a series of reports about toxic leaks began to raise concerns; this change in views took place in spite of (and in the context of) a decades-long, multi-million-dollar public relations campaign that had focused on the benefits of nuclear technology. In 1967 alone, for example, federal exhibits and displays about nuclear energy were seen by nearly five million people (U.S. Atomic Energy Commission, 1968). Aside from the fact that surveys in Nevada have continued to find intense opposition to any nuclear repository in the state, careful studies have also found opposition levels to *increase*, rather than decreasing, even in the face of expensive public relations campaigns designed to have precisely the opposite effect. The apparent backfiring of the latest and most sophisticated of the industry-funded public-relations campaign in Nevada has already been noted (see also Flynn, 1992). Such an outcome, however, is scarcely limited to Nevada. Similar findings have been encountered elsewhere in the U.S. (for a summary, see Mazur, 1981), and also in nations that are widely seen as being much more compliant with the views of technological elites, such as Taiwan (Liu and Smith, 1990) and Japan (Budd et al., 1990; for suggestive evidence of a similar problem in Korea, see United Press International, 1990).

As noted in a recent article in *Science*, "A single act of embezzlement is enough to convince us that our bookkeeper is untrustworthy. A subsequent opportunity to embezzle that is not taken would likely to do little to reduce the degree of distrust.... In this context, the attempts by DOE to regain the confidence of the public, Congress, and the nuclear industry by rearranging its organizational chart and promising to do a better job...in the future...was naive" (Slovic et al., 1991: 1606).

Case-Study Findings on "Experience." Even collectively, of course, the studies available from the open literature should not be taken as "proving" that experience with a potentially hazardous facility will lead to increasing levels of public concern. Particularly given the less-than-perfect record of past efforts to assess the likely risks of hazardous facilities, however, past studies appear to suggest that, for policymakers who wish to base their decisions on the best evidence available, it may be advisable to learn what lessons can be gained from cases where actual operating experience proved to be less than satisfactory. Such lessons are available from a number of the case studies that accompany this report.

While it is important to note that the facilities that have been analyzed in the case studies have been operated by a number of organizations, and not just the Department of Energy and its contractors, all of the case studies have found that problems related to trust and trustworthiness have tended to increase significantly, rather than decreasing, over time. It needs to be noted that the present assemblage of case studies should not be regarded as an exhaustive sampling, and that indeed, it may not even be possible to put together a representative sampling of *potentially* controversial installations. In particular, these case studies should not be seen as representing

in any way the unknown number of potentially hazardous facilities, nuclear and otherwise, that enjoy a history of successful risk management and correspondingly good relationships with their host regions.

In case it is not already obvious, however, DOE's repository-related efforts would not be seen by most observers as involving a history of successful risk management and correspondingly good relationships with their host regions. The agency's credibility has already been damaged by a number of problems, starting with difficulties in the work being done on the Yucca Mountain site itself—e.g., the announcement that the Secretary of Energy himself concluded that he had so little confidence in his Department's studies of the site, despite the expenditure of roughly half a billion dollars up to that point, that it would be necessary to throw out all previous studies and start over (Vald, 1989). Other difficulties have ranged from revelations of past risk-management problems at the nearby nuclear weapons test site (e.g., the disclosure that workers "were repeatedly exposed to dangerous levels of radiation from underground and atmospheric blasts over three decades" [Schneider, 1989: 1]) to continuing bad news about difficulties at other DOE nuclear installations in other states (e.g., the problems at the Rocky Flats facility near Denver that were so severe they led ultimately to a raid on the facility by the FBI in "Operation Desert Glow" [Jones, 1989:1]).

In fairness, it needs to be noted that the current officials of DOE could scarcely be held personally responsible for decisions that had been made decades earlier, and that while the FBI raid was made necessary in part by concerns that "high-ranking officials of the U.S. Department of Energy...conspired to illegally dispose of radioactive and toxic wastes" at the facility, according to newspaper reports on the federal affidavit on the charges (Graf and Finley, 1989:1A), the raid was carried out with the evident cooperation of the office of the Secretary of Energy himself. Still, even these mitigating considerations scarcely point to a ringing endorsement for the overall success of DOE's waste-management efforts, and a number of technical analyses have begun to conclude that, past assurances notwithstanding, there may be substantial reason to question the feasibility of operating the Yucca Mountain facility with the degree of success that many policymakers still envision (Krauskopf, 1990; Lawless, 1991; Malone, 1990).

Under the circumstances, the relevant cases would appear to be those in which an agency has already started to come under fire for trust-related problems—and perhaps significantly, as noted in the Slovic et al. example (1991) of a bookkeeper whose subsequent actions did little to overcome the loss of trust resulting from "a single act of embezzlement," neither past work nor the current case studies can provide much in the way of examples where negative evaluations have become more trusting over time. It is perhaps significant, however, that rather than being exempt from the general pattern, the Department of Energy and its predecessor agencies

would appear to provide almost a textbook example of the problems created by an agency's loss of trust.

At the Rocky Flats installation examined in Lodwick's piece, for example, an initially supportive community came to be far more suspicious in the wake of disclosures about safety problems that had previously been denied. When the safety concerns began to be an issue for public support of the facility, the contractor that had long been running the site on behalf of the federal government was replaced by another that promised greater attention to safety and to openness toward the public; that contractor, in turn, was in charge of operations for about a dozen years before being raided by the FBI and charged with safety problems that were not only being covered up but were criminal in severity. While the local reactions to these disclosures would have to be characterized as harsh, suffice it to say that even persons not having a deep familiarity with the relevant social science literature would have little difficulty predicting that such disclosures would be unlikely to lead to increased trust.

The Rocky Flats installation is the only one where the problems have so far become so severe as to lead to a raid by the FBI, but it appears not to have been the only one where problems of trust were destined to become more severe over time. As Hardert notes in his case study of Fernald, that DOE facility appears to have been like Rocky Flats in that local attitudes were initially quite supportive—continuing, in the Fernald case, up until after problems with off-site contamination began to be reported in 1984. The Fernald experience provides an intriguing contrast against the normal advice of risk-communications specialists about the importance of openness (Hance et al., 1988; National Research Council, 1989). As Hardert notes, at least a number of officials in DOE knew about the problem of off-site contamination by late 1984, but at least according to a local critic, it was not until August of 1990 that DOE officials admitted that, contrary to earlier denials, cesium 137 and thorium 230 were present both in and around the plant. While DOE spokespersons have been quite critical of this critic, in turn, it needs to be acknowledged that the agency ultimately agreed to an unprecedented, multi-million-dollar, out-of-court settlement that she was instrumental in negotiating. As Hardert notes, local residents can scarcely be blamed if they conclude that DOE and its contractors at Fernald have been more concerned with making sure that harmful *publicity* not escape the site than that harmful *materials* not escape; in 1990, when a DOE employee accidentally faxed the daily list of agency mishaps to the nation's 50 governors rather than to the DOE regional offices, that employee was fired the next day.

One of the criticisms of DOE that is particularly relevant to the issue of trust, as will be noted further below, is that the agency sometimes seems to have shown a marked disinclination to deal with the full range of facility-related impacts that cause problems for nearby communities, particularly in the case of socioeconomic impacts. Perhaps the only area of socioeconomic impact analysis that *has* been pursued with reasonable consistency in the agency's repository-related activities to date would have

to do with economic/demographic impacts. In their case study of the Hanford site, however, Carter and Willard find that even the analyses of economic/demographic impacts were flawed by an artificial narrowing of scope or focus, such that a significant fraction of the communities that actually experienced a visible, easily quantified daily flow of Hanford Reservation workers were treated as not being affected. The issue of a narrowing of focus relates to the "reality" of the socioeconomic impacts that are created or exacerbated by problems of trust, and this issue will accordingly be raised again in that section, below.

Particularly given that the case studies noted in this section would scarcely seem to involve the kinds of information that would be featured with pride in agency newsletters, however, two additional points need to be made before turning to that section. One point is that, while past actions by various offices within DOE have sometimes fallen far short of what might be desired, DOE is clearly not the only agency or institution to have experienced such problems. Edelstein's analysis shows that even if we turn our attention to a private firm rather than a public agency, and to an organization that has long had a local focus to its operations rather than a national one, we have no assurance that even a "state of the art" facility will be able to operate in a manner that is acceptably safe. In Edelstein's analysis, intriguingly, even among the employees who *were* directly dependent on the continued economic health of an industry involved with the management of hazardous materials, the majority of those employees evidently decided they were more concerned with their families' physical health; they expressed strong opposition to the granting of permits for expanded waste management operations. Edelstein also focuses explicitly on the hypothesis that experience will cause citizens' trust of a hazardous facility to grow over time; at least in the case of his study community, he concludes that the hypothesis proved to be clearly incorrect.

Levine's study focuses on a case where agencies became involved in trying to deal with a hazardous waste problem they did *not* create. Her analysis, accordingly, provides useful insights into what might happen under a scenario that has received little attention to date—the possibility that DOE or some other agency might encounter risk-management problems in the future but that, in the interest of restoring public trust, yet another agency would be brought in to make things right. As further evidence that problems with public trust could scarcely be blamed on the current officials of DOE alone, her findings show that, at least in the absence of more explicit attention to problems of community relationships, even a change of responsible agencies is unlikely to provide anything like a guarantee of improved public trust.

The final point in this section is that, while a number of the citizens who have had to live through contamination incidents are understandably angry toward the organizations they see as being responsible, the actions of the organizations are deserving of a degree of understanding, as well. Part of the problem may be that technical organizations are sometimes told to perform tasks that are simply impos-

sible. While the forces operating on them do little to mitigate the impacts sometimes suffered by affected communities, an awareness of these pressures can at least help to make a broader pattern of problems somewhat easier to understand.

As compellingly indicated by Shrader-Frechette's analysis (1990), there may be no such thing as a fail-safe system for dealing with some of the most powerful and, potentially, some of the most harmful substances that have yet been created as unfortunate by-products of human ingenuity. An agency that is *told* to produce a facility that is completely or even just "acceptably" safe may in fact have been assigned an impossible task; the best that can be hoped for in many such cases is to build a state-of-the-art facility. As noted quite clearly in Edelstein's analysis, however, even a state-of-the-art facility may be incapable of providing true safety.

When a loyal agency employee is told that the agency *must* produce a leak-proof landfill—in a set of instructions that may have more than a little relevance for an agency that is being required to design a facility that will keep high-level radioactive wastes isolated from the human environment for the next 10,000 years, a period roughly twice as long as the recorded history of civilization to date—an impossible assignment may leave a loyal agency employee with only two options. One is to refuse to obey a direct order, whether from Congress or from one's superiors; the other is to do the best job possible under the circumstances, to "certify" that job as meeting all applicable criteria, and to hope that good luck will carry the day—for many days, or even many centuries, into the future.

That is more or less what a growing number of *physical* scientists have begun to urge for the repository program, albeit with emphasis on the learning instead of the luck (National Research Council, 1990). Such a change of approach would be in line with the realities with which these physical scientists are acquainted. The problem, unfortunately, is that such an approach would be hopelessly inconsistent with what *social* scientists know, particularly about the realities of agency attention to expensive, complex problems, in remote locations, over long periods of time—the kinds of cases in which, at least in the past, the common pattern has had far less in common with traditional notions of learning than with problems that are treated as being out of sight, and hence out of mind.

The "Reality" of Socioeconomic Impacts.

As will be recalled, the final response to some past concerns about socioeconomic impacts has been to doubt that the impacts are "real." While many such expressions of doubt appear merely to reflect a lack of awareness of the relevant data—although the lack of awareness is in some cases so striking as to suggest the possibility of a deliberate decision to avoid the relevant information, as noted in the Hardert case study—there is at least one potentially legitimate reason for doubt. Case studies of technological contamination have increasingly come to point to the

kinds of conclusions represented in the Couch and Kroll-Smith report, and to a lesser extent by the Levine and Edelstein reports as well, but these findings appear to be at odds with the literature on "natural disasters."

At the risk of some oversimplification, at least the long-term socioeconomic impacts of most natural disasters have often been characterized as being relatively modest (see especially Mileti et al., 1975; Sterling et al., 1977; Quarantelli, 1985; but see also Melick, 1985). Are technological disasters actually that much more disruptive to human beings—particularly given that many such instances of technological contamination are far less dramatic than the hurricanes and earthquakes that have often been studied in the past? While at least one long-time disaster researcher has expressed his doubts (Quarantelli, 1989), in fact there is substantial and growing evidence that contamination incidents, while far less dramatic than natural disasters, may also be far more severe in the socioeconomic impacts they create. Particularly in conjunction with the material already available in the open, peer-reviewed literature, the case studies help to provide a basis for beginning to understand why incidents of technological contamination seem so consistently to create the very kinds of long-range, intense, negative socioeconomic impacts that tend to be largely absent from follow-up studies of natural disasters. (This discussion will draw heavily on a recent article in *Social Forces* [Freudenburg and Jones, 1991]); see also Erikson, 1990).

In a growing body of empirical research, technological disasters have been associated with an increasingly broad range of negative (and strikingly long-lived) social and psychological impacts. Some of the evidence comes from the Three Mile Island accident. In perhaps the most serious finding, Houts et al. (1988:47) encountered evidence of "a 10% increase in reports of intense distress [i.e., symptoms that are characteristic of mental patients] among persons living close to the facility," along with increased clinical episodes of anxiety and depression among mothers of young children. Other evidence has indicated that distress levels among the general population were significantly less severe than normally expected for the clinically mentally ill, but in this study, the clinical episodes subsided only gradually over the next year.

Bromet and her colleagues focused on mothers of preschool children, finding evidence of considerable stress among this group (e.g., Bromet, 1980; Bromet and Dunn, 1981); the high levels of distress found in the study panel 12 months after the accident did not decline significantly in follow-up interviews 32 and even 42 months after the accident. Notably, Dew et al. (1987) found the levels of stress some six years later—in the fall of 1985, during the very restart that was permitted by the Supreme Court decision—were even higher than in the immediate post-accident period.

Baum and his colleagues compared subjects living within five miles of Three Mile Island to several samples of control subjects who lived away from the plant, focusing on the period 15-17 months after the accident (before, during and after the venting of krypton gas from the damaged reactor). Their measures found subjects

living near TMI to exhibit greater stress on physical and behavioral as well as psychological measures than did control subjects, at four different data collection points (e.g., Baum, Fleming and Davidson, 1983; Baum, Fleming and Singer, 1983; Collins et al., 1983). Another follow-up study 58 months after the accident (Davidson and Baum, 1986) still found greater stress in a sample of 52 persons living near TMI than in a control group from Maryland; the findings in this study included physiological measures such as elevated catecholamine levels, which presumably would be even more readily distinguished from the negative attitudes that worried the Supreme Court than would the kinds of self-report measures that are the primary focus of this report.

More broadly, studies conducted under the auspices of the President's Commission on TMI found elevated levels of stress symptoms in the general population, as noted above (Dohrenwend et al., 1981), and Goldsteen and Schorr (1982) found even higher levels of symptomatology among their respondents than did the Presidential Commission study. The overall conclusion about TMI-related research from Houts et al. (1988:64) was that "there was intense stress during the crisis, dropping to low intensity distress after the crisis and continuing to slowly drop so that persistent low level stress was evident in the general population surveys for nine months after the accident and in certain subpopulations, which were most distressed at the time of the crisis, for several years after the accident."

Studies of other technological breakdowns have also found evidence of disruption. For example, Gill (1986) (see also Picou and Gill, 1989) studied a community where a train carrying hazardous chemicals derailed, followed by leaks, fires, and explosions. While a major portion of the population was officially evacuated for 14 days, and the excavation and restoration took over a year and a half to complete, "there were no deaths or serious injuries and the amount of physical destruction to private property was relatively minimal" (Picou and Gill, 1989:7). Even so, the study found elevated levels of stress on standardized psychological measurements. In another example, the 1972 flood at Buffalo Creek, West Virginia, was found by both qualitative (Erikson, 1986) and quantitative (Gleser et al., 1981) research to lead to social and psychological disruptions that remained significant literally for years. In the apt title of the study of yet another mining-related breakdown—a mine fire in Centralia, Pennsylvania, that contaminated a portion of the town's air and soil and led to community relocation—"the real disaster is above ground" (Kroll-Smith and Garula, 1985; Kroll-Smith and Couch, 1990).

Some of the most intriguing and instructive findings have come from studies of persons experiencing both natural and technological disasters, particularly from two sets of studies from Missouri, where the early 1980s brought both a series of floods and an infamous incident of dioxin contamination. Smith et al. (1986) compared symptoms among persons who had experienced both floods and dioxin contamination at Times Beach, Missouri, with those exposed only to dioxin and those exposed only to floods in other areas, finding more symptoms among the dioxin victims than

the flood victims: "One year after the disasters, only a third of the victims reported that they had fully recovered from the disaster experience. Flood-only victims were twice as likely to report full recovery than were those exposed to dioxin with or without accompanying flooding" (Smith et al., 1986:60). Similarly, Goodman and Vaughan (1986) found that persons who were victims both of the dioxin contamination and of floods suffered the greatest effects, but that the victims of dioxin contamination alone suffered greater effects than victims of flooding; "disaster type was found to be more predictive of variation than age on measures of reported loss, economic damage, and perceived recovery" (Goodman and Vaughan, 1986:i). Similarly, a study of Three Mile Island residents who had also experienced major floods in 1972 and 1973 "reported more long-term social and psychological impacts from the nuclear accident than from the floods" (Schorr et al., 1982, as reported in Kroll-Smith et al., forthcoming).

While it still may be too soon to conclude definitively that technological disasters lead to significantly elevated levels of psychosocial disruption, evidence to that effect has accumulated to the point that the possibility can no longer be ignored. Perhaps equally importantly, plausible causal explanations have begun to identify reasons for expecting just such a difference. While this is not the place for an exhaustive discussion, it appears that the many differences can be condensed into three sets of problems—the *ambiguity of biophysical damage*, the likelihood of a *corrosive, rather than therapeutic, "post-disaster" phase*, and the overall tendencies toward *sociocultural disruption* (for further discussions, see Kroll-Smith et al., forthcoming; Kroll-Smith and Couch, 1989; Couch and Kroll-Smith, 1985; Freudenburg, 1990; Freudenburg and Gramling, in press; see also Kasperson and Pijawka, 1985; Tierney, 1985).

Ambiguity of harm. To be sure, there can be significant variations across various types of "natural disasters," from floods to fires and from earthquakes to hurricanes, and there can be significant variations as well in factors such as the scale, suddenness, or degree of selectivity of impacts. Similarly, technological accidents can vary tremendously—ranging from the sudden and spectacular (e.g., the 1972 flood at Buffalo Creek, West Virginia) to the slow and insidious (the gradual leaching of toxic chemicals at Love Canal). As a general rule, however, one of the defining characteristics of what we have generally termed "natural disasters" is the presence of obvious and unambiguous destruction. By contrast, while Bhopal showed that it is possible for a technological disaster to lead immediately to a large number of deaths, an increasingly common pattern seems to be for victims (and the broader society) to learn of the *possibility* for an *indeterminate* number of deaths (or cases of contamination, genetic damage, etc.) *over the much longer term*.

In short, perhaps the most obvious characteristic of natural disasters—physical destruction—tends to be present only in an ambiguous manner in technological disasters. "Toxic chemicals leaching through underground swales or asbestos fibers floating through the air, for example, do not level buildings. . . . Chemical or gaseous

contamination of essential natural resources is often largely invisible" (Kroll-Smith and Couch, 1989:3). Yet this very absence of unambiguous destruction can actually be part of the problem insofar as social and psychological impacts are concerned: "Since its presence or absence is rarely available for sensory confirmation, biospheric contamination is likely to create severe doubts and raise such momentous questions as: 'How much toxicity is present?' 'Is my body absorbing any of the poison?' 'Is the absorbed dose dangerous?'" (Kroll-Smith and Couch, 1989:3; see also Vyner, 1988; Levine, 1982).

At the same time as uncertainty is becoming pervasive, moreover, technological disasters can intensify residents' need "to act on that world with imperfect knowledge." Victims need to decide just what kinds of problems they are facing, what its sources are, and whether or not they should take drastic action such as evacuation to respond (see the case study by Kroll-Smith and Couch for further discussion on this point).

The development of "corrosive communities." The essential ambiguity of much of the short-term information about technological disasters, however, tends to be coupled with social reactions that both sharpen and amplify the psychosocial impacts during the period we have traditionally called the "post-disaster phase." It is perhaps here that the comparison with natural disasters can be the most instructive: While disasters such as tornadoes or hurricanes can lead to significant loss of life and to sometimes-massive physical destruction and disruption of economic infrastructure, the disruption often ends there; the aftermath tends to be reassuring and restorative. Quarantelli and Dynes (1976) suggest that natural disasters tend to be consensus-type crises, where survivors work cooperatively in altruistic (and potentially even therapeutic) clean-up and rehabilitation activities (Drabek and Key, 1984; Drabek, 1986). The field of disaster studies has long drawn attention to the emergence of a so-called "therapeutic community" that emerges after disasters (e.g., Fritz, 1961; Barton, 1970); more recently, Quarantelli (1985) even developed the metaphor of a "social sponge" to denote the resiliency and reserve capacities of most communities for coping with disasters. Such descriptions are strikingly absent from descriptions of technological disasters.

Instead, some of the most disruptive consequences of technological disasters tend to emerge not during the ambiguous period of the "disaster" itself, but during what we have traditionally seen as the "aftermath" period—although accumulating experience suggests that the "after" terminology may not be fully appropriate (Erikson, 1976, 1990). The more common experience seems to involve instead the emergence of a corrosive context.

Rather than working cooperatively to deal with problems that were "nobody's fault" and resulted from natural processes, the victims (and potential victims) can become participants in a disruptive struggle over affixing blame—potentially finding that they are the victims of blame themselves. Rather than finding that authorities

act in a way that is generally helpful and appropriate, the victims often report that they find authorities to be evasive and nonresponsive, often more concerned with protecting bureaucratic prerogatives than with providing genuine assistance to victims. Rather than gaining a heartwarming appreciation for the helpfulness of the help from their fellow human beings, the victims find they become suspicious and cynical toward those who appear to be responsible for the accident but to be unwilling to accept responsibility for it. All of these problems, moreover, tend to take place under the omnipresent shadow of the potential for litigation, which can further promote the tendency for all parties to act in individualistically self-centered or even openly adversarial ways.

Sociocultural disruption. While the evidence that has accumulated to date is only suggestive, what it suggests is that technological disasters create physical ambiguities and social animosities in a way that may be particularly effective in creating sociocultural stress, perhaps in part because the consequences also threaten accepted social patterns and accepted social meanings. In terms of social patterns, while victims of technological disasters often form social groups offering high degrees of cohesion and social support, these groups often emerge as a result of the nonresponsiveness or even hostility of "established" leaders (Levine, 1982; Edelstein, 1988; Freudenberg, 1984). The differences between such victim organizations and other groups often leads to significant polarization within the community, often along lines of the social negotiation of meanings. When victims are unable to obtain concrete answers, "the apparent discrepancy between the novel demands of biophysical contamination and the inherent limitations of stable, predictable community organizations frequently results in makeshift groups emerging.... Because seldom does a single interpretation of the hazard monopolize the public's imagination, the emerging groups often compete with one another over such essential issues as the scope and degree of danger" (Kroll-Smith and Couch, 1989:3; see also Clarke, 1990; Kasperson and Pijawka, 1985; Fowlkes and Miller, 1987; Kreps, 1980; Levine, 1982; Cuthbertson and Nigg, 1987). As Molotch noted two decades ago, the polarization may not be without factual foundation: during the 1969 oil spill at Santa Barbara, for example, what "leaked out" was not just oil, but "a bit of truth about power. . . [and about] realities of social structure. . . not otherwise available to the outside observer" (Molotch, 1970:131). In light of the literature on stressful life events, however, the stressfulness of the emerging contentiousness may result in part from the fact that the legitimacy of existing institutional leadership can no longer simply be taken for granted (cf. Erikson, 1976; see also Kroll-Smith and Couch, 1989; Kreps, 1980; Freudenburg and Gramling, 1990). It may be that technological controversies are particularly stressful when they involve "recreancy," or evidence that the persons entrusted with the operation of systems may have failed to carry out their responsibilities with the necessary vigor (Freudenburg, 1990, 1991a, 1991b). In short, in cases where a major technological accident does occur—and unfortunately, the question seems to be one of when and where, rather than of whether—disruptions may be created not just by the accidents themselves, and not just by the experience of risk or threat, but also by

subsequent actions that threaten the very system of agreed-upon meanings that allow a complex social system to function.

Other Implications. Research on technological disasters also offers suggestive implications for what might be expected even in the absence of dramatic accidents. While there is a large and consistent body of literature showing that technological risks tend to be seen by the public as more serious than natural ones (for summaries, see Fischhoff et al., 1981; Freudenburg, 1988, 1990; Slovic, 1987), the foregoing discussion should make it clear that technological disasters may indeed be different from natural ones in terms of their impacts on society. Natural disasters can create great *physical* destruction, but their main effects on social systems may be to draw people together. Technological disasters may create virtually no visible destruction, while their main effect on social systems may be to drive people apart—disrupting the established order, and creating stresses both within individuals and between them.

One obvious implication is that the actual occurrence of "disastrous accidents," however they may be defined, may not be a necessary precondition for the creation of social and psychological stress; indeed, under some circumstances, ambiguous probabilities of (physical) harm may involve the most deleterious psychosocial consequences. In the case of Times Beach, for example, there was greater evidence of dissensus in residents of a neighborhood contaminated by lower levels of dioxin than in one where contamination levels were roughly seven times as high, a finding apparently resulting from the fact that the highly contaminated community was "officially certified" as contaminated, while the less highly contaminated community was left in a kind of limbo between the official definition of the situation and the definitions that emerged from other sources, including not just the residents' beliefs and fears, but also a certain level of scientific evidence (Goodman and Vaughan, 1986:15; see also Levine, 1982). Similarly, in an analysis of farmers whose cattle became contaminated with polybrominated biphenyls from a flame retardant that had been mixed into cattle feed (through careless practices both by the chemical company and by the manufacturer of the feed mixture), later analyses found some of the most significant stresses and problems, including physical health problems, among farmers whose herds were officially "safe"—that is, below the contamination levels identified as problematic by official state agencies (Selikoff, 1977, as summarized in Reich, 1983; see also Anderson et al., 1978).

More broadly, a range of studies of non-occupational exposure to hazardous substances has shown "elevated levels of psychological distress, both global and specific, among individuals subsequent to toxic exposure. Specific reactions found include higher than expected levels of demoralization, depression and anxiety. The primary concern ... is physical health ... [but] exposed individuals also report feelings of loss of control, helplessness, and powerlessness" (Lebovitz et al., 1986:XII; see also Levine, 1982; Edelstein, 1988; Fleming and Baum, 1985). Similarly, in other cases

involving the *potential* for contamination—a condition having more than a little comparability to the situations of ambiguity noted above—studies have found evidence of heightened distress. The most obvious case concerns TMI itself: During the time when the citizen case was still working its way through the courts, a group of respected stress researchers examined the available evidence and concluded that, while they found clear evidence that the 1979 accident did lead to increased psychological distress, they were unable to say whether restarting the undamaged reactor, the focal question in the PANE case, would be associated with increased stress (Walker et al., 1982). At the time, most experts on the social impacts of disasters would have concurred. In fact, however, it appears that restarting the undamaged reactor was indeed associated with increased distress (Dew et al., 1987).

In short, under the condition of existence proof—anything that exists is possible—at least the *potential* for the risk of an accident to be associated with heightened psychological distress has been demonstrated. The findings in this area are sufficiently new that it would be premature to draw definitive causal conclusions at this time—yet it is no longer tenable to ignore the ways in which the potential for an accident could be causally related to increased psychological stress. In short, while it once might have been argued that no research was warranted, but it is now clear that research is not only warranted, but promising and even necessary. In conjunction with other recent case studies of incidents such as the contamination episode at Goiânia (Petterson, 1988; Simmons, 1987), the case studies that follow represent a promising step in just that direction.

**SCOPE, STAKEHOLDER GROUPS AND IMPACT ISSUES
RAISED BY THE PROPOSED HANFORD, WASHINGTON
HIGH-LEVEL NUCLEAR WASTE REPOSITORY SITE**

BY

LEWIS F. CARTER AND WILLIAM WILLARD

SCOPE, STAKEHOLDER GROUPS, AND IMPACT ISSUES
RAISED BY THE PROPOSED
HANFORD WASHINGTON HIGH-LEVEL-NUCLEAR-WASTE-REPOSITORY SITE
(WITH POSSIBLE PARALLELS TO THE YUCCA MOUNTAIN NEVADA SITE)

Lewis F. Carter and William Willard
Washington State University

Executive Summary

The paper identifies the diverse publics concerned with development of the Hanford Nuclear Reservation as a potential site for a High Level Nuclear Waste Repository and explores reasons for inclusion or exclusion of certain publics and inclusion or omission of issues important to each of these groups. Special attention is given to delimiting: (1) the diverse "publics," (2) the issues of interest to these publics, (3) the reasons why some publics and issues received attention early in the selection process, while others did not, and (4) some of the longer-term consequences that followed from these exclusionary choices.

The study suggests that artificial narrowing of scope conditions is not a site specific phenomenon. Rather, some special characteristics of the nuclear industry as its representatives interact with diverse publics, and as these publics form perceptions of the industry, seem to raise recurrent issues. To the extent permitted by observations, the report identifies lessons from the Hanford experience that appear to have relevance for anticipating and managing the impacts that might be associated with development and operation of a repository for high-level nuclear wastes at the Yucca Mountain site in Nevada.

Though the Hanford and Yucca Mountain sites differ notably in terms of geology and geo-hydrology, the sites are similar in terms of proximity of population centers, transportation corridors through adjacent states, down-wind farming and ranching interests, down-stream irrigation interests, concerns about possible tourist impacts, possible disputes concerning Indian historical and treaty rights, and the sometimes adversarial relationships between the U.S. Department of Energy and interested stakeholders in the states and regions who feel that their welfare and interests have not received sufficient consideration.

We conclude from our experience that more inclusive definitions of impacted areas, impact variables, and affected publics, while more cumbersome in the short run, pose fewer risks of awkward oversights. Field verification of suspected impact areas and groups becomes especially important in contexts where an adversarial model of multiple parallel studies, responsive to different interested "publics," is employed.

SCOPE, STAKEHOLDER GROUPS, AND IMPACT ISSUES
RAISED BY THE PROPOSED
HANFORD WASHINGTON HIGH-LEVEL-NUCLEAR-WASTE-REPOSITORY SITE
(WITH POSSIBLE PARALLELS TO THE YUCCA MOUNTAIN NEVADA SITE)

Lewis F. Carter and William Willard
Washington State University

This report addresses issues raised by pre-mature limitation of scope, closure of stakeholder groups to be considered and restriction of impacts to be assessed in preliminary evaluations of physical, economic and socio-cultural impacts associated with the proposed siting of a high-level-nuclear-waste-repository at the Hanford, Washington site. Though some of our findings are attributable to the unique history of the Hanford complex and to special features of the surrounding communities, other observations are likely to apply more generally to communities where hazardous or nuclear materials are to be placed. Though the Hanford and Yucca Mountain sites differ notably in terms of geology and geo-hydrology, the sites are similar in terms of proximity of population centers, transportation corridors through adjacent states, down-wind farming and ranching interests, downstream irrigation interests, concerns about possible tourist impacts, possible disputes concerning Indian historical and treaty rights, and the sometimes adversarial relationships between the U.S. Department of Energy and interested stakeholders in the state and region who feel that their welfare and interests receive insufficient consideration. The Washington and Nevada sites are notably different in terms of the (Northwestern) anadromous fish issue, the prior (Northwestern) history of injection of wastes into underground aquifers, the scope and variety of previous nuclear projects, and the extent to which a supportive "nuclear culture" may be found in the immediate vicinity of the proposed development.

Our report examines the relationships between activities of firms and agencies managing, operating and overseeing the Hanford Reservation with outside communities and interest groups. Our initial fieldwork was performed in the context of a preliminary assessment in 1987 of the possible impacts of the then proposed siting of the federal HLNWR at Hanford. Consequently, some of the issues raised and impacts addressed are attributable to the social and political contexts within which that inquiry was embedded. Most noteworthy of these conditions were:

- o Tensions in the Northwest between the supportive "nuclear culture" of the Tri-Cities area in Washington (Richland, Pasco, Kennewick, the economies of which have depended on Hanford for forty years) and the "environmentalist culture" prevalent in a sizable portion of the surrounding region.

- o "Down-wind" concerns stimulated by previous emissions from the reservation and made more immediate and visible to a broader range of regional residents by experience with the patterning of Mount St. Helens ashfall.
- o Strongly pursued Indian issues (Yakima, Nez Perce, Umatilla) including land acquisition disputes and then recent evidence that "lifestyle" differences (prevalence of fish and game in diet and more time outdoors) might have led to differential historical exposures to radiation.
- o Transportation corridor concerns raised by adjacent states
- o Initial exclusions of interest groups under federally legislated guidelines (Indian nations, neighboring states).
- o Widespread regional mistrust of Hanford related agencies and firms exacerbated by the 1986 (onward) de-classification of evidence concerning the extent (in some cases intentionality) of contamination of regional ground, water and air. The break from the forty year national security related secrecy surrounding these excursions undermined some of the remaining residual trust in a number of groups.

Contextual tensions surfaced in the determination and modifications of scope conditions (Indians were added through federal legislative action; cities of Spokane and Vancouver, Washington and the states of Oregon and Idaho were drafting litigation to this end when the site was disqualified). The tensions between sections of the state also appeared in selection of study contractors and subsequent research team composition, as well as political and other pressures brought to bear on individual researchers during field investigations. While the most activist partisans (Hanford Family supporting the repository and several activist groups opposing) made public appeals for "objectivity" in investigations, there were some attempts to limit access to groups and information and to discredit information supplied by other groups. The extent to which similar factors may be present in Nevada is not known to us. Our approach to this problem was to be as inclusive as possible and our report addresses:

- o the diverse publics affected by developments at Hanford
- o the issues of interest of those publics
- o the reasons why some issues received ready attention in the policy process, while others did not
- o the longer-term consequences that followed from such choices

The report draws primarily on nuclear siting experience in Washington State, though some similarities could be drawn from our more limited experience with the more truncated siting controversy in Mississippi; our experience suggests serious long

term risks (of opposition, litigation, etc.) may attend any narrowing of scope conditions, though the extent to which this is the case may depend in part on broader factors, including the history of interactions between firms/agencies and diverse publics. Observations identify lessons from the Hanford experience that appear to have direct relevance for anticipating and managing the impacts that might be associated with the development and/or operation of a potential repository for high-level nuclear wastes at the Yucca Mountain site in Nevada.

Social Impact Assessments cannot be appreciated without explicit recognition that great potential for conflicting interests exists between those seeking to implement a development project (or management plan) and at least some of the various populations (or "stakeholders" or "publics") whose futures may be affected by that implementation. These discrepancies among the interests (gains and losses) of different publics are reflected in the work of the specialists which they employ to discover and document what are termed the "impacts" of a development. As clients, these publics are understandably concerned that "their specialists" give attention and voice to their special concerns, which may include economic, cultural, health, and life-style issues. Indeed, political acknowledgement of a need for systematic evaluation of consequences of developments for surrounding "publics" formed the basis for the National Environmental Policy Act (NEPA, 1969).

While the notion can be defended that Social Impact Assessment does not really differ from more traditional social science in the general goal of "... (understanding) the causes, conditions and consequences of social life..." (Wolf, 1983, p. 16), some unusual research dilemmas are raised by narrowing of the focus to the consequences of a specific development, the necessity for integration of multi-disciplinary expertise and attending to the interests of multiple publics with varying stakes in existing social-economic arrangements. Part of the problem stems from an underlying "specialist-generalist" tension: proper assessment of specific projects will require awareness of many narrow technical issues (involving physical, biological, social, cultural and legal systems) while maintaining awareness (and openness) to complex (and partly obscured) existing social systems. The proposed siting of the High-Level-Nuclear-Waste-Repository (HLNWR or "repository"), at the Hanford reservation illustrated this general problem in that the impact assessment required some awareness of what was to be built (engineering and manpower parameters), special risks (biological, radiological, hydrological, psychological), mitigation and compensation possibilities (economic, political and legal issues), while developing a broad "social mapping" of potential impacts on existing social groups. Figure 1 illustrates the diversity of relevant "publics."

FIGURE 1: DECOMPOSITION OF POTENTIALLY IMPACTED "PUBLICS"

- A. Hanford Reservation Employers and Workers**
  - 1. Federal Agencies (DOD, DOE, EPA)
  - 2. Corporations (Rockwell, Battelle, Westinghouse)
  - 3. Technical Specialists
  - 4. Labor Groups (differentiation by major crafts)
- B. Economic Diversification Interests**
  - 1. Technician and Technology Transfer Developments
  - 2. Regional Industrial and Manufacturing Alternatives
  - 3. Tourism, Convention and Retirement Developments
  - 4. Regional Trade Developments
  - 5. Service and Support Workers
- C. Agricultural Interests (Product Stigma Issues)**
  - 1. Orchards, Vineyards and Wineries
  - 3. Farmers Depending on Irrigation (largely "row crops")
  - 4. "Dry Land" Farmers (largely wheat, barley)
  - 5. Livestock Producers (cattle and, less extensively, sheep)
  - 6. Agricultural Labor (migrant and settled)
- D. Fisheries Interests**
  - 1. Anadromous (migratory) Fish Stocks
    - a. Ocean Fishers Dependent on Stocks
    - b. River Fishers
  - 2. Sport and Tourist Fishing
- E. Electrical Power Generation**
  - 1. Hydropower
  - 2. Thermal Plants (nuclear and other)
- F. Regional and Local Government Organizations**
  - 1. Major Area Towns
    - a. (USDOE designated) Pasco, Kennewick, Richland
    - b. (other) Yakima, Walla Walla
  - 2. Small Communities
    - a. (USDOE designated) Benton City, West Richland
    - b. (other) Yakima River Valley towns from Prosser to Selah
  - 3. Adjacent Counties
    - a. (USDOE designated) Benton and Franklin
    - b. (other) Yakima and Grant
  - 4. Indian Reservations (Standard impacts, spiritual ties, sites)
    - 1. Yakima
    - 2. Nez Perce
    - 3. Umatilla
- G. Black Population**
- H. Hispanic Population**
  - 1. Migrant
  - 2. Settled
- J. "Downstreamers"** (Irrigation and drinking water issues in Washington and Oregon with fishery issues in Washington, Oregon and Idaho)
- K. "Downwinders"** (Product stigma concerns in Washington with health concerns in Washington, Oregon, Idaho and Montana)
- L. "Transport Corridors"** (River, rail and highway route concerns in Washington, Oregon, Idaho and Montana)

The "Multiple Publics" Problem

One of the central (and yet imperfectly developed) tasks of social impact assessment is to develop a common evaluational framework for dealing with the concerns and interests of such diverse publics. The earliest SIA's have been characterized as "pro-forma" listings of issues which often merely summarized exchanges between "...ideological developers and environmentalists ... with no common grounds for analysis ... (who traded) largely irrational attacks and defenses..." (Flynn, 1985, p. 2) While this form of assessment left regulatory agencies relatively free to respond in terms of their own internal agendas or biases, Gold (1985, p. 141-158) has documented that ignoring the concerns of multiple publics can entrench animosities and sow seeds of future problems which may prove surprisingly costly in terms of future conflicts ("...project delays and cancellations, losses in worker productivity, community resistance...", Gold, p. 141). Gold's message is that an impact assessment which is narrowly targeted only toward the immediate goal of acquiring a permit (or project approval) may sweep aside interests of diverse publics, but the interests remain and will subsequently plague the project in political, social and economic arenas. He illustrates that more lasting (and cost-effective) accommodation can be achieved by genuine attempts to account for, and accommodate to, diverse interests. His appeal to long-term cost-effectiveness leads Gold to term such an approach one of "enlightened" self interest (for the firm or agency).

While unique features of projects and of host communities (regions) make generalization difficult, three general approaches appear to be emerging for dealing with the problem of multiple publics:

- o "standardized" impact assessment models (e.g. Planning and Assessment System, Group Ecology Method)
- o "enlightened" (sensitive and comprehensive) assessment with genuine and general community involvement (Gold's proposal)
- o "adversarial" impact assessment with two or more "parallel" studies conducted by different teams with oversight by (and fiscal responsibility to) different "publics",

While there is currently no generally applicable and agreed upon "standard" model of social impact assessment, several of the competing systems are comprehensive enough to present a beginning (minimal) checklist which should be supplemented by "special impact" and "special publics" in any specific assessment project. For instance, the Hanford HLWNR project required consideration of "special groups," not identified in general models ("downwinders," "downstreamers," residents of transportation corridors concerned about risks unique to this project, Indian groups concerned about special exposures because of dietary and lifestyle differences.)

Gold's guidelines for an "enlightened" approach are extremely useful to the extent that firms or agencies can be motivated to employ them, though there is the obvious risk that such efforts

will not extend beyond consideration of the impact concerns of a "minimal winning coalition" (in a political sense) and, consequently, may still ignore legitimate but relatively powerless "publics." Indeed, a case can be made the groups most likely to be excluded from the original Hanford scope conditions were excluded because of a lack of (or the appearance of the lack of) effective political organization.

"Adversarial" models are similarly limited to the extent that different "publics" will usually have variable resources and sophistication. As in the legal system on which these are modeled, access to "advocates" for one's interest depends to some extent on knowledge and resources. In general, project developers (firms or agencies) will have more resources for commissioning and overseeing research than will host communities or regions. In some cases, like the HLNWR studies, the political process (Nuclear Waste Policy Act of 1982, section 116 (c)) legitimizes and provides for funding of "parallel" studies responsible to "host publics," a mechanism which calls to mind the institution of the "public defender" in the legal system.

"Adversarial Models"

Adversarial approaches to social impact assessment (and some emerging forms of evaluation research) typically take the form of one or more "competing" research projects, each ostensibly seeking to develop a comprehensive understanding of project impacts. The resulting relationships between researchers and publics take on some of the adversarial features of client-advocate which are more characteristic of the legal profession than of detached (and more traditional) scholarly research. An additional complication less characteristic of the legal system, where the "client" is often a person or firm, is found in the adversarial model of social impact assessment where the "client-publics" of a single team may be quite diverse (e.g. the activist proponents and opponents noted in Figure 1).

Researchers in such settings must attend to all of the usual evidentiary standards of their various disciplines, with the added caution that conventional "scientific criteria" imposed by routine peer review processes may be augmented by the greater than usual chance that one's findings will be subject to "hostile scrutiny" by publics with varying interests and that one may be called to defend those findings in legislative hearings or in courts of law. All actors in the attending political processes, whether opposing or proposing a development (or simply potentially affected bystanders), will call for "objective" assessment, though views will differ as to what constitutes such an ideal.

It should be obvious that such research contexts will not generally lead to a single set of "findings" which all parties agree upon. Rather, each research program will (quite properly) develop somewhat variant definitions of scope conditions (impact areas, impact populations, impact variables) as well as possibly

quite divergent valuations of those impacts and the appropriate mitigation/compensation measures. While none of the "sides" in such research can ignore some common evidentiary rules (the "science" of the activity) because of the scrutiny from other "publics" (and their advocates), each research team will (again quite properly) take care to include and emphasize the concerns and interests of their "client-publics." Final political and legal dispositions of impact (and possibly mitigation or compensation) claims will be "negotiated" (in agencies, legislatures and courts) rather than "discovered" (in some external, "objective" reality).

While we have too little experience with the adversarial models to justify sweeping generalizations, certain common threads have developed which allow researchers to anticipate some of the differences which will develop between the studies responsible to by different "publics." In general, project developers (and proponents) will tend to minimize external impacts while "host publics" (and opponents) will tend to identify broader impact (areas, publics, variables) and to value these more dearly. Gold (p. 139) discusses this tendency toward minimization of impacts by proponents in terms of Schnaiberg's (1980, p. 139) "theory of the firm" which seeks efficiency by "externalizing" costs (to others) and "internalizing" benefits (to itself). His observation may apply equally well to bureaus and agencies as well as to assorted "host publics." In the adversarial model, each research team is assuring that the "agenda" for political decision making includes the concerns and interests of their clients, in so far as these can be documented and defended by scientifically acceptable standards.

In a sense, such research can be expected to develop a kind of "market spread" between "asking and selling" prices for mitigation-compensation negotiations in which all parties are aware of the valuations which others place on impacts. What may be less obvious is that early decisions (negotiations) in the research process will strongly condition subsequent outcomes. For example, there may be agreement about the mathematical suitability of a methodology (e.g. a cost-benefit system of equations), but early "scope" decisions (e.g. inclusion of four "impacted" counties rather than two) may seriously change the "output" from such equations. Similar arguments can readily be imagined for inclusion or exclusion of various publics and impact variables. Long term research activities by "advocate teams" will likely display elements of feedback, the "preliminary findings" of one team providing impetus for expansion of another team's scope (or additional effort to defend the restricted scope).

The Research Context

This study explored the early stages (or intimations) of such negotiation processes as displayed in the divergent views of "social impacts" developed by teams working for two "clients": the U.S. Department of Energy (USDOE) and the Washington State

Department of Ecology (WSDOE). Specific attention is given to the evolution of divergent views of "impact areas" to be studied (and consequently, impact populations or publics) as these developed in the scoping and reconnaissance stages of the research.

Observations reported here are based in part on work done while acting as a periodic consultant sub-contractor for Impact Assessment, Inc. of La Jolla, California. The large multidisciplinary Impact Assessment, Inc. team agreed to study social, economic and cultural impacts of the proposed High-Level-Nuclear-Waste-Repository (including some special transportation, risk, stigma and mitigation-compensation issues) for the Department of Ecology of the State of Washington. The preliminary assessment work was supported through Federal funds made available to the Washington State Department of Ecology by a grant from the U. S. Department of Energy under provisions of Public Law 97-425 (which required that USDOE fund impact studies to be conducted by potentially affected states and, subsequently, potentially affected Indian tribes). Analyses and interpretations presented here result from independent scholarly activity conducted by the authors and subsequent to termination of the research because of elimination of the Hanford site from further consideration by Congressional action (12/22/87). The views are solely those of the authors, as independent scholars, and are not to be construed as reflecting the views of Impact Assessment, Inc., nor of any agency of the Federal Government or the State of Washington.

An "adversarial model" is implicit in the fact that the various state studies (Nevada, Texas, here Washington, earlier Mississippi) and the Northwestern tribal studies (Nez Perce, Umatilla, Yakima) were independent of, and to some extent parallel to, planned USDOE impact assessments. These parallel studies were intended by Congress to accommodate the concerns of potentially impacted groups that USDOE assessments might be less inclusive than desired, as well as less attentive to local cultural conditions and issues than would studies overseen by the impacted populations themselves. Separate legislation subsequently authorized additional studies by Oregon and Idaho, to focus on transportation corridors and Columbia River issues.

In a very real sense, impact scope "negotiations" began earlier (before SIA research) when decisions were made concerning which states and tribes should have a voice in the research. The original Nuclear Waste Policy Act of 1982 acknowledged that states considered for a site would be given research funds; later negotiation resulted in designation of the three Indian tribes as "impacted"; neighboring states (Oregon and Idaho) resorted to litigation to achieve recognition of their "impacted" status.

Description of the Focal Project

As civilian nuclear wastes (primarily spent fuel rods) began to fill "on-site" storage facilities of commercial reactors by the late 1970's, plans began to develop ways for permanent isolation

of these materials from the biosphere. Some early proposals included containerized storage under the ocean, under polar ice caps and in decaying solar orbits, though various risk analyses soon led to abandonment of these proposals in favor of isolation in repositories deep underground (2000-4000 feet).

The long isolation periods required (10,000 to 100,000 years) and concerns about transportation risks (if all materials were transported to a single location) were reflected in the Nuclear Waste Policy Act of 1982 which directed USDOE to commence planning for two waste repositories, one in the Eastern part of the country and another in the West. (The two repository plan also reflected some realities of regional politics relevant to coalition formation for passing the act in Congress.) The stages in development of these repositories were to include: (USDOE, 1986b)

1. USDOE development of guidelines for site selection. These were completed in 1984 (later revised somewhat). The revised criteria called for technical assessments to include:
  - a. isolation features of the physical environment: geohydrology, geochemistry, dissolution, tectonics, "rock" characteristics, meteorology, climatic changes and erosion (though the long time frame precluded distinguishing sites in terms of the last two criteria),
  - b. human utilization features: natural resources, offsite installations/operations, environmental quality, site ownership/control, transportation and socioeconomic impacts.
2. Draft Environmental Impact Statements to include comparative evaluation of several storage substrates and with locations in at least five states. Relevant study on these began before the NWPA. Sites considered in salt domes were Mississippi and Louisiana sites identified in 1973; those in bedded salt deposits were Texas and Utah sites identified in 1976; the one in basalt lava flows was the Washington site identified in 1979; the only compressed volcanic ash site, called "tuff," was the Nevada site identified in 1978.
3. Based on comparative evaluation of sites, USDOE was to nominate five states and recommend at least three sites to the President for proposed detailed "site characterization" studies. The sites nominated in May, 1986 were a Texas site (Deaf Smith County), a Nevada site (Yucca Mountain) and a Washington site (Hanford Reservation). While some political leaders in each state expressed concern about the nomination process, Washington's representatives were especially concerned about the fact that Hanford's inclusion appears to have been largely attributable to site ownership, the stark environment, and socioeconomic impact judgments (given that the site was rated lower than others on most of the physical criteria). All nominated states raised concerns about abandonment of the search for a second (eastern) repository.

4. Site characterization studies were to commence at all three nominated sites and to cover all aspects of the selection criteria (including "test shafts" to verify physical features of the proposed storage strata). For both physical and social criteria, independent studies were to be conducted by USDOE and the affected states and tribes. The "redundancy" of parallel studies is explicitly justified in the Request For Proposals issued by the State of Washington (WSDOE, 1986) with references to "...concerns about credibility of past (U.S.) DOE activities at the Hanford Reservation (raised in public workshops)..." (p. 9) and "...a need for independent State review of USDOE accident assumptions (and other matters)..." (p. 14). Oregon and Idaho were unsuccessful in seeking "impacted" status under the NWPA legislation but commenced independent studies funded in through other legislation. Characterization studies were expected to continue for approximately five years and to meet criteria of "...scientific credibility and legal defensibility." (WSDOE, p. 11)
5. Site selection was to involve a recommendation to the President based on the (various) characterization studies. After presidential selection, the state containing the designated site could accept it or object. In the latter event, the state's objection could be over-ridden by action of both houses of Congress.
6. Repository construction was to take approximately 5-10 years (with some ambiguity about this because of proposals to begin filling parts of the underground site while concurrently extending it.) Parallel USDOE and "impacted group" monitoring studies were to continue through construction, operational and decommissioning stages.
7. Repository operation was to continue for approximately 20-40 years (with parallel monitoring of impacts by USDOE and impacted groups).
8. Active post-closure monitoring was to continue for approximately 100 years.
9. Distant future security considerations (100-10,000 years and 10,000-100,000 years) have been discussed in terms of backfilling the site, possible monitoring considerations and appropriate warning notices (given possible "language drift" and "political variability" over such extreme time periods). These speculations raise obvious questions which may be beyond current engineering technologies and fall clearly outside current social planning technologies. Two of the longest lived examples of human management systems, the Confucian Civil Service and the Roman Catholic Church do not even approximate such time spans in their continuity.

Competing Definitions of Impact Areas and Populations

Field reconnaissance in the Columbia River Basin revealed that Hanford projects are related in complex ways to surrounding communities, counties, states and socio-economic or cultural groupings. The complex of state, regional and federal projects on the reservation have something of a life of their own, involving repeated phases of boom-bust, several distinct employee populations and complex institutional structures, all of which is embedded in a broader host area of considerable diversity.

Existing industry, agriculture, cultural groups, and natural resources, as well as proposed new economic initiatives, interact with Hanford projects in ways which are not adequately reflected in generic (and highly aggregated) social impact assessments utilized by USDOE in defining project issues. These generic approaches miss the varied impacts associated with historical and developing alternative economic activities in the area, distributional impacts on several kinds of project employees and other resident groups, and the differential adaptive strategies for adjustments to boom-bust cycles developed by residents.

Adequate anticipation of changes in the Mid Columbia Basin under a variety of alternative developments at the Hanford reservation requires detailed disaggregated examination of impact areas for standard impacts, types of special impacts, and the several co-existing social and economic groups. In addition, the recurrent, almost cyclic, booms and busts of Hanford projects have some residual effects on surrounding communities which are atypical of the more commonly studied "one-shot" developments. Such studies are likely to misinterpret regional impacts unless they are grounded in knowledge of the historical development of the area and based on locally acquired knowledge grounded in direct field contact. These issues are explored below.

Impact Areas for Standard Impacts

USDOE has relied on standard descriptions of the primary impact areas as consisting of two counties (Benton and Franklin) and, within these, to the cities of Richland, Kennewick, Pasco, West Richland and Benton City (USDOE, 1986b, p. 4-38). While they may have been correct in basing their estimate of residential impacts for the "site characterization" stage on recent experience with employees of the Basalt Waste Isolation Project (BWIP), commuting patterns for the proposed "construction phase" workers should be based on more the residential experiences during the earlier Washington Public Power Supply System (WPPSS) construction phase, because the construction worker settlement pattern is quite different from that of the technical and managerial workers recently with BWIP. Further, the principle study of the WPPSS settlement pattern (Community Development Services, 1979) and subsequent studies relying heavily on these findings (Cluett, et. al., 1984) are incorrect, especially in their exclusion of Yakima county (specifically the string of "boom" phase bedroom

communities along the Yakima River from Grandview to Yakima itself).

The "shortcut" assessment approaches of the earlier studies have remained unchallenged in their limitation of the primary impact to Benton and Franklin counties. The exclusion of Yakima County (and to a lesser extent other adjacent counties with more minor direct impacts) simply does not square with existing official records, abandoned and vacant housing, overbuilt public facilities, local reports of boom stage crowding and shortages, or first hand observation of actual commuting paths (as well as direct observation of commuting workers, especially from the "North Gate" of the reservation).

The following observations garnered from a series of research projects of varying lengths of time suggest that any future studies of Hanford project impacts, especially for projects situated in the north end of the reservation or involving construction workers, should amend the study scope to include the string of small communities from Grandview (just west of Prosser) to Selah (just beyond Yakima):

1. While the Cluett (1984) study was cited as excluding examination of these communities on the basis of their supposedly lying well outside a somewhat standard "50 mile radius, 90 minute" commuting range, the map accompanying an early USDOE draft statement was flawed in two ways which improperly restricted the definition of the impact area.

First, the map showed a 50 mile diameter circle for impacts (thus excluding Yakima, Sunnyside and the string of small communities between these). Yakima was in fact 42 miles by road from the "North Gate" and approximately 45 miles from the BWIP test drill site. (see Figure 2 for the corrected 50 mile commuting radius and the original 50 mile diameter.) While the map was corrected in subsequent drafts, the analysis accompanying the original incorrect map was not modified.

Second, the map and appended analysis ignored the fact that the Hanford Reservation consists of several widely separated "work sites" with four major entry routes (one crossing the Columbia at Vernita Bridge, one branching to Yakima from the North Gate, one branching to Sunnyside from the north gate and one exiting at Richland). Those who work in the North (N-Reactor, BWIP proposed drilling site) end of the reservation tend to use one of the first three entries (primarily to Yakima County), while those working on the South end use the Richland exit.

In addition, while 50 miles may equal approximately 90 minutes by the south route, if one must use city streets of Tri-Cities, the northern routes follow rural highways which

FIGURE 2: USDOE FIGURE SHOWING COMMUTING CRITERION
(smaller circle appeared in early official drafts,
added here by authors for comparison purposes)

reduce actual commuting time to approximately 50 minutes to Yakima or Sunnyside and places all of the Yakima River communities within 90 minutes or less.

2. Public records, accessible in Prosser (Benton County Seat) and Yakima (Yakima County Seat) as well as other records in the small communities, record clear boom-bust cycles for several indicators which correspond to the WPPSS boom and bust. These records include RV park occupancy, mobile home permits, "short-platting" for subdivision, and house construction. It appears that the earlier studies did not search for these, possibly because of the "premature exclusion" of Yakima County and perhaps because the studies tended to study "from afar" rather than employing the ethnographic method. (See, Gold, pp. 160-161, for a general discussion of this problem.) Once the narrowed frame-of-reference was adopted, subsequent maps of the impacted area were so restricted by this view that "outside reviewers" might be unaware of the existence of the North Gate or the Yakima River communities. See Figure 3 for the most often cited official view of the impact area.

3. By making local contacts in these "excluded" areas we accessed households in the Yakima River communities, for which some members are employed in Hanford projects, and respondents from these who can list names of similarly employed acquaintances living in small towns from Selah (north of Yakima) to Desert Air (across the Vernita bridge) to Plymouth (on the Oregon border). See Figure 2. These respondents also report local housing crises during the earlier WPPSS construction boom ("no place for RV hookups," "mobile home sites filled and crowded together," "only three houses for sale" in a town of several thousand people).

4. Local informants also point to current housing conditions as displaying the effects of "bust" phases (WPPSS mothballing, N-Reactor closure). Personal observation confirmed numerous abandoned mobile home sites, whole subdivisions with for sale signs and a majority of vacant homes. The crash in housing prices was so extreme that asking prices were below equities (and in excess of "market value"). There were extensive foreclosures and repossessions.

5. A supervisor of county road crews reports "steady streams" of workers traveling daily from the Yakima River communities to the north gate, including organized carpooling in vans. He sensitized observation of scattered "park and ride" lots where some workers leave their vehicles while car-pooling.

6. Personal driving of the Yakima/Sunnyside routes demonstrated these communities to be within a 60 minute commute (at legal and safe speeds even in a snow storm in December). A stream of several hundred vehicles, many with multiple occupants, was personally observed leaving the North

FIGURE 3: CLUETT VERSION OF IMPACT AREA
(generally accepted in USDOE documents)

Gate at quitting time on December 17, 1987. Three-fourths of these proceeded along the road which branches to Yakima or Sunnyside. No sizable intermediate destination settlements exist along this road until after one enters Yakima County. (See Figure 2.) A smaller set of vehicles traveled north across the Vernita Bridge to settlements in the area of Desert Air (which also has abandoned dwellings and mobile home sites). (See Figure 2.) These observations were taken while the N-Reactor remained closed and therefore underestimate even current, much less boom construction-stage, commuting.

7. While the impacted Yakima County communities (with the exception of Yakima itself) are all small and politically easy to overlook in impact assessments, they are nearly contiguous and their aggregate population approximates (or slightly exceeds) that of Tri-Cities. Further, their land values and rental prices make them especially attractive residential settings for the more temporary construction phase workers (and the more "rural oriented" of operations workers.) In addition, first-hand experience showed that it was quicker to travel to many of these communities from much of the reservation than to travel to Pasco or Kennewick (listed as "impacted"). Further, it appears that "boom" effects in the smaller communities consist of a much larger percentage of residents (school children, etc.) than in the somewhat more diverse Kennewick or Pasco. When aggregated, it is likely that a careful assessment of the unemployment and other "bust" claims made on Yakima County might exceed those found in Pasco (Franklin County).

Field observations raised a presumptive case of significant residential boom impacts both along the Yakima River communities and in the small communities north of the Columbia River. Proper delimitation of impact counties for planning or mitigation goals would require going beyond arbitrary "time-distance" rules (even if these were consistently applied from different work sites). Some appreciation of this assessment problem is conveyed in the Cluett report by the additional use of a "license registration 'census'." However, the use of the license census was inadequate for two reasons.

First, counts must be made during "boom" phases, rather than a count of residual registrations remaining after the "bust" has already begun as was done in the Cluett report. Second, and more generally, the prevalence of organized carpooling, especially likely for those commuting relatively greater distances, means that those who commute further will be systematically undercounted by license censuses. A method is needed to "weight" each vehicle for the number of occupants.

An efficient estimate of worker residence (at any point in time) can be developed for the North Gate by positioning an observer in (or near) the guard station. Virtually all cars

leaving the reservation contain people who work there. These will be almost exclusively residents of Yakima County if they proceed straight west (Hwy 24 to Yakima area or Hwy 241 to Sunnyside area after the junction, itself located in Yakima County). (See Figure 2.) They will be largely residents of Grant County if they head north (Hwy 24 across the Vernita Bridge). Finally, those heading south (Hwy 240 to the Tri-Cities area) will be largely residents of Benton County. An observer positioned at the north gate and counting occupants of vehicles taking each of the three options could improve on current impact estimates.

However, even this strategy, along with the more precise "census of employees" by contractors, would be limited to current impacts and would not allow proper projection of anticipated "boom" impacts. If accessible, retrospective analysis of records of reported residences for employees of different types (construction, operation) from different work areas of the reservation (offices, N-Reactor, WPPSS) could form the basis for a better projection, though even these would require careful application. If such analyses are impractical, better assessment than currently available could be provided by "residual analysis," using perhaps "boom-bust stage" data from counties, towns, mobile home sites, moving companies, U-Haul dealers, and wholesale "jobbers" stocking stores in the various communities.

Simultaneous and Cumulative Impacts

Ongoing and potential Hanford projects differ from most developments assessed by generic SIA procedures for defining an impact area in two important respects: their duration/scope and the fact that the projects involve nuclear (and sometimes classified) technologies. While an attempt is made to evaluate any single project (WPPSS, N-Reactor, Purex, BWIP) in isolation from other projects, the experience of worker populations and the surrounding communities is that some projects replace others (softening impacts) and some projects replace others (exacerbating impacts). The conventional wisdom of both proponents (who see projects as substitutable in terms jobs) and opponents (who see projects as sharing elements of risk) stands in contrast to agency and contractor limitation of concerns to specific projects under consideration, but the conventional wisdom may be a better guide to the community impacts.

Duration/Scope

"Conventional impacts" of worker populations can usually be limited to specific areas and for limited time periods. However, the size of the Hanford reservation and dispersal of its projects means that one project may impact one area, and another apparently similar one, quite different areas. (See Figure 4.) Housing patterns and choices of technical and professional workers, operational employees and construction employees are likely to diverge considerably, especially when they compete for locations and given the differences in presumed permanence. (See Figure 2.)

The map illustrates the Hanford Site boundary in Washington, Oregon, and Idaho. Key features include:

- Geographical Features:** The Columbia River, Snake River, and Yakima River are shown.
- Transportation:** Major highways are marked with route numbers (e.g., 2, 12, 24, 30, 39, 50, 60, 101, 124, 155, 200, 240, 250, 300, 390, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000).
- Urban Centers:** Cities like Pasco, Kennewick, Richland, Prosser, Umatilla, Hermiston, and Walla Walla are indicated.
- Infrastructure:** The Hanford Site boundary is clearly delineated, and the location of the Reference Repository is marked.
- Orientation:** A north arrow is provided for reference.

10118

Unlike most "major facilities" (power plant, mill, mine) which have one major construction phase followed by an operational phase (a short term boom followed by a predictable bust), "the" Hanford project is really a series of projects with cycles of boom and bust. In a sense, the area has been an "impact zone" for over 40 years. For this reason it is inappropriate to think in conventional SIA terms. Some "impacts" may be softened because one boom may fill up the excess capacity left from a previous one, which were "under utilized" during the bust.

One the other side, the expectation of recurrent boom (cycles), leads to different community adaptations than what is seen where it is clear that construction will be a "one-time" activity. Rather than focusing on "portable" development, schools, public facilities, housing are developed to an extent which may or may not be sustainable. The bonds, taxes and mortgage commitments for these constitute an unusual legacy of impacts. Should the Hanford booms be over, the area must write off at least that portion of their capital investments which they cannot quickly utilize for workers in a "diversified" economic base. Some financial community informants indicate that the current "bust" is so extreme that "equities" are smaller than outstanding mortgage balances. (They expect severe dislocations if the N-Reactor doesn't open and/or if there is no WPPSS conversion.) Others, with considerable luck and timing, have been able to "milk" the boom-bust cycles (selling in booms and repossessing in busts).

The cycles of Hanford have been more like tides than single developments and the region is unusual in its cumulation of facilities which are (and may be) under utilized. If new reservation projects do not again flourish the area appears in some respects like a gigantic mill or mining town after the mill or mine has closed. However, the complexity, scale, and infrastructure is so large that one cannot imagine simply "closing down" towns (or areas of towns). Under utilized buildings, residences and other elements of infrastructure may be a strong selling point for potential new enterprises in the area.

Personal Adaptive Strategies

At the individual and family levels, there is considerable variation in the experience of "busts." While oversimplification, it is useful to distinguish types of individuals who differ in methods of (and resources for) coping with "rampdowns." Preliminary field work, coinciding with the recent unexpected closure of the BWIP project and Hanford site disqualification, identified the following categories with different experiences of "booms" and "busts":

- Hanford related professionals and technical workers
- Hanford related clerical and service workers
- Hanford related blue collar workers (construction and operatives)
- Community based professionals, commercial and financial interests

Community based labor
Agricultural interests

In Tri-Cities and the surrounding areas, many individuals and most families do not fit discretely into one or another of these "types." Indeed, the scale of Hanford related projects, though direct employment and various subcontractors, is such that the field researcher is struck by the fact that it is difficult to find a respondent who is unrelated to Hanford employees, either at some time having been employed in a Hanford related activity or having family members so employed. An implication of this is that many, if not most, area families will be affected by significant work "stoppages" (BWIP, N, WPPSS), though the effects will be more partial and marginal in some families than others.

Nuclear Industry Projects

The fact that Hanford is the location of some of the world's earliest and most extensive nuclear developments raises special impact issues and concerns, as well as special problems of assessment. In addition to the more conventional impacts, Hanford nuclear projects have been developed in a broader context, which requires that issues of potential contamination and stigmatization be raised. These tend to be emotion laden topics for both opponents and proponents of nuclear developments. These are also issues which further extend the potential "impact area" into surrounding counties and states.

Extensive efforts to restrict physical impacts of nuclear materials to the reservation boundaries have been generally successful, with some notable exceptions (tritium and possibly iodine contamination of groundwater, some contaminated sediments in the Columbia River, periodic leakages of storage facilities and several airborne releases, most notably the releases in the late 1940's and early 1950's). The exceptions have resulted in designation of an official 10 mile "impact area" outside the reservation, residents of which have been provided emergency radios to alert them to possible releases.

Disclosures of releases and leakages over the past ten years have increased public awareness of, and concern about, broader physical impacts in areas referred to as "down wind" and "down stream" from the reservation. (Additional disclosures are continuing to occur as documents are declassified and as the "Dose Reconstruction Study and associated lawsuits progress.) Health concerns and market concerns about contamination of agricultural products have developed in the surrounding region. These concerns have emerged in groups dependent on the Columbia River as well as in the broader population of the Northwest who map potential impacts of airborne releases from their personal experience of the nearly region wide Mount St. Helens ashfall. That series of volcanic eruptions provided a visible and public physical model of the potential impact area for airborne releases.

Special Notes on Differences in the Potentially Impacted Publics

Hanford Reservation Employers and Workers

1. Federal Agencies (DOD, DOE, EPA)
2. Corporations (Rockwell, Battelle, Westinghouse)
3. Technical Specialists
4. Labor Groups (differentiation by major crafts)

Hanford technical and professional workers are highly trained in skills much sought by other federal projects and private contractors. For this reason, they are somewhat insulated from some personal effects of rampdowns, provided there are no serious impediments to their relocation. Over the years, individual and institutionalized strategies have developed. These include networks for reassignment or new employment at other nuclear installations. Some have taken a series of temporary assignments, to return to Tri-Cities when projects were renewed. For single employees, or those without investments in homes, this can be a relatively painless process. (One BWIP employee located a new job within three days of the recent "defunding;" many were revising Vitae and telephoning prospects within hours of the defunding.) Residential purchases represent impediments to moves, but some employers will underwrite such losses. The most serious complications involved those with families, especially where spouses were otherwise employed locally and where "new jobs" were temporary or of the "circuit" variety.

Clerical, service and blue collar workers are not as well insulated from economic consequences. Again, for single renters, relocation can be arranged on the basis of skills and experience, but without the institutionalized network of the professionals. Of those with families, a number have chosen to "work out" in past rampdowns (a term used to describe one spouse, usually the husband, working in distant locations around the country while the other spouse anchors home and family). While some institutionalized networks are available to facilitate "working out," the family stresses induced limit the time for which this is a solution. During past downturns, others have shifted to alternative types of work, almost always at reduced rates of pay; still others have patched together combinations of employment with spouses or other linked persons.

Economic Diversification Interests

1. Technician and Technology Transfer Developments
2. Regional Industrial and Manufacturing Alternatives
3. Tourism, Convention and Retirement Developments
4. Regional Trade Developments
5. Service and Support Workers

Community based professionals, business people, and financial interests experience considerable "shakeout." Some relocate; some remain with reduced business or clientele. Businesses which falter or individuals who are heavily invested in local resources (housing, stores) are likely to be most affected and individual

(or family) survival will vary with adaptability, relocatability, belt tightening. Fewer of these will be networked into institutions for relocation, though many are also linked to Hanford workers who may be.

Community based laborers and service workers indicate responding to ripples from rampdowns by moving, taking less desirable work or traveling greater distances to work in industries (e.g. to Umatilla, Hermiston, Walla Walla, Yakima). Those who are unable to find work within commuting distance or to adjust to reduced circumstances, move when they are unable to wait for an "upturn." "Bust" phases are described as "outages" by some, who hope to wait out the phase.

For those community based workers, of whatever status, who manage to stay in the community and who develop alternative employment, depressed housing prices are sometimes taken as opportunities for residential mobility (moving to more desirable neighborhoods, purchasing a house).

Product Stigmatization

C. Agricultural Interests (Product Stigma Issues)

1. Orchards, Vineyards and Wineries
2. Farmers Depending on Irrigation (largely "row crops")
3. "Dry Land" Farmers (largely wheat, barley)
4. Livestock Producers (cattle and, less extensively, sheep)
5. Agricultural Labor (migrant and settled)

Regional producers of fruit, field crops and livestock express concerns about stigma which may attach to their produce, especially should any accident occur in transport or storing of wastes. Two groups seem especially vulnerable to even the rumor of contamination: wine makers whose product is very sensitive to fashion and orchardists who are developing increasing export markets in Japan. Preliminary contact with such producers suggests special sensitivity to these issues; producers feel compelled to research possibilities of contamination and yet feel that even the study of such possibilities may damage their markets. So sensitive was this issue that a prominent regional political figure warned the study team not to study this topic directly. Obviously, even without the political pressure, simple ethical considerations suggest that research on product stigma should be sensitive to this dilemma and, wherever possible, rely on "surrogate data" (e.g., data on Polish markets following Chernobyl or existing Nevada site surveys) rather than direct surveys of potential consumers.

Agricultural interests are not so directly linked to busts. Over the past forty years there has been a slow transition of agriculture, as dryland farming and ranching have been augmented with the more capital intensive irrigated farming of annual crops, and subsequently with the yet more capital intensive raising of perennial crops, and finally some overlay of vertically integrated

agribusinesses (wineries, processing plants). Owners and operators of these may benefit to some extent from downturns, in that labor is more available for harvests and processing plants. In many cases, agriculturalists will combine dry-land operations with some ranching and irrigated cropping. Generally, annual croppage will be used to sustain the early non productive years of the perennial investments (orchards, vineyards).

A number of farmers and ranchers are also involved in developments associated with "boom" periods and these may experience economic pressures during busts depending on their financial exposure. Others, who are appropriately positioned, report "windfalls" from abandonments or repossessions associated with earlier land sales.

Hispanic Population

While the annual migrant labor stream employed in some of the region's agriculture is not directly linked to Hanford cycles, there is some evidence of an historic pattern called "settling out," which may be affected by booms and busts in the nonagricultural sectors. While the evidence concerning numbers is circumstantial, it appears that approximately 10% of migrant laborers arrange to settle in the Columbia Basin each year. (This is based on some ethnographic information and on the recurrent excess of Hispanic growth over what can be attributed to birth and death processes.) It is possible that the intensified labor competition associated with "busts" may impact the "settling out" pattern though no evidence is available on this point.

According to the best available information, the counties immediately adjacent to the Hanford Reservation have significant and growing Hispanic populations; from 1980 to 1990 the Benton county Hispanic population increased from 109,444 to 112,560; Franklin county from 35,015 to 37,473; Grant county from 48,522 to 54,758; and Yakima County, from 172,508 to 188,508. Hispanics are the largest minority in Washington state and most of these are of Mexican origin. Over ninety-two percent of the Hispanic population of the Yakima Valley is of Mexican origin with a minority of other Latin American origins. Mexican migration to the Yakima Valley began over a century ago during the territorial period; however, it did not begin in any significant numbers until the 1950s when people from the Rio Grande Valley of Texas came to work in labor intensive agricultural crops. At first there was a seasonal migration, but a settling down process started by the middle fifties. The magnitude and sources of the movement of people increased after 1980 when the economy of Mexico was severely depressed by the bust of the oil boom and eroded by inflation and when Mexico began to be inundated with a flood of Central American civil wars refugees. Concentrated in lower status occupations, with significant numbers working outside and in agriculture, this population may be more "at risk" than others to environmental hazards associated with Hanford developments. However, they are least likely to be included in "impact groups"

because of lack of political power. The average migrant farm-worker in Washington state is male, 30-years-old, married, has three children and earns \$5000-6,000 annually. The relatively poorly sheltered children in these sometimes quite large extended families may constitute a special risk group.

"Downstreamers"

Residents of Columbia River-dependent areas of the Northwest have expressed particular concern about the proximity of the nuclear reservation to the Columbia River. These concerns have given rise to the term "downstreamers" for those dependent on this river system, further extending the claimed boundaries of the "impact" area. Concerns include irrigation and drinking water issues in Washington and Oregon, with fishery issues in Washington, Oregon and Idaho. (See Figure 5.)

Four categories of people have special concerns about possible contamination of the Columbia River and the two large aquifers which underlie the Hanford Reservation. The proposed HLNWR would have penetrated both aquifers and, though only the upper aquifer is currently tapped for irrigation, a long term perspective includes the probability of utilization of the deeper aquifer. Many agricultural activities (orchards, vineyards, farms) rely on irrigation from the Columbia River and to a much lesser extent on the upper aquifer. Towns and cities downstream from Hanford also use the river as a source of drinking water. A growing tourist industry, based in part on fishing and water sports could be impacted by water contamination (or the perception of it).

Finally, Northwest fisheries interests are especially sensitive to possible river contamination. Concern for fish stocks deserve some special attention as the Columbia River is the principle migration route for many "anadromous" (migratory fish which have both salt water and fresh water phases) species and varieties. Consequently, the concern extends far downstream where varieties of salmon are taken (including ocean fisheries) and far upstream into Washington, Oregon and Idaho where spawning beds are located. Strictly speaking, many of the "downstreamers" actually live "upstream," but their economic (and cultural) dependence on fish stocks requires maintenance of downstream water quality. (See Figure 5.) Both Indian and non-Indian fishers are particularly sensitive to any potential threats to fish stocks as these are currently showing severe stresses from the dams and other developments in the extensive system of Columbia River tributaries.

While not "products" in the traditional sense, tourism, conventions and retirement communities are growing Columbia Basin developments which are also sensitive to stigma. Kennewick, Pasco, Richland organizations promoting these as attempts to diversify their economy are also sensitive to such issues.

FIGURE 5: RELATIONSHIP OF COLOMBIA RIVER SYSTEMS TO HANFORD
Irrigation systems and spawning areas include Snake, Yakima, Walla Walla River Systems and others not shown

"Downwinders"

Some of the issues raised about site specific and industry specific impact areas beyond the immediate vicinity of the reservation can be understood only by placing these in historical and political context. Populations far removed from the reservation have insisted that they be given assurances concerning the safety of proposed nuclear projects. The city of Spokane (approximately 100 miles Northeast of the reservation) and other groups argued for inclusion in the "impact area" and were preparing suits to force that inclusion, though these plans were abandoned when the site was disqualified in 1987. These groups have continued to pursue legal avenues to force their inclusion in the on-going "dose reconstruction study" which attempts to assess exposures through milk and produce which were caused by earlier air-borne releases.

While winds in the Columbia River Basin are quite variable (especially near ground level), the prevailing direction (at higher elevations) is toward the northeast from the Hanford Reservation. The term "downwinders" was originally used by a group of rural residents living immediately northeast of the reservation who experienced unusual rates (for their social categories) of certain radiation related conditions (primarily thyroid cancers and leukemia) and are attempting to link these to historical releases from reservation facilities. There is much animosity in the Tri-Cities area over this issue, with individual's who believe they were affected constructing "death maps" to establish pattern and a number of other groups, partly out of fear of unwarranted stigmatization, labelling the treatment of the issue "hysterical." The issue is the subject of several major studies and promises considerable litigation.

Still other groups, including Indian groups north of Spokane (also northeast of Hanford) have initiated legal action raising concerns about historical exposures to releases. A massive "dose reconstruction" study has begun to attempt estimation of radiation exposure attributable to intentional "test releases" of iodine from the Hanford reservation (in the late 1940's). Nuclear opponents and people who believe that they were victimized display extreme mistrust of assurances about safety, based on the long period of secrecy (over 30 years) surrounding the releases, as well as earlier denials of leakages.

Based on the 1980 (and subsequent) volcanic ashfalls experienced by residents of the Northwest, regional residents have tended to generalize the term "downwind" to include all areas which experienced significant cumulations of volcanic ash. Residents reason that the several Mount St. Helens eruptions ("upwind" from Hanford) provided a series of physical tests which delimit the areas most vulnerable to significant contamination from reservation based airborne releases.

Because of the prevailing wind pattern, the most significant

ashfalls were found in a fan shaped area beginning at Mt. St. Helens and stretching approximately from Moscow, Idaho north 150 miles to the Canadian border. (See Figure 6.) However, the variable winds and unpredictable eruptions also deposited lesser amounts of ash to the southwest, including Portland, Oregon. Consequently, the term "downwinder" should be recognized as a shorthand designation for those whose location places them at special risk from possible airborne contamination. Various groups will define the extent of the risk area differently (e.g., the original "downwinders" prefer very constricted limits for the term). However, the concept of being "downwind" is rooted in the personal experience of many regional residents. Variable personal definitions should not lead analysts to conclude that the term is merely psychological, as we can map the physical boundaries and extent of actual risk through records of cumulative ashfall.

"Downwind" concerns include issues of personal health as well as concerns about contamination of produce and livestock. (The latter concerns developed further after Polish produce was banned from European markets following the Chernobyl disaster.)

Emotions tend to dominate discussion of these issues. Respondents in the Tri-Cities area display a defensiveness about the nuclear industry which puzzles and alarms other state and regional residents. On the other hand, "outsiders" are seen by many Tri-Cities respondents as hysterical and uninformed.

A curious feature of interviews in the area of the reservation is that many respondents have ritualized ways of dismissing health and other contamination concerns with almost "cartoon like" characterizations ("We don't glow in the dark," "When I touch the light switch, it doesn't spark," "We've lived here 30 years and we're O.K."). Radiological risks are minimized by discussion in these terms. Strikingly absent from these discussions is the mention of any realistically possible consequences. The words "cancer," "leukemia," and "thyroid" are simply not used, at least not around "outsiders." Residents are openly proud of being a part of a community seen as having mastered a powerful and potentially dangerous technology.

"Transportation Corridors"

A special issue related to the transportation implications of the High Level Repository further broadened the claims of potential impact areas beyond that associated with other Hanford projects. Unlike other projects, the repository would require routine transportation of highly radioactive materials through surrounding communities and states. (See Figure 6.)

Residents outside the immediate vicinity of the HLNWR are sensitive to the fact that few major transportation routes suitable for heavy truck traffic lead into the Northwest. (The two major routes through Oregon and the single major route through Montana-Idaho-Washington are shown in Figure 6). Waste

FIGURE 6: RELATIONSHIP OF AREA RECEIVING PRONOUNCED ASHFALL FROM MOUNT ST. HELENS ERUPTIONS TO HANFORD RESERVATION (and major transportation routes to Hanford Reservation)

transport which comes from dispersed sources across the country would be concentrated in these corridors. In addition to activist groups concerned with transportation safety, two neighboring states initiated legal action to secure a voice in planning for transportation factors associated with the proposed Washington site.

Some Concluding Observations

Generic social impact studies are not adequate for delimiting potential impact areas, nor for anticipating populations (or publics) which will inject themselves into the assessment process for major developments at the Hanford Reservation. Particularly essential to adequate impact assessment is differentiation of types of impacts, recognition of differential impacts from assorted work sites, and separate assessment of impacts for diverse populations. On-site study with direct field verification and contact with the various "publics" is essential for anticipating issues which may become central in future projects.

There is a need for developing more "process" models (akin to Gold's "inner structure") which portray the complexities of dependencies among the various economic sectors of the Mid-Columbia region if adequate assessment planning is to be done. Further, the tendency of generic impact studies to curtail "impact areas," limit impact variables, and restrict "publics" to be considered appears short-sighted. More inclusive definitions of areas, variables, and publics, while more cumbersome in the short run, pose fewer risks of awkward oversights. Field verification of suspected impact areas and groups becomes especially important in contexts where an adversarial model of multiple parallel studies, responsive to different interested "publics," is employed because such contexts imply that "everyone may examine everyone else's books." While such research will never likely achieve the abstract "objectivity" touted as a goal in some textbooks for novices, the cross-research scrutiny and criticism of the adversarial model may substitute instead the more modest goals of balance and equity. Shortcutting and prematurely closing the areas and range of groups to be studied will appear to simplify impact assessment processes, but in the longer run, is likely to set the stage for hostility and litigation.

References

- Carlos, Manuel L. State Policies, State Penetration and Ecology: A Comparative Analysis of Uneven Development and Under-development in Mexico's Micro Agrarian Regions. Center for U.S.-Mexican Studies University of California, San Diego, 1981.
- Cluett, Christopher, et.al. Nuclear Waste Repository in Basalt: Preliminary Socioeconomic Assessment, RHO-BW-CR-142P/BHARC-400/83/023, Richland, Washington: Energy Systems Group, Rockwell Hanford Operations, Rockwell International, June, 1984.
- Community Development Services, Inc. "Socioeconomic Impact Study: WNP 1 & 4. Volume 4: Final Report," prepared for Washington Public Power Supply System, Richland, Washington, 1979
- Chavez, Leo R. "Mexican Immigration and Health Care: A Political Economy Perspective." Human Organization Vol. 45, Winter 1986, No. 4, pp. 344-352.
- Cook, Annabel Kirschner. Hispanics in Washington, 10 Census Notes. Cooperative Extension, College of Agriculture and Home Economics, Washington State University, 1982.
- Gamboa, Erasmo. "Mexican Migration into Washington State: A History, 1940-1950", Pacific Northwest Quarterly 121/ 72, 1981.
- Flynn, James, "Human Identity in the Technological System: A Report from the Front Lines," presentation at the Fourth International Conference on the Comparative Historical and Critical Analysis of Bureaucracy, Vancouver, B.C., September 2-6, 1985.
- Gold, Raymond L. Ranching, Mining and the Human Impact of Natural Resource Development, New Brunswick, New Jersey: Transaction Books, 1985.
- NWPA (Nuclear Waste Policy Act of 1982) Public Law 97-425, 42 USC 10101-10226.
- Schnaiberg, Allan. The Environment: From Surplus to Scarcity, New York: Oxford University Press, 1980.
- USDOE (U.S. Department of Energy), Recommendation by the Secretary of Energy of Candidate Sites for Site Characterization for the First Radioactive Waste Repository, Washington, D.C.: USDOE, OCRWM (DOE/S-0048), May 1986a.

USDOE (U.S. Department of Energy), Environmental Assessment: Reference Repository Location, Hanford Site, Washington, Volumes I, II, III, Washington D.C.: USDOE, OCRWM (DOE/RW-0070), May 1986b.

Willard, William and Fernando V. Padilla. "The Hispanic Population of the Yakima Valley". Prepared for the 1989 Conference on Meningococcal Disease, Red Lion Inn, Yakima, Washington, October 25-27, 1989.

Wolf, C. P. "Social Impact Assessment: Methodological Overview," pp. 15-33, in Kurt Finsterbusch, Lynn G. Llewellyn and C. P. Wolf (eds.), Social Impact Assessment Methods, Beverly Hills, California: Sage, 1983.

WSDOE (Washington State Department of Ecology) "Request for Proposals for a Report on Social and Economic Impacts of a Potential High-Level Nuclear Waste Repository at the Hanford Site, Washington," Lacey, Washington: Office of High-Level Nuclear Waste Management, Washington Department of Ecology, August 29, 1986.

ROCKY FLATS, COLORADO: A CASE STUDY

BY

DORA G. LODWICK

Executive Summary: Rocky Flats, Colorado

An analysis of forty years of interactions between a plutonium processing plant in Rocky Flats, Colorado and surrounding communities illustrates one long-term relation between a state and the Department of Energy. While the historical context has changed, many patterns will be similar to past experiences. How does DOE, with its national mission, interact with state leaders and community residents?

The development of Rocky Flats has been divided into seven phases to reflect the changes in the interactions. The first is the **Site Selection and Plant Construction** phase from 1951-1955. During this period the site was selected, the plant was established, and local community residents sought to understand what was being produced so secretly. Newspaper reporters "guessed" what was being produced from the hints given out by different sources and from their own analysis of the characteristics of other atomic plants. During this period there was warm acceptance of the plant at Rocky Flats as a contributor to "national security" and to the regional economy.

The second phase is the **Establishment and Normal Development** stage. This lasted for thirteen years, from 1956-1969. During this phase, Rocky Flats expanded and consolidated its work. Slowly Dow Chemical Company, the plant manager, and the Atomic Energy Commission, which oversaw the plant, began to explain Rocky Flats to the community. Generally the plant continued to be well-regarded and the economic benefits of the plant were emphasized. This is also a period of time when the metropolitan area expanded closer to plant site.

Comparatively little was known about the characteristics of plutonium during these early phases. The Federal government was trusted when its representatives claimed the production processes posed no threat to local residents.

While inadequate technical knowledge may have been a factor in Dow Chemical Company's pronouncements during the earlier part of this period, this was less true in the 1960's. Fires had become a normal part of running the plutonium processing plant. The management company chose not to investigate potentially hazardous effects of two major plant fires. This, plus discrepancies between what was said at national and at local levels about plant safety stimulated local questions.

The third phase, 1970-1974, was when information about the negative environmental and health impacts of the plant were exposed by members of the communities. This period was the **Beginning of Controversy** stage. Three primary issues stimulated concerns about the plant. Two major fires occurred, one in 1957 and one in 1969. A large spill of contaminated oil was reported in response to inquiries about the hazardous effects on health and environment of the fires. The mantle of secrecy which had hidden Rocky Flats for so many years was being lifted. These were the last years of Dow Chemical Company's management.

Dow Chemical Company was replaced. It had become "untrustworthy" due to management errors of judgement and its emphasis on secrecy. Researchers became sources of alternate truths as Rockwell attempted to recapture local trust.

The fourth phase began in 1975, when Rockwell International Corporation began managing the plant, to 1978 when nationally based protest groups began attacking the very existence and purpose of the plant. This **Open Door** phase was based on Rockwell's stated "no secrets" policy, a new management philosophy. However the stage had already been set for the escalation of protests and challenges to the plant. State officials, local political leaders,

community members and national protest groups all took a negative stance towards Rocky Flats. Scientific and legal challenges were made against information provided about events at the plant and the effects of the plant's production processes on its workers and the surrounding communities. Local scientists and citizens independently gathered data to monitor the plant. Rockwell developed an aggressive public relations strategy presenting how safely and economically it ran the plant.

During the fifth phase, from 1980-May, 1989, the plant saturated its environmental and social base. This is the Protest and Local Influence phase. More negative environmental and health effects were discovered both within the plant and in the community. Some attempts were made to deal with the community health and environmental impacts. Controversies developed over how to dispose of hazardous wastes. Rockwell modified a proposed incineration process due to public and political pressures. State and local officials, community members and national protesters continued to press against the plant asking that it be closed or relocated. Colorado obtained the right to control Rocky Flats' disposal of mixed hazardous and radioactive wastes.

During the 1970's Rocky Flats negotiated perceptions of environmental, health, and safety hazards. Safety awards and bonuses were given to Rockwell Corporation even as DOE was discovering clear problems at the plant. Plant staff members falsified reports to reflect greater environmental safety and compliance than what was actually occurring. Both DOE and Rockwell collaborated in covering up information about hazards. Local real estate developers denied or covered up information about Rocky Flats.

Local workers and residents continued to attack the plant and DOE. The struggle to define what information would be believed and what would be the trusted institution became very strong through the 1970's and into the late 1980's.

A community survey, conducted in 1982, showed that residents living within 10 miles from the plant were uneasy about Rocky Flats. Beyond that area, residents were more concerned with the economic contributions the plant made to the region. Communities which had higher educational levels trusted the plant less and were more in favor of moving or modifying the plant than communities with lower average education.

Operation Desert Storm was a watershed event, in 1989. Prior to this event, community residents were fragmented by the debate over the trustworthiness of the plant. The FBI raid reinforced those who were struggling to claim that Rocky Flats was NOT trustworthy. Those who had trusted Rocky Flats were stunned. Local residents, political leaders, and workers were shocked.

DOE then fired Rockwell claiming that a new culture was needed which would be more concerned with environmental and health issues. Rockwell defended itself claiming that the government was making contradictory demands on the management company. Residents divided into those which supported or were antagonistic to the plant.

A 1990 survey of a community which had been most strongly affected by the plant indicated that over 50% of the people had negative opinions about Rocky Flats. However, even among those people, the economic benefits of Rocky Flats were very important. They seemed willing to find a compromise way of keeping the plant open. They thought this could be facilitated by using an external monitoring organization. This, in effect, created a new institution which could be trusted to protect local residents.

The Department of Energy became more active locally as the new management company,

Executive Summary

Rocky Flats, Colorado: A Case Study

EG&G, prepared to assume leadership. During this period, local political leaders engaged national Colorado leaders in overseeing the actions of the Department of Energy.

Conclusions

The Department of Energy and its management companies are beginning to learn how to work with complex and dangerous productions processes. These processes will inevitably create unexpected accidents or effects which are not understood.

Rocky Flats shows that the management corporations and the Federal Government have not yet learned how to work with these technologies and retain the trust of the people who are negatively affected by the technologies. DOE and its managers have tried to underestimate or coverup the hazards. This has served to destroy their "trustworthiness." This pattern has been consistent throughout the 40 years of Rocky Flat's operation.

Nevada is potentially entering an operation WITHOUT the trust of local residents. Rather than trying to underestimate the potential hazards, it should overestimate potential problems. Assume that current technology is too complex and knowledge too limited to be able to foresee and control the "normal accidents" of the future.

- * Acknowledge that the safety limits are not known and may quite possibly be inadequate. Future technologies may have better answers.
- * Establish an external monitoring group which is responsible to local residents. It should have the resources and technical capacity to come to its own conclusions.
- * Provide "hazard pay" for workers. Regularly update workers' training as more is known about the processes.

Nevada should gather the resources necessary to work closely with both DOE and local residents. It should develop its own information. Key Congressional members should continue to monitor DOE.

ROCKY FLATS, COLORADO: A CASE STUDY

by

Dora G. Lodwick, Ph.D.
Miami University
Oxford, Ohio 45056

1991

Introduction

The development of Rocky Flats has been divided into seven phases to reflect the changes in the interactions between the plant and the communities around it. During the years since it was founded in 1951, Rocky Flats plutonium nuclear trigger and reprocessing plant has changed drastically. Initially, the plant was welcomed as an important contributor to the economic development of the Denver-Boulder metropolitan region. It was no longer welcomed by political and economic leaders as well as Colorado residents by the 1990's.

The **Site Selection and Plant Construction** phase lasted from 1951-1955. During this period the site was selected, the plant was established, and local community members sought to understand what was being produced so secretly. Newspaper reporters "guessed" what was being produced from hints given out by different sources and from their own analysis of the characteristics of other atomic plants. During this period there was basic acceptance of the plant at Rocky Flats.

The second phase is the **Establishment and Normal Development** stage. This lasted for thirteen years, from 1956-1969. During this phase, Rocky Flats expanded and consolidated its work. Slowly Dow Chemical Company, the plant manager, and the Atomic Energy Commission, which oversaw the plant, began to explain Rocky Flats to the community. Generally, the plant continued to be well-regarded and the economic benefits of the plant were emphasized. This is also a period when the metropolitan area expanded growing closer to the plant site.

The third phase, 1970-1974, was when information about the negative environmental and health impacts of the plant were exposed by members of the community. This period was the **Beginning of Controversy** stage. Three primary issues stimulated concerns about the plant. Two major fires occurred, one in 1957 and one in 1969. A large spill of contaminated oil was reported in response to inquiries about the hazardous effects of the fires on health and the environment. The mantle of secrecy which had hidden Rocky Flats for so many years was being lifted. These were the last years of Dow Chemical Company's management of the plant.

The fourth phase lasted from 1975, when Rockwell International Corporation began managing the plant, to 1979 when national protest groups began attacking the existence and purpose of the plant. This **Open Door** phase was based on Rockwell's stated "no secrets" policy. However the stage had already been set for the escalation of protests and challenges to the plant. State officials, local political leaders, community members and national protest groups

all took a negative stance towards Rocky Flats. Scientific and legal challenges were made to information provided about events at the plant and the effects of the plant's production processes on its workers and on the surrounding communities. Local scientists and citizens independently gathered data to monitor the plant. Rockwell developed an aggressive public relations strategy presenting how safely and economically it ran the plant.

During the fifth phase, from 1980-May, 1989, the plant saturated its environmental and social base. This is the **Protest and Local Influence** phase. More negative environmental and health effects were discovered both within the plant and in the community. Some attempts were made to deal with the community health and environmental impacts. Controversies developed over how to dispose of hazardous wastes. Rockwell modified a proposed incineration process due to public and political pressures. State and local officials, community members and national protesters continued to press against the plant asking that it be closed or relocated. Colorado obtained the right to control Rocky Flats' disposal of mixed hazardous and radioactive wastes.

Federal Probes and loss of legitimacy were the themes of phase six. This began in June, 1989 and continues to 1990. The federal agencies, FBI, DOE, EPA, and GAO (General Accounting Office) swoop down on Rocky Flats for close scrutiny. DOE fires Rockwell International and his EG&G Inc. by December, 1989. Rocky Flats is closed "for inventory" purposes. Phase seven stresses cleanup. EG&G learns more about Rocky Flats while the plant continues to be "closed". Debates rage about whether or not it will be reopened and modernized.

This case study is based on an analysis of newspaper articles released since 1951 about the Rocky Flats plant in Colorado. Most of the articles are from the *Rocky Mountains News* and *The Denver Post*. Materials from other newspapers and from community studies and activist publications are used when obtainable and appropriate. This content analysis covers articles written through May 18, 1991.

There are two primary purposes for doing an analysis of newspaper articles: (1) It is possible to trace the primary events and stakeholders who are publicly associated with the plant over forty years. (2) It is possible to trace the changing perceptions, as presented by reporters, about the plant. The articles on Rocky Flats have been predominantly positive over the forty years. Rocky Flats received bonuses due to their positive media image as late as 1988. This image was shattered by the 1989 probe conducted by Federal agencies.

Sociological research on technological hazards concludes that the manner in which information is presented to community members about hazards greatly affects their responses (Kasperson 1985; Levine 1982). Therefore it is important to conduct this analysis as a first step in understanding some of the lessons of Rocky Flats for the state of Nevada.

Phase I- Site Selection and Plant Construction (1951-1955)

Site Selection

Two themes emerge from the first period - "national security" and good business. These two themes were combined in the announcement that Denver had been selected as the site of an "Atom Plant". The announcements were simultaneously made by the offices of the Colorado Senators E. C. Johnson and Eugene D. Millikin and Representative, William S. Hill in

Washington D.C. and Dick Elliott of the Los Alamos, New Mexico arm of the Atomic Energy Commission (AEC), on March 24, 1951. Rocky Flats is a "major installation in the atomic energy program." There would be no answers to further questions about the plant in the interest of national security (News, March 24, 1951).

The sense of urgency and speed appeared from the very beginning. Various national sites had been reviewed in October, 1950. In February, 1951, the Denver site was inspected and in March, 1951, the Rocky Flats site was chosen. The site selection criteria included:

- * sparsely populated area with a reasonable commute to nearby communities of Boulder and Arvada.
- * good climate for the processes used in the plant
- * good living conditions for the workers
- * higher education facilities available in nearby communities (Denver, Golden, Boulder)
- * moderate water, gas, and electricity facilities (News March 24, 1951).

The environmental demands on the area did not seem high. The energy needs of the plant would be provided by a nearby coal mine, a gas line near the edge of the property, and two power lines already on the property. Its moderate water needs could be provided by a Denver municipal water ditch and a nearby reservoir in winter (Post, October 12, 1951).

On March 24, 1951, the Army Corps of Engineers had secretly been surveying four square miles of a high plateau outside Denver. This area was barren, too rocky for cultivation. It was used primarily for grazing. While the owners of the land would confer with government representative on the price of the land, they had no alternative but to sell (Camera, March 27, 1951). AEC would use condemnation proceedings, if necessary for the full title of the land. The only wrinkle in this process was a brief slowdown while the parties negotiated for surface and subsurface rights of the land (Post, June 14, 1951).

Secrecy

Secrecy was emphasized. The first construction activity on the grounds was a guardhouse (News, May 10, 1951). Dow Chemical Company would manage Rocky Flats for AEC while Austin Company of Cleveland would be responsible for designing the plant and supervising its construction (News December 20, 1951).

From the very beginning the newspapers attempted to pierce the secrecy of the plant by using any information presented. The hints included:

- * no atom bombs or weapon would be made in the production plant
- * unspecified raw material or part of a nuclear fission process would be produced at Rocky Flats (News, March 24, 1951)

By comparing the specifications given for Rocky Flats with what was known of other atomic production plants, the Post concluded that "atomic explosive - the metals plutonium and

uranium 235 - will be fabricated or tooled here into special shapes for bombs, warheads or artillery shells" (Post, March 24, 1951). The importance of secrecy and security was emphasized. Two fences were built around the property. The internal one was 9 feet high and electrified emphasizing the security important to Rocky Flats. Guards with guns patrolled the area (Camera, March 27, 1951). Questions about whether or not there would be air restrictions over the plant, as in some of other AEC installations (Post, October 12, 1951) were answered with "that is not necessary."

Secrecy was still emphasized in 1954 when Rock Flats officials agreed to answer reporters' written questions:

As announced by the AEC on March 22, 1951, Rocky Flats is a classified production plant and handles radioactive materials. Production is used in the industrial sense and may include phases of fabrication, assembly of parts, procurement, production engineering, receipt and shipment, inspection and quality assurance, etc. (News, June 1, 1954).

"National security" hid all activities which happened in the plant.

Community Leaders' Reactions

Political and business leaders' were predominantly elated with Colorado's selection. They were elated about the positive economic and employment benefits to the region. These benefits were mentioned by Governor Thornton, by the president of the Colorado Federation of Labor, by the presidents of the U.S. National Bank and of the Denver National Bank, and by the manager of the Boulder Chamber of Commerce. The President of the University of Colorado emphasized increased research facilities while the president of the Boulder School Board, the mayor of Boulder, and leaders in Arvada stressed the overcrowding of their school systems. Golden leaders thought their schools could absorb the influx.

Potentially negative effects included lack of rental property in Arvada, Boulder and Golden. The estimated 1,000 workers would bring about 3,000 people to the nearby communities (News, March 24, 1951).

Seven of the eleven (64%) community leaders made some comments about the war. The majority were not concerned with the possibility that the region would become a greater target for the enemy. Two leaders said they were glad to help in the war effort (News, March 24, 1951; Camera, March 24, 1951).

Economic Benefits

Economic benefits were apparent. Rocky Flats would be the Denver area's largest industrial installation. The \$45 million project was larger than the \$44 million Gates Rubber Company (News, March, 24, 1951). The annual payroll was estimated at \$5 million (Camera, March 27, 1951) for 1,000 men and 200 women. All but 300 would be hired from the Denver area (News, January 28, 1952). (This would create more local jobs and fewer housing problems.)

"This plant means Big Business for Denver" (Post, March, 29, 1951). About \$20 million of the \$45 million would go to the Austin Company of Cleveland, Ohio to build secret, technical structures. The nonsecret projects would go to the lowest bidder emphasizing local contractors (Post, December 12, 1951) as listed:

- * \$ 2 million subcontract went to Denver's three largest plumbing and heating firms
- * \$ 500,000 to Colorado Premix Concrete Company
- * \$ 50,000 excavation contract
- * \$ 1 million for electric wiring of technical building
- * \$ 81,000 for protective alarm and communications system
- * \$ 164,000 electrical distribution system
- * \$ 795,000 administration building
- * \$ 71,000 water supply line
- * \$ 90,000 water tank
- * \$ 850,000 general shop and warehouse
- * \$ 100,000 sanitary sewer system
- * \$ 225,000 electrical work (News, January 28, 1952).

By August, 1952, \$40 million construction contracts had been given out with 75% spent in Colorado. Besides Austin Company, the Midwest Contracting Company of Dallas was listed as receiving a \$71,377 construction contract for building a water supply line (News, December 20, 1951). There were no big contracts left by August, 1952. The construction workforce peaked at 2,800 in July. The construction payroll reached \$14 million with \$13 million paid in Colorado (Post, August 28, 1952).

Rocky Flats was finished in October, 1953. It cost \$43,739,000 (News, September 3, 1958). It started with an unspent reserve cushion due to David S. Persons' ability to economize and improvise (Post, August 28, 1952). This initial fiscal responsibility may have helped to create problems much later when more was known about the toxicity of plutonium.

Labor Force

The projected permanent workers of 1,200 would be primarily employees of the Dow Chemical Company. In 1953, Rocky Flats had 1,200 permanent workers and 21 employed in the AEC field office. In 1954 1061 worked for Dow, 22 for AEC, and 1 was employed by the military (News, September 3, 1953 and June 1, 1954). All workers needed to have a "Q clearance". This checked their loyalty and background over the previous 15 years (Post, October 12, 1951).

The average wage of the Rocky Flats worker was \$2.31/hr. on January 1, 1953. The average payroll per month was \$428,000 (News, June 1, 1954). This was close to the \$5 million annual payroll projected in 1951.

The Denver Metal Trades Council (AFL) represented the workers at Rocky Flats. In 1953, they signed a one year contract increasing wages by 15%. This brought the wages for

workers in 10 different craft unions to community standards and compensated them for having "to drive to Rocky Flats" (News, May 17, 1953).

The following year, there was a week long strike by workmen in a dispute over working conditions at the water supply line (News, January 28, 1954).

Health Hazards

The health hazards of Rocky Flats were boldly minimized from the very beginning. The water in the plant would be made radioactive, but it would be decontaminated before being disposed. "The plant will offer no threat whatever to the health of residents of nearby communities . . . and the workers on the project will be safer than downtown office workers who have to cross busy streets on their way to lunch" (Post, October 12, 1951).

In June, 1954, Rocky Flats officials responded to written questions submitted by the media. They said, "the degree of radioactivity [in the plant] is small . . . Radiation sickness is not a health factor at the plant . . . radioactive materials used do not have any properties that could cause an explosion" (News, June 1, 1954).

There is no danger to surrounding areas, populations, crops or livestock from Rocky Flats Plant operation. Every feasible safeguard is employed to protect the workers, the plant and the surrounding areas (News, June 1, 1954).

The message of safety and of no threat to worker or community health was repeated throughout the first 25 years of Rocky Flats' operations.

Secrecy Continues

Secrecy continued to control Rocky Flats operations. The public was told that the plant was administered "as an installation of Santa Fe operation Office, the AEC field organization responsible for research, development, production and testing of atomic weapons" (News, June 1, 1954). In 1955, the Chairman of AEC described Rocky Flats as "an atomic weapons center not devoted to the peacetime development of atomic energy" (News, August 23, 1955).

When mentioning that the progress of construction could not be divulged very often, the public relations head at Rocky Flats said, "We know that this sound ultra hush-hush, but we're quite sure the public wants that when it comes to atomic work. Just what will be produced will probably not be known until a free world can examine atomic progress without fear" (News, January 28, 1952).

When Lewis L. Strauss, chairman of AEC was told that "many Coloradans" are concerned about the purpose of the project, he said that he would have to think a lot before saying anything (News, August 23, 1955).

Summary

Secrecy was sufficient for Phase I of the development of Rocky Flats. The Colorado site was selected and the construction was completed. Secrecy in the name of national security

determined the information which was given to local business, political and community leaders. The employment and economic benefits were stressed. The projected economic benefits were met.

Very little was said about the environmental and health impacts of the plant. The plant repeatedly was presented as posing no threats to the workers or the community. Generally this was accepted. Colorado leaders and community residents welcomed "the presence" in their midst. This was the honeymoon period.

Phase II - Establishment and Normal Development (1956-1969)

Rocky Flats was established from 1956 to 1969. It went through a series of expansions. Generally relations with local political and economic leaders were very cordial. Secrecy was still the dominant theme. From all indications, Dow Chemical Company was performing efficiently and effectively with a concern for the safety of its workers and of the community. The Atomic Energy Commission also was meeting its mission objectives. Both the Dow plant managers and the AEC managers of Rocky Flats fulfilled their obligations and retired. Successors followed without many problems. These 13 years were the Golden Years of the weapons production plant.

Economic Development

The economic advantages of Rocky Flats continued to be apparent. Between 1956-1957 the plant went through its first "giant expansion." Swinerton-Walberg Company of San Francisco and Denver was the general contractor. The Catalytic Construction of Philadelphia was the architect-engineering firm participating in this expansion. A \$75 million expansion to create a 50% increase in production also went to Swinerton and Walberg Company of San Francisco in 1969 (Post, September 20, 1969).

In 1960, there was another expansion. The annual report of the AEC noted that \$4.5 million was requested for a construction program and \$400,000 for additional project work. In 1959, \$689,080,000 was spent on uranium. This jumped to \$708,448,000 in 1960 (News, November 7, 1960). Similar figures are reported by another newspaper in noting that \$5.5 million was requested for the 1960-1961 year to replace and upgrade equipment while only \$2.5 million was budgeted for this purpose in 1962 (News, March 30, 1961).

Reporters noted inconsistencies between figures given in different sources. The AEC semi-annual report noted that \$18.4 million was spent in expansion (Post, September 5, 1956). The following year it was reported that a project started in November, 1954 would be completed in the summer of 1957 at the cost of \$21 million dollars. When asked about the discrepancies, officials said that the project ended up having "greater scope" than originally estimated (Camera, January 18, 1957).

The importance of these inconsistencies appeared later. In 1957, Rocky Flats managers comments were not publicly disputed.

These expansions added to the labor force as indicated:

1956 - 150 were added to Dow's staff and 30 to AEC's workers

1957 -	1,575 employees of Dow with projected addition of 100 more within the next 18 months.
1961 -	2,000 hired by Dow and 44 by AEC
1963 -	2,822 employees and 3300 projected in the next 18 months.
1967 -	2,100 workers
1969 -	3,400 workers
1970 -	4,000 (projected)

(Post, January 16, 1958; March 30, 1961; September 20, 1969; also, News, April, 10, 1963; January 17, 1967).

In 1958, the Rocky Flats investment was \$65 million. It continued to be one of the largest investments in Colorado. The annual payroll at that time was \$9.5 million and \$4 million was spent locally for goods and services (Post, January 6, 1958). About the same amount was spent on goods and services, but the payroll had increased to \$13.5 million for Dow Chemical Co. and \$300,000 for the AEC payroll in 1961 (Post, March 30, 1961).

The figures continued to grow. In 1963, the annual payroll was \$18 million with an additional \$8 million spent on equipment and supplies. Ninety-one million was invested in the plant, even though \$1.5 million was paid from the operating costs in 1963 (News, April 10, 1963; July 3, 1964). By 1969, \$31 million was spent on the payroll by Dow and \$558,000 by AEC. Services and supplies accounted for an additional \$14.3 million (Post, September 20, 1969).

Labors' Concerns

Workers continued to display low-keyed dissatisfaction with their working conditions. The workers were not satisfied with their contract. In 1958 the 900 members of the Denver Metal Trades Council, which represented 16 different unions, voted 381 to 103 to reject Dow's new contract. They wanted a wage package and 8 days vacation after one year and 15 days after two years (Post, June 8, 1958). This was the workers' public response to what later became known as the major fire of 1957.

Health of the workers became a greater concern as more became known about the plant. AEC semi-annual report noted that construction had begun on an \$18.4 million addition to the "weapons production facility at Rocky Flats." This was the first official admission that weapons or component of weapons were being made in Denver (Post, September 5, 1956). The following year AEC admitted that "handling plutonium the fissionable and highly poisonous fuel for A-bombs - is part of its routine business" at Rocky Flats. Plutonium was described as not intensely radioactive but "... chemically active, and that makes it one of the most dangerous radioactive poisons known" (Post, June, 16, 1957). This newspaper article reported the first known explosion which occurred at the plant on June 14, 1957. As a result of this explosion, two men were undergoing medical tests to determine if they were contaminated by plutonium radiation.

Prior to this, when asked about the health dangers, the Rocky Flats officials had responded to written questions saying:

job hazards to workers at the plant are, in part, similar to those encountered in a normal industrial operation which involves the use of machines, power tools, cranes, furnaces and radiographic devices (News, June 1, 1954).

Therefore the medical facilities were comparable to medical facilities in other government and industrial installations. Rocky Flats officials continue to reiterate the benign nature of the plant. Its managers are concerned and responsible, they claimed.

If there is an accident inside the Rocky Flats plant which involves casualties or which otherwise will have general public interest, Rocky Flats management will act to supply a factual report to concerned news media without waiting for inquiry (News, June 1, 1954).

The extent of the 1957 fire was not revealed publicly. Yet, the media reported that workers at Rocky Flats wore film badges which were collected and tested every few days for radioactivity dosage in 1978. Every three weeks urinalysis was conducted of those working close to radioactive substances. The check for radioactivity became daily or several times a day by 1965 (Post, January 16, 1958; May 26, 1965; September 20, 1969).

Environmental Hazards

The same month that the nation's top industrial safety award went to Dow Chemical Company, a spontaneous combustion fire in the plant created \$50,000 worth of damage. The flames spread via the ventilation system, but were contained in the building. There was "no spread of radioactive contamination of any consequence" reported Rocky Flats officials (Post, September 12, 1957).

Environmental safety issues became more salient. The first mention of radioactive waste material produced at Rocky Flats appeared. An AEC spokesperson said that 400 tons a month of low grade radioactive waste material was produced there. These wastes, in sludge form, were packaged in steel drums and hauled by truck carriers to the National Reactor Testing Station site at Arco, Idaho. Where it was buried in huge "atomic graveyards" (Post, September 9, 1957). The solid wastes were placed in polyethylene bags and welded into 55 gallon drums and buried in concrete lined trenches in Arco (Post, January 16, 1958).

Water is removed from the radioactive materials. The safety of the water was explained as follows:

Salt in water can become temporarily radioactive when exposed to certain kinds of radiation . . . which dies away quickly. Rocky Flats water is placed in storage ponds where it is tested and retested until it is safe to discharge into Walnut Creek which empties into the Great Western Reservoir (Post, September 9, 1957).

When the water is released, it is safe to drink, wrote reporters. Air samples were taken regularly and checked against normal background radiation.

Openness Briefly Begins

The first tour since Rocky Flats opened in 1951 was developed to show the safety of the plant (News, November 7, 1960). Only two "minor accidents" had occurred with nuclear materials since 1952 and no accidents since 1958 reported news articles (Post, March 30, 1961).

New atomic laboratories for plutonium and uranium research were opened briefly to visitors in 1965. This \$4.5 million facility amazed reporters who visited the site (Post, May 26, 1965). Rocky Flats would receive \$35 million upgrading funds to create nuclear warheads for the nation's missile-toting submarines. The plant continued to expand its mission (News, April, 28, 1967).

Fire Repeated

On May 11, 1969, another fire occurred. This accident affected Buildings 776 and 777 which were damaged by smoke and water as well as plutonium contamination. This is the first time that water was used on plutonium fires. This led to the addition of sprinkling systems to the plant. One fireman was contaminated. Only one man, a utility maintenance person, was there on the Sunday when the fire happened. During the week there were safety workers assigned to extinguish smaller fires which occurred on average once a month or over 200 since 1953. This information had not been previously divulged to the public.

The damages of the 1969 fire were estimated at \$50 million - \$33 million to repair the structure and equipment; \$10 million for cleanup and \$7 million for general improvement. AEC asked the Senate Appropriations Committee for \$45 million to restore and replace the damaged facilities. The buildings were washed with chemical detergents to remove radioactive residues (Post, May 20, 1969). "Hundreds" of railroad cars carried 330,000 cubic feet of contaminated wastes to the National Reactor Test Station waste site.

There was "no appreciable amount of plutonium outside the building and no known contamination off site as a result of the fire," reported the Post (May 20, 1969).

The seriousness of this fire was not apparent until reporters read the official testimony before the Senate Appropriations Committee. The AEC requested emergency funds of \$45 million for clean-up. Dr. Glenn T. Seaborg, then chairman of the AEC, said, "The damage is the most extensive ever incurred in the weapons production complex." The nuclear missile production was halted for the rest of the year due to the fire (News, June 25, 1969 and Post, June 24, 1969).

Summary

The period from 1956-1969 was a honeymoon period between the Rocky Flats plant, the AEC, and the host region of Colorado. The plant went through a series of expansions as it contributed to the U.S. weapons production program. It also carried out its promise to create positive economic benefits to the region.

Accidents occurred, but they were countered with newspaper reports of safety awards, improved monitoring devices and procedures. While explosions occurred, contrary to the

information presented by Rocky Flats spokespersons in the past, most of the problems seemed confined to the plant site. Contradictory information about plutonium was offered only after damages had been seen by the public. Yet the damages were primarily internal damages. These were "normal accidents," produced by complex technologies (Perrow 1984, 1986). In most cases, Dow Chemical Company and the AEC seemed to be operating responsibly and as good neighbors.

Phase III - Beginning of Controversy (1970-1974)

The honeymoon was over. No longer would local political and economic leaders and community members accept statements made by Rocky Flats officials at face value. Too many contradictions emerged. Reporters began piecing together contradictions and brought them to the attention of community people. There were contradictions in the data presented by Rocky Flats and by independent scientists. Arguments developed over the accuracy of studies.

Safety and truth became the themes of this period. The period ended when Dow Chemical Company, in an unprecedented move, did not seek to renew the management contract which it had had with the Atomic Energy Commission since 1951.

Secrecy

The shroud of secrecy was being lifted as the Dow Chemical Company's management came to an end. Since 1970, special groups had toured the plant. There had been two mass visits for the families of Rocky Flats workers. In 1972, James H. Hanes, the Dow general manager, invited 16 newswomen to tour Rocky Flats. He was making "a concentrated effort to remove the clouds of mystery that have hovered over Rocky Flats for twenty years" (*Post's Empire Magazine*, October, 8, 1972). This policy was also supported by Bill W. Colston, AEC field manager of Rocky Flats from 1973-1974 (*Post*, August 13, 1974). While this openness had been emerging, it became especially important as Rocky Flats was losing its credibility and being attacked.

Environmental Hazards Debated

The 1969 fire and the contradictory information given to the press and to the Congressional Appropriations Committee stimulated strong local response. The Colorado Committee for Environmental Information (CCEI) became a catalyst for the controversy. This local group was formed in response to concerns about the environmental effects of the fire. Dr. Edward A. Martell, a nuclear chemist for the National Center for Atmospheric Research, chaired a soil sampling task force for CCEI. This task force gathered soil samples near Rocky Flats in September of 1969. From those soil samples Dr. Martell found "traces of radioactive contamination" downwind up to 10 miles from Rocky Flats plant. He described how plutonium clings to soil. It can be carried over a large area on dust borne by the wind. This can be a health hazard when inhaled (*News*, February 11, 1970).

The CCEI Report suggested that the May 11, 1969 fire caused \$45 million in plant and equipment damage plus \$20 million more in plutonium damage. Plutonium oxide dust, created

by the fire, could contaminate the soil. Since the winds came from the west and northwest towards the east and southeast, the plutonium could have escaped downwind from the plant towards Denver (Post, February 12, 1970). The CCEI Report was sent to AEC in January, 13, 1970, but it was kept secret. It was reviewed in a closed meeting of CCEI, AEC, the Colorado Department of Health, and the Dow Chemical Company (News, February 11, 1970). The report was made public by the Colorado Department of Health (News, February 13, 1970).

The CCEI report was the first voice to suggest that the "continued operation of the Dow Chemical Company's Rocky Flats plant represents a serious threat to the health and safety of the people of the Denver area." Because of the nature of the plant, there is a high probability of "criticality accidents" (News, February 13, 1970). It also proposed informing the employees of Rocky Flats about the serious uncertainties in present "accepted standards of plutonium exposure" (Post, February 12, 1970).

Several events were stimulated by that report. Initially, AEC investigated sabotage at the plant. It reported that four months before the fire, four transmission lines towers supplying power to the plant had been dynamited. Two months after the fire, a series of "troublesome events," destroying property on the plant, occurred suggesting potential sabotage (Post, January 14, 1970).

AEC and the Colorado Health Department conducted their own sampling of the air and water. They both found 1/10- 1/100th of the plutonium concentration safety standard in the air for the general public. This level was established by the International Commission on Radiological Protection and the National Committee on Radiation standards (News, February 11, 1970; February 13, 1970). AEC argued that CCEI had found minuscule amounts, about 5 times the "fallout". People can live without any problems on soil contaminated by up to 14,000 times the fallout amounts of plutonium. Thus there was no hazard. The State Department of Health claimed that plutonium is hazardous only when "airborne in heavy concentrations" (Post, February 12, 1970).

Dow started its own soil monitoring and found minute amounts of plutonium. Lloyd M. Joshel, general manager of Rocky Flats, said that the unofficial limit to plutonium in the soil established by some U.S. and British researchers [there are no officially established standards or limits for plutonium in the soil] is 4,000 to 14,000 times what they had found in the soil (News, February 13, 1970).

Furthermore, Rocky Flats officials claimed that the plutonium traces found in the soil were NOT due to the May 11, 1969 fire but rather from three other causes:

1. leakage of plutonium contaminated lathe coolant oil from drums stored at the plant over two months in the late 1968. When the oil was reprocessed and decontaminated, some of the oil-soaked dirt blew east before the area was paved over.
2. a 1957 fire, which was smaller than the 1969 blaze, damaged some air filters allowing a small amount of plutonium to escape. A small amount of off site vegetation was contaminated.

3. air coming from the plant's ventilation system, which is constantly monitored, produced a total of about 38 millicurie (1/50th of an oz.) of plutonium since 1958 (Post, February 12, 1970).

Additionally, the media reported that 1/10 thousandth of an ounce escaped through the filter system in the May 11, 1969, fire (News, February 19, 1970).

Dr. Edward Martell took the position that even a small fraction of plutonium oxide is enough to be a health hazard. For the general public, the acceptable radioactivity contamination standard is ten times lower than for workers since employees are exposed for only 40 hours a week while the general public is exposed all the time (News, May 13, 1971).

Political Leaders' Responses

Political leaders of Colorado became very alarmed. The Congressmen called for an investigation. Governor Love expressed concern. Lt. Governor Mark Hogan, who was a Democratic candidate for governor (Post July 23, 1970), became quite vocal saying "Colorado officials are going to have to fight AEC to protect people" (News, February 15, 1970). Two bills were introduced into both houses of the Colorado legislature giving "the governor power to proclaim an environmental emergency and to declare a moratorium on the use of any material which creates hazardous situations" (News, February 19, 1970). This was the strongest negative response the Colorado political leadership had given Rocky Flats up to this time.

Joshel, the general manager of the plant, said it was wrong for states to make safety standards. "AEC is very safety conscious. . . and has a safety record equal or better than any company or other government agency" (News, February 15, 1970).

Lieutenant Governor Mark Hogan contacted the chair of the Joint Committee on Atomic Energy (JCAE) requesting an investigation of the safety issues at Rocky Flats. Air Force Colonel Seymour Schwiller was sent to investigate the issues. He spent two days examining the log books at the plant, appearing on site during working hours and at 5:30 p.m. to determine how secure the plant was, and interviewed Colorado Health Department members and union officials. Then Colonel Schwiller reported that Rocky Flats was following adequate safety and security procedures (Post, July 23, 1970).

The Colorado Department of Health more actively monitored potential hazards. Dow was asked to notify the Department "immediately" of plant incidences. The Health Department also requested weekly surveillance data rather than the semi-annual report historically given to the Health Department. The data were to include a complete meteorological summary including wind speed and direction (Post, February 19, 1970).

The Colorado Department of Health took 25 soil samples from around Rocky Flats and from around the state to determine plutonium background levels. The samples were sent to Las Vegas for analysis. Sediments from the bottom of Woman and Walnut Creeks and reservoirs, which run next to Rocky Flats, were also analyzed for plutonium buildup.

Dow Responds

External response. Dow asked AEC's Health and Safety Laboratory (HASL) to examine contamination possibilities around the plant. By gathering 8" soil samples in 33 sites as far as 40 miles from Rocky Flats, HASL concluded that 2.6 curies of plutonium had been scattered close to the plant and an additional 3.2 curies was spread over 1,250 square miles to the east and north of the plant. (2 curies = 1 oz). This was generally in agreement with the estimates of CCEI, the Colorado Health Department and Dow Chemical Company.

The HASL Report suggested that leaking barrels were the cause of the distribution of plutonium in the east rather than the 1969 fire. The direction of the contamination was "incompatible with the winds direction of the day". Furthermore, plutonium was found 13 cm. underground. The HASL Report stated that barrels had been stored outside from 1958-1968 and that the leak had first been noticed in 1964 (News, August 20, 1970).

Internal Response. Dow Chemical Company used its employee newspaper, Dow Corral, to present its perspective and question the biased interests of CCEI (Post, April 5, 1970). It also developed a "Fact Sheet - Building 707" which was handed out during a family open house held at the plant. The sheet detailed the ways in which the new production building had many safety features which weren't in the old buildings (Post, January 10, 1971). The new Building 707 would increase Rocky Flats' production capacity by 50% as well as address environmental hazards and safety issues. The fires, the normal accidents, were addressed.

Air filters were improved. They were resistant to fire and water damage. Many fire detection and suppression systems were added to the production gloveboxes. Added compartmentalization of the building would guard against fire and explosions (Marketplace, May 7, 1970).

Labor Unrest

Rocky Flats wanted the families of the workers to see the safety of the new plant for work stoppages had plagued the construction of Building 707. There had been 12 walkouts in 1969. One kept 140 sheet metal workers off their jobs for more than a month (Post, January 14, 1970).

From June 28, 1970 through July, 2,000 maintenance production workers went on strike for higher wages. Three other workers were fired for "serious misconduct" after the strike had begun. Local 15440, International Union of District 50, Allied and Technical Workers of U.S. and Canada filed charges against the plant with the National Labor Relations Board (NLRB). The Board, however, refused to issue a complaint (Post, July 23, 1970).

Dow Chemical Company came under attack through testimonies presented before the Colorado Industrial Commission. A Rocky Flats worker was fired for "refusing assignment" to Building 776 where the 1969 fire occurred. Joseph Sykes, who had worked for 30 years in defense related industries, showed how he had accepted lower paying assignments rather than working in Building 776 even before the fire. The workers called the extra 10-15 cents received for working there, "hot pay". Sykes sought back pay and unemployment compensation.

Dr. Edward Martell of CCEI testified that he estimated that 100-200 lbs. of plutonium were involved in the 1969 fire. This estimate was developed from the \$20 million figure reported as the value of the unstable metal stored in the building (News, August 6, 1970).

Additional Fuel for the Controversies

Not only was Rocky Flats coming under increasingly intense criticism from CCEI, its workers, and local officials, but was not helped by contradictions between statements made before the House Appropriations Committee and to the public. While local managers claimed the plant was safe and created no environmental or health hazards, AEC presented a very different picture of the plant.

AEC sought \$88 million to "correct fire and safety shortcomings at the plant." The scope of the needs were the result of a safety survey of the plant by AEC's Factory Insurance Association and the Factory Mutual Research. They indicated that filters needed improving. Plutonium waste tanks were open and vented to the environment. The tanks had minute leaks (Post, January 10, 1971).

Before the Appropriations Committee, the 1969 fire was presented as a "near catastrophe." Rocky Flats was concerned about serious health and safety gaps of its outmoded, crowded and corroded operations especially as it entered the "biggest weapons program" in its history. The expansion would require \$355 million in addition to the safety requests. Major General E.B. Giller, AEC's Assistant General Manager for Military applications, described the hazards of the plant. He said that "some AEC plants have sufficient materials and heat-generating flammables in a day's operation" that if a major fire breaks through a building then

hundreds of square miles could be involved in radiation exposure and involve cleanup at astronomical costs and create a very intense reaction by the general public exposed to this. ...It is the dumping of radioactivity on homes, streets, cars, and clothes of people which would require cleanup.

It would require the pickup of two inches of soil, washing down homes, buying clothes and creating the possibilities of lawsuits even though no one would probably be medically sick. Explosion is not the major problem. This corroborated "portions of the preliminary report of the CCEI issued in January of 1970" (Post, January 10, 1971).

Rocky Flats local officials stressed the safety of the plant. Dr. Lloyd Joshel indicated that there had been 24.3 million hours of work in the plant without a disabling injury. That was the 4th best all-time record in U.S. industries. It was the best record in AEC facilities.

Environmental Monitoring Procedures

In other actions designed to reaffirm the safety of the plant, Dow reported exploring options for soil stabilization for radiation control (News, May 9, 1971). Stronger environmental monitoring procedures were developed both by Rocky Flats and by the Colorado Department of Health.

1. Air samples were taken 5 minutes of every hour at nine places throughout Colorado, especially in cities such as Boulder and Broomfield. An 8 hours high volume air sample was periodically taken at one of the stations.
2. Water sampling was conducted at 4 nearby reservoirs on a bi-weekly basis. Community tap water was monitored monthly. Streams and lakes were examined twice a year for gross alpha content (this is a plutonium radioactivity emission).
3. Vegetation was sampled semi-annually for uranium and plutonium.
4. Soil sampling of the surrounding area, remote areas, and lake sedimentation for plutonium and strontium-90 was conducted (News, April 10, 1970).

By the end of 1971 these monitoring procedures had been further strengthened. Air was then sampled in 12 locations up to 20 miles from the plant. Soil was sampled from 1-5 miles of the plant two times a year for analysis of plutonium content. The vegetation was also sampled two times a year, especially from plants eaten by cows. Water was cleaned in the plant's sanitary sewage system until it met drinking water standards. Then it was put in settling ponds. These fed into creeks leading to the Great Western Reservoir, which provided domestic water for the city of Broomfield, or into the Stanley Reservoir, which provided water for the city of Westminster. More than 200 samples of air, water, dust, soil and vegetation were gathered per month. The results were publicly available through the Colorado Department of Health (Post, November 17, 1971).

The Colorado Health Department also conducted full time surveillance of Rocky Flats. It conducted air sampling on and off the plant site 24 hours a day. It routinely sampled the water and plant sediments as well as having continuous soil sampling. Community drinking water supplies were also carefully watched.

These monitoring procedures lead Dr. Robert Siek, assistant director of occupational and radiological health of the Colorado Department of Health to claim, "at the present time safety considerations at the plant . . . are at an all-time high. It is one of the safest operations you can imagine" (News, May 13, 1971). Robert Siek and Peter Metzger, past CCEI president, suggested that the controversy over the safety of the plant and the public outcry which that generated were central to the increased cooperation and safety monitoring of the Rocky Flats plant (Post, October 18, 1970; News, March 17, 1972).

In September of 1971, the AEC started developing safety criteria for plutonium plants (Post, March 21, 1972).

Hazardous Wastes

Other problems emerged even as the safety and environmental hazards issues seemed settled. The first allegation came from workers who claimed that previously Dow stored contaminated drums and covered them with dirt. Other drums were sealed without being covered. Perhaps those drums could have leaked (Post, July 23, 1970). In July, CCEI charged Rocky Flats with improper burial of radioactive wastes. After the JAEC sent investigator

Colonel Seymour Schwiller, who had declared the plant safe, CCEI again charged that the waste disposal practices were in direct violation of AEC regulations. The charges included:

1. A large number of drums of oil and other machine tool coolants used in the processing of uranium and plutonium was stored in a field on plant grounds. While they were removed, leakage from the drums contaminated the soil. In 1969 it was covered with asphalt. A small amount of plutonium in the creeks was due to the soil from the drums. Plans were needed to dispose of the asphalt pad and contaminated soil.
2. Incinerator ash with contaminated plutonium was dumped near the original plant incinerator (Post, October 18, 1970).

Plutonium and uranium contaminated materials had been buried in 7 trenches since 1954 (ending in early 1970), stored above ground or put in sanitary landfills in 5 other sites on the grounds. The Colorado Department of Health learned about this in 1969.

Rocky Flats claimed to know it had burial sites, but it did not know what was in the barrels. Dow cooperated and dug up materials which had been buried between 1953-1958. One thousand four hundred barrels with 10% corrosion were removed in April and May of 1970. In 1971 Rocky Flats provided a "full inventory" of the material buried on the plant site (Post, August 7, 1983).

The Environmental Protection Agency (EPA) and AEC both monitored the contents of the landfills on the plant. There they found three radioactive materials: (1) Americium 241, was found by EPA only. Americium 241 is created through plutonium decay, yet no plutonium was allowed in the landfills. (2) A strontium 90 find was baffling for it was not used in the plant's operations. The State Health Department said 26 picocuries (pc) was found compared to 0-3 background amount. The maximum amount safe for drinking water is 100 pc. (3) Tritium (radioactive hydrogen) was "not discovered by Rocky Flats for its monitoring equipment was set only on alpha radiation," which is the plutonium radiation. Tritium has beta radiation (News, October 18, 1973).

Meanwhile the plant continued to convert radioactive wastes into solid wastes and ship them from the plant to east of Arco, Idaho, two weeks after the wastes were generated. Chemical non-radioactive wastes were shipped every six months (Post, July 10, 1973).

Political Responses to Environmental Risks

The State Health Department discovered tritium levels ten times "as high as it should be . . . but it was safe nevertheless," in Broomfield's water. The City Council of Broomfield sent a letter "demanding that the AEC immediately stop dumping radioactive tritium into its drinking waters and pick up the tab for cleaning up the reservoir."

AEC claimed there was no hazard in the amount of tritium that got into the reservoir. However, its "good neighbor" policy lead it to plan to build a pipeline that would take the radioactive tritium away from Walnut Creek, which feeds into the Great Western Reservoir and

Broomfield's water, to Rock Creek which feeds into the S. Platte River. While the pipeline would not take that long to build, EPA needed to approve the plan (News, November 8, 1973).

Health Risks

Health problems at the plant continued. In September, 1971, two men received radiation contamination due to a chemical reaction of a plutonium can. One was treated in the plant and the other chose to have an experimental "lung lavage" operation in New Mexico to remove any radioactive particles from his lungs (Sentinel, September 1, 1971).

More continued to be learned about the nature of plutonium during this period.

1. Plutonium is not found in nature. It is an artificially produced element. It is insoluble and toxic in very small amounts and that's what makes it a hazard... it clings to soil and is carried by dust. When inhaled, it clings to a person's lungs (News, February 11, 1970).
2. When inhaled, small particles of pure plutonium oxide are known to be one of the most potent lung-cancer producing agents in the world, claimed Dr. Paul Metzger, president of CCEI. This is based on AEC studies or on studies done by contractors retained by AEC (CCEI Report, Post, February 12, 1970).
3. The Rocky Flats employee newspaper claimed that there are no known cases of plutonium-caused cancer in humans although a few human have been carrying radioactive matter in their bodies for as many as 25 years. This statement was made by Dr. Chester R. Richmond, researcher at the University of California and the Los Alamos Science laboratory (Post, April 5, 1970).

The Post criticized both CCEI and AEC for not mentioning dose rates. Plutonium 239 oxide penetrates 2/1,000th of an inch into the human tissue. It is not soluble in water so it is eliminated in body wastes if ingested. If inhaled, it may be exhaled or stay in the lungs. There is no agreement about the effects of a small dosage on the human system. However, the National Academy of Science and the National Research Council recommend that all radioactivity be isolated from the environment (Post, April 5, 1970).

4. Dr. D.C. Hunt reported in an article in Nuclear Safety about the 1957 fire that plutonium is a man-made element which is insoluble and toxic in very small amounts. Airborne plutonium particles have an affinity for even the smoothest surfaces and readily become attached. Resuspension probabilities are small even for large surface amounts. Burning plutonium produces large, heavy particles that settle out rapidly near the area released (News, Mary 13, 1971).

Debates over levels and cancer effects developed more strongly during this period. Rocky Flats presented data indicating that the workers at the plant had lower rates of cancer deaths (52 per 100,000) than the average Colorado population (130 per 100,000) and than the

nation (162 per 100,000). Of the 18 known workers who died of cancer and the 52 who were still employed at the plant, about 50% of each group worked in a plutonium production building and 50% did not (Post, March 21, 1972).

In reporting on radioactive contamination of employees, only 3,750 employees were examined. Of those, 475 were carrying either some lung, body or a combination of lungs and body radioactivity levels of 3,000 millirems in any one quarter of the year up to 5,000 a year. This was enough to restrict their exposure to plutonium production processes (Post, March 21, 1972). However the cancer could not be conclusively linked to working at Rocky Flats.

A special Report on the Topic of the Day in the Denver Post listed radiation incidents which had occurred since 1957 at the plant. These events were reported in documents of the U.S. Atomic Energy Commission Division of Operational Safety for 1959 and 1971. Twenty incidents were listed. The last two were based on data from Rocky Flats itself (Post, March 21, 1972).

Changing Context

The population of the region increased and moved closer to Rocky Flats. In 1950, the population in the surrounding areas was 27,596. Many areas near there were NOT cities then. Just new cities had added 170,728 to the population by 1969. Between 1950 and 1969, the following growth occurred in adjacent counties and cities:

- * 25 % in Denver County
- * 357 % in Jefferson County
- * 256 % in Boulder
- * 2,117 % in Arvada
- * 91 % in Golden (Post, March 21, 1972).

The closeness of the population became an increasing concern. In 1972, Rocky Flats covered 2,520 acres. AEC asked Congress for \$8 million to buy an additional 4,640 acres as a buffer zone of 1-1.5 miles around the site (Post, March 21, 1972). In 1973, Congress appropriated \$6 million for the land and then another \$5.6 million in 1974 (Tribune, July 25, 1974).

Economic Contributions

While the environmental and health safety issues were the primary focus of this period of controversy, the economic benefits were not forgotten.

- * 1969, workers brought \$ 32.5 million into the Colorado economy
- * 1970, this went up to \$34.6 million
- * 1971, \$39.9 in payroll and \$67.6 in operating costs

The Federal Government had spent \$620.2 million for the operation of Rocky Flats plant over 20 years (Post, March 21, 1972).

There were 3,750 workers at the plant. This was expected to reach 4,000 as production increased (Post, January 10, 1971). Over 7,900 have been employed by Dow Chemical Company since 1953.

Dow Declines Management

The controversies of this period took its toll on the management of Dow Chemical Company and AEC. Since 1952 Dow had always renegotiated its 3-5 years management contract and no other companies submitted rival proposals. However, in 1973 other companies were invited to compete and three major firms sought the 5 year, \$350 million cost plus fee contract to operate Rocky Flats starting in July, 1975. Dow chose not to bid on the managements contract (Post, August 13, 1974; News, December 12, 1973).

Summary

The 1970 to 1974 period was a very controversial period for the Rocky Flats production plant. This was the period when "disillusionment" set in. The 1969 fire served as a catalyst which propelled scientists from the community, local political leaders, Rocky Flats workers, and state agencies to question and even attack the plant. Repeated discoveries of environmental contaminations, even though they were generally low, served to reduce the legitimacy of the management company which had for so long denied the existence of any environmental contamination. The company had to repeatedly take back its assurances of safety in light of the evidence presented by others. Finally it began to be more "open" about its operations and problems. But by then it was too late. The continual challenges to the winner of an industrial safety award made it no longer able to retain its management contract with the Federal Government for the Rocky Flats plant.

Phase IV - Open Door Approach (1975-1979)

July 1, 1975, Rockwell International took over the management of Rocky Flats through its Atomic International Division. Robert O. Williams Jr. who had experience as a director of a nuclear reactor project in Idaho became the general manager. Eleven top Rockwell International management veterans of various phases of nuclear reactor projects headed up the management team for Rockwell. William V. Habere became director of the production operations for Energy Research and Development Administration (ERDA) which followed the AEC (Post, June 19, 1975). There was thus a complete change in the leadership of the plant. The workers remained basically the same.

Rockwell entered its leadership period saying that "within the limits of national security restrictions" visitors would be welcomed to Rocky Flats by appointment.

We're going to make an all-out effort to acquaint the citizens of Colorado with advanced safeguards of plant operation and maintain continuing communication between the plant and the surrounding communities as a basis for mutual understanding and trust (Post, June 29, 1975).

Over 7,000 people toured the plant between 1975 and 1979. While Dow had been gradually opening up, Rockwell used this as the center of its relationship to the local communities. This approach was a strong counterpoint to a judgement placed on Dow soon after Rockwell took over - "the bulk of Dow's mistakes has been management errors of judgement and philosophy" (News, July 22, 1975).

"Truth and openness" continued to be themes of these years. In some ways the newspaper article entitled "A Review of Dow's Stewardship" reflected wiping away the old and creating room for the new.

Dow's management frequently attempted to conceal its mistakes over the years by lying to the public. . . . as more and more documents were released, it became clear that very few of Dow's public statements were true (News, "Trend", July 22, 1975).

Three examples of concealed mistakes were used in the article: (1) the 1969 fire was minimized by Dow. The Company did not want to check plutonium contamination outside the plant though smoke was seen on the roof. (2) Dow failed to report a tritium leak. EPA branded Dow and AEC as negligent. (3) While Dow discovered a leak to contaminated oil drums in 1959, it claimed to have discovered the leak only in 1968. Between 1959-1966, 5,000 gallons of contaminated oil seeped 86 grams of plutonium into the soil. In 1971 the area was blacktopped. In 1974 AEC discovered plenty still "blowing around" right next to the blacktopped area (News, "Trend," July 22, 1975).

Openness Leads to Disclosures

Rockwell public relations representatives talked about the production process and the plant in order to underscore the new philosophy of the new management. A nuclear reactor in South Carolina makes the 2.2 kg. "buttons of plutonium" by processing uranium. These are sent to Rocky Flats where several hundred kgs. of plutonium are molded, milled and shaped into primers which are then sent to other AEC locations for weapons assembly, reported the representative.

Candidly, Rockwell reported on safety problems of the plant. A May 19th accident exposed 10 workers to plutonium. Ten of the 5,000 plutonium handling operations were shutdown while 43 were chosen for closer safety review. Rockwell also reported exposure to 81 employees when a plastic disc with plutonium in it was dropped in an office area. The office and nearby cafeteria were contaminated (News, November 19, 1976).

Hazardous materials had been sent through Stapleton International Airport in Denver or through the Jefferson County airport in non-specialized flights since 1952. In 1975, Rocky Flats no longer shipped plutonium except for medical and national needs. Jefferson County Airport halted radioactive flights of ERDA (Post, May 5, 7, 1977).

Wastes Treatment

Safety and health continued to be themes of this period. Rockwell reported shipping 400 cubic yards of soil, which had been contaminated around the asphalt slab, to Idaho (News, June 12, 1976).

A plutonium waste-treatment plant was built for \$187 million. This would help recover a greater amount of plutonium from wastes and treat effluent for reuse at the plant site. Thus water would NOT be sent into water systems of surrounding communities. The incinerator arm of the plant would help reduce the solid wastes by 75% thus reducing what was shipped to Idaho (Post, February 5, 1978).

Health Risks

Cancer challenges continued. Studies examined the link between Rocky Flats' production processes and cancer. Researchers' findings were pitted against each other.

In October, 1973, Dr. Carl Johnson, director of the Jefferson County Health Department, found that people who lived downwind of the plant had a higher cancer rate than those living in areas which were not close to the plant. At that time he suggested that the cost of hospitalization, social services, lost income, sickness and premature death could easily reach \$2.2 billion if there were negative effects on the community (News, October 15, 1973).

A four year study conducted by Dr. James MacInroy for AEC examined body tissue of 111 people from the Denver-Boulder region and compared that to 220 people in 4 cities (two with and two without plutonium facilities). He found that people in the Denver region had more plutonium in their liver and less in the lungs, lymph nodes, vertebra, kidneys, and gonads, than the other subjects (Post, February 4, 1975). Dr. John Cobb of the University of Colorado Medical Center refined the study by determining where people had lived. He found that people who had lived near Rocky Flats had radioactive plutonium in their body tissue (News, November 11, 1978).

Dr. Carl Johnson then further refined his study by looking at 1975-1977 birth defects. He reported that the rate of birth defects in Arvada, closer to Rocky Flats, was 14.5 out of 1,000. In the rest of Jefferson County, farther from the plant, the rate was 10.4 out of 1,000 births. He then focused on "true malformations" and then at the types of malformations that had been related to radiation damage in infants - such as microcephaly, Down's syndrome, grossly deforming malformations, etc. He found that in every case Arvada had higher rates than the rest of the County (Post, October 31, 1978).

His study was criticized by the Nuclear Regulatory Commission, by EPA, by the Colorado Department of Health and by the Rocky Flats Monitoring Committee. The criticisms included problems with statistical errors, methodological errors, and no record of increased cancer in the lungs, bones, or liver - areas which in the past had been associated with plutonium radiation (Post, May 5, 1979).

Studies were conducted to determine if there was an increase in cancer in community residents, and among the workers at Rocky Flats. Rockwell Company was willing to claim that there were 40 cancer deaths among Rocky Flats employees from 1970-1975. The Company, however, was not sure of the figures from 1952-1969. The equivalent figures for the U.S.

during this period was 47 cancer deaths, and 36 for Colorado, according to the Company (Post, July 29, 1976).

In 1978, Rockwell reported that 70 employees had died of cancer between 1952 and 1977. This figure was based on 3,582 employees out of the 9,189 who had worked at the plant since 1951. During that time 5,607 or 61% had left the plant (Post, August 6, 1978). The workers were between 30-80 years old and 68 of them were males. The main type of cancer (23.7%) was of the digestive organs. Genital-urinary-reproductive cancers and cancer of the lungs were the second most prevalent types of cancers. Each type affected 22.6% of the workers who died from cancer. The fourth most prevalent type was brain tumors, affecting 11.8% of the workers. This is not among the top 8 types of cancers in national figures (Post, August 6, 1978).

In 1979 DOE agreed to fund a study of worker safety which would take 14-17 months to complete. Representative Tim Wirth had negotiated with DOE for over a year for the study. Wirth presented it as a "Review of the Future of Rocky Flats." This study was necessary because of significant fears and misgivings which continued about the presence of Rocky Flats in the Denver area (News, April 10, 1979).

Monitoring Strategies

Besides the continual monitoring of Rocky Flats by the Colorado Department of Health and the Jefferson County Health Department, Governor Richard Lamm and Representative Tim Wirth established a Rocky Flats investigation Task Force chaired by Robert Siek, Assistant Director of Colorado Department of Health. The Task Force came up with 59 suggestions in their final report including:

1. There should be an independent monitoring committee over all Rocky Flats operations.
2. The Federal Government should replace Great Western Reservoir with another water supply since this has been contaminated and can possibly continue to be so in the future.
3. Security should include defense against sabotage, terrorism, and theft.
4. Medical studies should be conducted of the short and long-term effects of exposures to low levels of radiation of all the plant's workers.
5. ERDA and Rocky Flats should give speedy, accurate, detailed information to the state, employees, and public about radiation conditions and accidents.
6. The buffer zone around the plant should be increased.
7. An emergency response plan should be developed for the area.
8. Federal standards should be established for plutonium and radioactive materials.
9. Federal government should subsidize the state to cover the cost of monitoring Rocky Flats. (Colorado State Health Department spent over \$100,000 a year to monitor the plant.)
10. The federal insurance of nuclear facilities should be replaced with private nuclear industry liability law.
11. State legislation should be developed for regulating and siting nuclear facilities.

12. The medical facilities and staff at Rocky Flats should be upgraded (News, October 15, 1973).

The Lamm-Wirth Committee also suggested that the risks of moving the plant might be greater than continuing the operation of the plant. That move would remove the safety systems which create barriers with the atmosphere. The Committee did recommend moving the plant or changing its production to an environmentally more benign process. It suggested that the negative impacts of the closure on the state and local economy would be negligible because the workers could be absorbed into other industries of the area (News, October 15, 1973).

Three years later, ERDA replied to the Lamm-Wirth Committee. ERDA claimed that the recommendations were met by the existing standards and procedures developed by Rockwell. It also disagreed with the basic conclusion that the plant posed a threat which justified moving it. It would cost \$2 billion and would take 10 years to move Rocky Flats (Post, April 2, 1976).

The Colorado Department of Military Affairs (DMA) and the Colorado Department of Health were to work on an emergency response plan with information given to them by ERDA and Rockwell International. The Rocky Flats Monitoring Committee pursued the issue (Post, March 27, 1977). This plan was completed in 1978 and the first drill occurred in 1980.

Environmental Risks

Environmental plutonium contamination was discovered by Dr. Carl Johnson after submitting 25 dust samples to radiochemical processes. The Colorado Health Department examined another 25 samples and additionally 42 samples were sent to a non-Colorado laboratory for analysis. Ten percent of the samples showed the presence of radioactive cesium 137 west of Rocky Flats. Landowners in Jefferson County brought a suit against the agency that sold them the land saying that it had misrepresented the land in 1972 (Post, April 10, 1976).

Later, Jefferson County Commissioners sought Dr. Carl Johnson's advice on whether or not to rezone for a proposed housing project near the plant. Dr. Johnson recommended against it saying the land was not safe. He also testified before the Colorado Land Use Commission about the contamination around Rocky Flats. Johnson's scientific procedures were heavily criticized, but national experts supported his procedures as being more expensive, but better than the usual procedures (News, May 6, 1977).

A year later the U.S. EPA agreed that homebuyers in the area needed to be told about Rocky Flats and about the emergency preparedness plans. The U.S. Department of Housing and Urban Development wanted EPA to take on that task. This became important as three housing developments were proposed near Rocky Flats - Silo and Sunstream subdivisions in Westminster had 2,500 units and the Walnut Creek Development near the Great Western Reservoir had 1,882 units. Those developments were 3 miles downwind from Rocky Flats. HUD was afraid that developers would drop Federal Housing Assistance mortgages if it insisted on having them follow EPA's suggestion. The concern was that warning homebuyers would depress property values in the area (News, May 10, 1978).

The plan was implemented. Persons who bought houses with FHA/VA bans within 10 miles around Rocky Flats between March 1979 and June 1982 received a "Rocky Flats Advisory Notice" or a "Rocky Flats Emergency Response Plan" (Stagl 1983).

National Protests and Rockwell's Response

While issues about Rocky Flats were debated locally and within and between national agencies, Rocky Flats was about to become more visible nationally. The first national protest against Rocky Flats was held in April, 1978. Grassroots sponsors (Rocky Flats Action Group and Mobilization for Survival) joined with religious groups (American Friends Service Committee and the Fellowship of Reconciliation) to call for closing Rocky Flats. Five thousand protesters gathered, from all over the United States, on April 29 and 30, 1978. On April 30th, 1978, as an act of civil disobedience, a continual sit-in on the Rocky Flats railroad began (News, April 30, 1978; Nuclear Reports, June 18, 1978). The Cactus Alliance, a coalition of anti-nuclear groups from five Western states was formed (Boulder Mobilization, July 25, 1978).

Sixty protesters, members of the Rocky Flats Truth Force, went to trial in November for trespassing and blocking the railroad tracks for at least 6 months. The defendants wanted to use a "choice-of-evil" argument in court and to move the trial to U.S. District Court in Denver. Neither was allowed by Judge Kim Goldberger (News, November 14, 1978).

The arguments raised by the five lawyer defense team was that the protesters acted out of a deep concern for the "hazards to the community." The trial served as a public platform to marshal expert witnesses who testified about the hazards created by Rocky Flats -

1. Dr. John W.E. Gofman, former associate director of Lawrence Livermore Laboratory testified that Rocky Flats has released between 1/3-1/2 lbs. of plutonium off the plant's site. Since plutonium decays in 1/2 every 24,000 years, it will be around in harmful quantities for 250,000- 500,000 years.
2. Dr. Anthony Robbins, director of the Colorado Department of Health, questioned whether one could trust the statements made by the Department of Energy about radioactive emissions and other problems at the plant. Officials knew about cesium, but didn't tell the Health Department.

Rocky Flats received plutonium shipments shipped through non-specialized private air freights carriers without telling airport officials or government entities.

3. Dr. Edward Martell said that he tested the soils around the plant to see if any plutonium had escaped the 1969 fire because the officials at Rocky Flats resisted testing. Although the official knew about the contaminated oil leaks, they said nothing until Dr. Martell's findings had to be explained.
4. Dr. John Cobb, professor of preventive medicine at the University of Colorado and a member of the defunct Lamm-Wirth Task Force said that the Task Force made 16 recommendations to improve plant safety and none were implemented. Health officials were misled or kept in the dark by Rocky Flats executives and federal officials (News, November 18, 19, 1978).

In March, 1979, Rockwell International began an aggressive public relations campaign by taking a multimedia presentation of "The Rockwell Story" on a tour of 68 cities around the country. The basic theme was that Rocky Flats was being run in a safe and economic manner (News, March 27, 1979).

A second major peaceful protest was held on April 28, 1979 and there were 10,000 - 15,000 there (Post, April 29, 1979). Two hundred men and women were arrested on April 29th for trespassing. Only arguments about trespassing would be allowed in court said the judges (News, June, 1979).

Summary

While Rockwell International experienced a brief honeymoon by having an open door policy and blaming the Dow Chemical Company's mismanagement for some of the safety problems, these strategies were insufficient to carry it peacefully through the first four years of its management.

Local scientific, political, and grassroots organizations had found their voices and their questions. Studies were conducted which indicated different perspectives on safety and on environmental problems. Monitoring functions and other safeguards were developed by local leaders.

For the first time, a local group suggested that the economic benefits of Rocky Flats were less than the environmental and safety costs. The costs were too great. Therefore the state appointed Task Force proposed moving or transforming Rocky Flats. National protest groups began having demonstrations protesting the existence of the plant and proposing its closure.

Phase V - Protest and Local Influence (1980 - May, 1989)

The 1980's were a time when protests became institutionalized. The Colorado political and grassroots leadership became more successful in influencing some of the practices of Rocky Flats. The claims of the local leaders and researchers began to be supported by national studies. The Environmental Protection Agency became more strongly engaged in the debates.

National Protest Activities

Yearly protests were held at the Rocky Flats plant. The rallies would last for one or two days with numbers ranging between 5,000 and 15,000 from all over the U.S. Peaceful acts of civil disobedience usually followed the rallies. The guards at the plant began to recognize and interact with those who regularly participated in the rallies. Arrests were made, fines were levied, and court cases were held. In the Spring the guards braced for the year's peaceful rally.

Health Risks

The cancer effects of plutonium continued to be examined in studies conducted by EPA, DOE and independent researchers. Results continued to be debated. A three year study

conducted by DOE on the health of Rocky Flats workers found that the cancer rates among the workers were similar to average cancer rates among all U.S. workers (News, April 14, 1985).

Tissue studies conducted by EPA and independent researchers seemed to confirm that people who lived closer to Rocky Flats had a higher degree of plutonium in their tissues than those living further away. Some cancer studies showed a similar association (Post, June 29, 1980; October 20, 1981; October 26, 1981; News, August 20, 1980; June 14, 1981). So the cancer question was examined but not resolved during this period.

Community Safety

Home-buyer alert. A Rocky Flats Advisory Notice was in effect from 1979 to 1982. Anyone buying a home with FHA mortgage effect insurance or other HUD assistance within a 10 mile radius was told that (1) emergency response plan would be used if radioactive material accidentally was released from Rocky Flats, and (2) soil in parts of the counties was contaminated with plutonium, though none in the areas of the residences. This advisory was ended in June 1982 at the recommendation of a Denver HUD regional administrator who resigned a month later. The administrator, who then became a developer, claimed to remember nothing of past conversations (Post, August 20, 1989).

Local Influence on Hazardous Wastes Control

A major disagreement between Rockwell International Corporation and community residents developed over the incineration of radioactive and chemical wastes. Hundreds of community residents showed up for hearings and shared their fears about the potential release of plutonium oxides over Denver (News, May 8, 1987). Rockwell feared running out of space for its wastes. Rockwell agreed to do a test-burn using non-contaminated materials. This agreement came at the request of Representative David Skaggs, who convened a group of independent scientists to review the incineration plans. Sierra Club brought a suit against Rockwell to prevent the burning.

After this, Rockwell ran a series of test fires using only diesel. Problems were uncovered with the test runs including fires that shot 6 feet into the air and melted an observation window and sprinkling systems which did not work (News, October 30, 1987). As a result of the tests, the incinerator was modified.

In 1986, the state gained the right to monitor the cleanup of mixed hazardous and radioactive wastes at the plant. DOE retained control over the high-level radioactive wastes and disposal programs in New Mexico (News, June 6, 1986). This came after several years of disagreement between the state and Rocky Flats officials.

State control of mixed hazardous and radioactive wastes came after the US EPA nominated Rocky Flats to the Superfund list of the nation's worst toxic waste sites. Five areas deserved Superfund listing, claimed EPA: (1) leaking waste points, (2) contaminated ground water, (3) landfill with radioactive and chemical wastes, (4) Walnut Cree, and (5) Stanley Lake (Post, May 26, 1986).

In 1986, 2,304 chemical and radioactive waste sources were identified at Rocky Flats, about eight times what the officials from the Department of Energy expected. Monitoring wells were drilled to watch for chemical and radioactive groundwater contamination (News, November 21, 1986).

Safety

A three year study was conducted by DOE on the health of workers also included an examination of the safety factors at the plant. The ability of the buildings and equipment to withstand potential earthquakes, tornadoes, plane crashes, etc. Specific suggestions were made to upgrade the facilities (Post, November 3, 5, and 28, 1981).

Several studies were conducted to determine what it would cost to move the Rocky Flats plant. The results were pretty consistent with the findings of the Lamm-Wirth Task Force. A study by Battelle Columbus Division for the Department of Energy concluded that the majority of the 3,800 workers at the plant would find other work. It would take ten years and cost about \$1.5 billion to move the plant. (Post, February 18, 1982). A 1985 study found that it would cost between \$1.9 and \$3 billion to move Rocky Flats (News, April 14, 1985). Both Governor Richard Lamm and Representative Tim Wirth have been in favor of moving the plant for years.

Summary

From 1980-1989 annual nationally based protests become part of the routine. The debates, however, continued over whether or not Rocky Flats increased cancer rates of its workers or of the residents around it.

Monitoring and disposing of the hazardous wastes became a key issue for this period. The state gained the right to regulate mixed hazardous and radioactive wastes at the plant. Political leaders, scientists and local residents strongly protested the disposal of wastes through incineration. The state worked with Rockwell to test the incinerator and to refine the process. Rockwell complied with the local pressures to pretest the incinerator.

Some Colorado political leaders continued to press for the removal of the plant from the region. Studies repeatedly confirmed that the economic loss to the region of such a move would be minimal. However the cost of clean-up, the environmental costs, would be very high and would take at least 10 years.

Phase VI - Federal Probe and Loss of Legitimacy (1989-1990)

Close Rocky Flats?

The Department of Energy presented a 2010 report on how to modernize its 16-plant nuclear weapons system. DOE would phase out Rocky Flats over 15-20 years and move its operations to another site. In this report, DOE acknowledged that suburban encroachment and the public's perception of risk were the primary reasons for moving the plant. Even an "insignificant" incident would force a shutdown of the plant (January 13, 1989). A coalition

of seven local environmentalist and citizen groups applauded this report citing the following reservations:

- * There should be no increase of plutonium reprocessing before phasing out the plant's operation
- * Current employees should be used during the cleanup at the plant
- * Independent researchers should be granted access to the medical records of nuclear weapons complex workers nationwide
- * Adequate funds should be earmarked for the cleanup (Post, January 7, 1989; News, January 7, 1989).

Six governors, who had nuclear weapons plants with serious environmental problems in their states, also wrote President Bush urging more funds for cleanup (News, January 29, 1989).

Before the end of the month, however, Rocky Flats announced the reopening of the plutonium-reprocessing building, Building 771. The building had been shut since October, 1988, when a safety inspector declared it not safe. A warning sign was covered by an electrical panel. Further inspection found 10 times more plutonium than desirable, though the levels were still within "safety range." Other problems included dangerously managed electrical safety and complacent attitudes (Post, January 20, 1989).

Safety

Bonuses. Rockwell International was praised for making major "safety cultural change" among its workers by establishing corporate and plant safety oversight groups. It developed an aggressive safety improvement program which would eventually make safety a priority at the plant. DOE contractors are awarded bonuses if they meet or exceeded production goals and recently, safety standards.

Weakness noted in Rockwell's annual evaluation included: additional improvements needed in safety programs; some leaks of contaminated wastes in storing cemented waste pond materials; poor quality laboratory analyses of environmental data; waste-discharge laws violation; and more control needed of air contamination in buildings (News, February 16, 1989).

Cleanup

DOE added \$5 million to the Rocky Flats; annual budget to cleanup Hillside 881. That area had groundwater contamination which was the "most serious problem" in the nation's nuclear weapons complex. The Hillside had 12 radioactive and chemical waste dumps and spills. It also had up to 400 tons of plutonium-contaminated soil from cleanup of the 1969 fire (Post, January 28, 1989).

Budget. Senator Tim Wirth accused the national administration of promoting popular projects such as the space station and the Superconducting Super Collider instead of focusing on the environmental and modernization needs of weapons facilities. He estimated that the TOTAL nationwide cost of building new weapons plants and of cleaning pollution at the existing facilities would be more than \$200 billion (Post, March 1, 1989). Soon after this, Dominic Sanchini,

manager of Rocky Flats for Rockwell requested \$395 million for building and equipment upgrades during 1990-1995. This was up \$65 million since 1980-1989.

This request was made when Rocky Flats' operating budget was \$388 million. New plutonium production had almost ground to a stop for 80% was gotten through reprocessing (Post, March 2, 1989).

Wastes

Disposal of the radioactive wastes continued as a problem. Seven railcars with 140 barrels of wastes were being kept in the plant and new wastes were stored inside buildings. Six governors asked President Bush to help break the impasse of nuclear waste disposal. Rocky Flats would be filled to legal capacity, again, in March. Waste could then be put in temporary storage areas for no more than 90 days without violating state waste laws (News, January 29, 1989).

The following month, Governor Andrus of Idaho agreed to accept two boxcars of wastes each month for six months. In September Idaho would again evaluate whether or not DOE was making enough progress towards preparing the Idaho waste disposal site for radioactive disposal. Rocky Flats created more than two boxcars a month (News, February 24, 1989).

Protest Activities

The Sierra Club was one of the earliest national groups to use the law against Rocky Flats. It sued Rocky Flats for not complying with state and federal hazardous waste laws in early February (News, February 2, 1989). By the end of February, it was testifying at a congressional hearing that DOE had deliberately understated the surface and groundwater contamination, especially at Hillside 881 (News, February 24, 1989).

In May, the Sierra Club sued DOE and Rockwell International Corporation to block use of "incineration for low-level radioactive and chemical waste" disposal. That month, the Sierra Club won a temporary ruling saying that a more complete study would need to be conducted before the incinerator could be used. DOE, meanwhile, argued that the incinerator was exempt from regulation, due to national security reasons, since it was primarily used for plutonium

recovery. Rocky Flats, however, began the study, that was quickly dropped when the "more pressing matters" occurred (News, May 20, 1989).

While the Sierra Club was using legal tactics, other protesters overstepped the law. Members of Evan Mecham Eco-terrorist International Conspiracy group were arrested by the FBI for planning to sabotage Rocky Flats as well as two nuclear power plants in California and Arizona. They had been cutting electric poles when they were arrested (Post, June 1, 1989).

Operation Desert Glow

June 10 Rockwell International took out an ad in the local newspaper inviting families of workers and other community members to tour Rocky Flats to learn about Rockwell and nuclear weapons plants. The ad boasted, "Rockwell International - Where Science Gets Down to

Business" (News, June 10, 1989). This advertisement was an ironic follow-up to events which happened on June 6.

Early that morning, over 70 FBI agents and several dozen EPA investigators descended on the plant in a convoy of cars. While telling workers not to disrupt their work, the investigators spread over the plant working around the clock to gather documents and to conduct soil, water and other pollution analyses (News, June 8, 1989). The U.S. attorney and other federal officials held a press conference the next day "to assure citizens that no new public health danger was involved" in the probe (News, June 9, 1989).

While the federal officials spoke up, local officials, including Colorado's U.S. Representatives, were frustrated about NOT being told much about the raid.

The Rocky Mountain News immediately took legal steps to unseal the search warrant. From the 116 page affidavit, it was clear that investigators were reviewing the plant activities back to November, 1980. This period was all under the management of Rockwell International Corporation. The allegations made by the U.S. Justice Department, were:

1. Illegal use of an outdated and unpermitted incinerator to treat at least nine hazardous or mixed wastes in buildings 771 and 776.
2. Illegal dumping of chemicals and experimental medical wastes into Walnut and Woman creeks that flow into drinking water supplies.
3. Concealment of environmental contamination.
4. False certification of federal environmental reports and unpermitted treatment of wastes (News, June 7, 10 1989; Post, June 10, 1989).

The laws involved in the probe included the "Resources Conservation and Recovery Act," "The Clean Water Act" and the "False Statement Statute." Each law carried fines for infractions (Post, June 10, 1989).

The plant had been under investigation for over a year. In December, 1988, FBI airplanes with infrared observation and photographic equipment flew over the plant three different times during nights and days. This technology noted heat from liquid discharged from the plant's sewage into the creeks. Higher than expected heat radiated from the incineration building (Post, June 10, 1989).

Federal investigators then put water monitoring systems right outside the plant's ground. These recorded "secret dumping of what appeared to be medical wastes" (Post, June 10, 1989).

The key figures under investigation were:

Earl Whiteman, former DOE area manager for Rocky Flats and assistant to Energy Secretary, James Watkins, in Washington D.C.

Raymond Romatowski, manager of DOE's Albuquerque Office in November, 1987.

Dominic Sanchini, Rockwells' manager for Rocky Flats, and J.E. Dorr, Sanchini's predecessor at Rocky Flats.

These were the people managing the activities of the plant when Building 771 was suppose to be shut down for lack of safety. They had publicly claimed the building was totally shut down.

These officers are also the ones who certified, in 1985, that the Rocky Flats groundwater monitoring system complied with Federal Law. This' however, was found to be false. Whiteman and other DOE officials "reclassified a number of wastes as nonhazardous, when in fact they were hazardous."

The affidavit provided another insight into the "cover-up" going on within DOE and Rockwell about Rocky Flats.

July 14, 1986: A DOE internal memorandum mentioned that Rocky Flats officials had been getting favorable treatment in the media rather than the bad press they might have deserved.

July, 1986: An internal DOE memo said that Rocky Flats was "in poor condition generally in terms of environmental compliance; its permit applications were grossly deficient." Some of its waste facilities were patently illegal.

On November 13, 1987; Romatowski wrote a memorandum to other DOE officials suggesting that the "agency should resist the efforts of environmental and public health authorities who were trying to clean up Rocky Flats.

Yet DOE backed Rockwells' claims about plant safety and performance by collaborating on making low waste estimates and making false statements about waste disposal at the facility (Post, June 10, 1989).

To the public and to federal and state regulators, Rocky Flats was presented as a safe, well-run facility. Rockwell's management rate was "excellent."

GAO Allegations

Rockwell's management rating of "excellent" and its health and safety standards rating of "very good" earned the company \$8.6 million in bonuses in 1987. In 1988, Rockwell was awarded \$4.9 million in bonuses but lost some of it because employees were making "toys instead of bomb parts" in a model shop (News, June, 1989).

The General Accounting Office's energy division was conducting its own investigation of the bonuses paid to plant operators. These bonuses were designed as "incentives . . . based on meeting production and delivery goals, staying within budget, meeting quality goals and environmental regulations" (News, June 9, 1989). This probe was started by U.S. Representative, Mike Synar, from Oklahoma in November 1988, because Rockwell made gifts for private use and billed the government.

State Health Department Allegations

During this same time, Colorado Health officials cited Rocky Flats for 25 violations of the Colorado hazardous waste regulations. The officials also emphasized that none of the violations were threatening to the public.

These allegations included:

- * inadequacies in groundwater monitoring
- * improper storage of hazardous wastes
- * mixtures of hazardous and radioactive materials
- * failure to keep adequate operating and inspection records.

Tom Looby, Health Department Assistant Director, said these violations raised 'serious concerns' about the ability of DOE and Rockwell to manage hazardous wastes at the plant (News and Post, June 8, 1989). This was the second time in two years that Rockwell and DOE had been cited by the state. While they had been threatened with fines, none had been collected (News, June 8, 1989).

Reactions to Operation Desert Glow

Issues of trust, credibility, and lying quickly surfaced in community reactions to the FBI Raid on Rocky Flats.

Colorado's National Responses. While Energy Secretary James Watkins briefed key Senate and House members "to stem a congressional backlash against the Department before it could begin," Colorado representatives had strong words about DOE.

It's clear we've been lied to year after year . . . there is clear collusion between Department of Energy officials and Rocky Flats officials . . . plant officials who are criminally involved must be removed immediately.

- Senator Timothy Wirth

DOE and Rockwell have done little to deserve the public's trust and confidence. Credibility here is a critical value. . . DOE is very short on it these days. They can't afford to squander what they have.

- Representative David Skaggs

Generally, there was shock and anger as more information was gained about Rocky Flats (News, June 7, 1989).

Colorado Governor. Romer repeatedly expressed anger and dismay at the FBI probe. He said that the plant should be shut if it couldn't meet health and safety criteria. He lashed out at DOE and Rockwell calling it "ridiculous" for one agency of the government to be investigating another. He also lambasted sloppy mismanagement (Post, June 10, 1989).

By June 11th, the Governor was calling for firing bad operators at Rocky Flats. "But you just can't go on not trusting anybody in federal government" (Post, June 11, 1989). His

answer was to install more monitors and tighter quality checks, including giving greater access to health officials.

City Leaders. Arvada leaders were surprised and disappointed with the FBI probe. But they claimed that their water was safe, because it was monitored by the city. Also, real estate developments were protected by environmental and safety tests (News, June 8, 1989).

The Broomfield city manager immediately ordered diversion of the Walnut Creek water from its water supply. EPA almost immediately said that the city didn't have a permit to do so (News, June 11, 1989). EPA regional director, Jim Scherer, said, "This is just what I feared most. . . it's what the people will think. People have a hard enough time believing us already when we tell them we don't believe any new public health hazards exist out there." (News, June 11, 1989).

Community Residents' Responses. One resident said, "they've lied to us for years, I guess they have to lie every day simply to stay in business. If they ever told the truth the public might not stand for it" (Post, June 10, 1989).

The choice between health hazards and lost jobs in the Broomfield-Louisville areas was a major dilemma. In a working class bar, reporters spoke to the patrons:

Keep it open but use tighter controls, said two patrons. One claimed that the fuss was all political. It was blown out of proportion. I've lived 4 miles from Rocky Flats for 20 years and it doesn't bother me (Post, June 10, 1989).

A week later, area residents were more cautious. Local residents didn't like the negative stigma being attached to their communities. Feelings of anger and of being scared were expressed by several Broomfield residents. A sense of loss of trust and the unfairness of not being able to trust those who were responsible for their safety was a common theme. Buying bottled water and no longer laughing at "glow in the dark" jokes were common responses. Cancerous friends and relatives were remembered.

The stigma attached to the community had already done economic harm- especially to real estate deals, claimed community members. Business owners feared reduction in customers in the areas (News, June 18, 1989).

These events happened at a time when Secretary of Energy James Watkins was trying to rebuild confidence in DOE. That agency had been charged with mismanaging the nation's weapons system for years (Post, June 10, 1989).

Workers' Responses. The source of the probe was unclear. The News reported that two former employees were the source of information for the FBI probe (June 10, 1989). Plant employees contacted the FBI a year ago about their safety concerns, reported the Post. In May, 1987, both EPA and FBI simultaneously got calls about safety concerns at the plant (News, June 10, 1989; Post, June 8, 1989).

FBI agents set up telephone hotlines in Denver which received more than 100 calls within 24 hours about events at Rocky Flats. Most calls were from people with first hand information about the plant (News, June 16, 1989).

The United Steelworkers of America Local 8031 was the largest union at Rocky Flats. For years, it had fought to increase safety and environmental concerns. The past year they had praised Rockwell for showing more safety concerns than in the past (Post, June 8, 1989). While

Jim Kelly, liaison for the Local 8031 was not surprised by the investigation, he was annoyed at the timing . . . for things had begun to improve.

He reported that the workers were "taken aback by the suddenness of it all" and were wondering what would happen (News, June 8, 1989).

Legislative Responses

Representatives Pat Schroeder and David Skaggs introduced a amendment to the 1990 Defense Department budget requiring that employees who had worked for Rocky Flats would get first preference for cleanup jobs if the plant were forced to close (Post, June 16, 1989).

Later, Representative Pat Schroeder introduced legislation into the House which "would extend to defense-contractor employees the same job protection that government whistle-blowers enjoy." This was to help prevent managers from retaliating against their employees (Post, August 9, 1989).

Representatives Pat Schroeder and David Skaggs addressed the bonus issue by having the House Armed Services panel adopt an amendment requiring DOE to emphasize safety and environmental compliance in calculating bonus pay to its nuclear weapons plant contractors. Also, DOE was to see if the bonuses received by Rocky Flat from 1981-1988 were awarded under "fraudulent circumstances." If they were, the bonuses would have to be returned.

Representative David Skaggs introduced legislation that would prevent DOE from paying fines its weapons contractors might incur by breaking state or federal environmental laws (Post, June 16, 1989).

DOE Responds

Bonuses Frozen. The following day, DOE froze between \$4 and 5 million in bonuses for the plant operations between September 1988 and March 1989. Energy Secretary James Watkins sent a letter to Rockwell chairman, Donald R. Beall, expressing concern about Rocky Flats saying that "we are not in a position to produce at all unless and until we are in a position to meet all environmental, safety and health requirements" (News, June 17, 1989). The letter also said that DOE would consider "any violations of environmental laws at the plant as a breach of contract." A "new culture of professionalism in operating the Rocky Flats plant" was needed, claimed the letter (Post, June 17, 1989).

Health Records. DOE agreed to make public health records of 600,000 Americans who had worked at nuclear reactors and weapons facilities. They would be available to independent qualified workers. DOE set aside \$4.5 million for a national repository for "all epidemiologically relevant information on DOE workers" (News, June 24, 1989; Post, June 23, 1989).

External Monitoring of Rocky Flats and DOE

In 1988 a Defense Nuclear Safety Board panel was created to watchdog DOE. DOE had been resisting giving more oversight power to states or other groups. Local DOE officials and the managing corporations needed to be more competent managers, claimed DOE.

The Rocky Flats Environmental Monitoring Council had been established in Colorado. Melinda Kassey, senior attorney of Environmental Defense Fund and member of the Council, claimed that "secrecy around the plant activities makes citizen oversight impossible" (Post, March 2, 1989). While Resource Conservation and Recovery Act permits were developed to help monitor nuclear weapons plants, it was hard to respond to a draft Act without more information. Those permits would give "state and federal environmental agencies tighter control over cleanup of existing waste sites and authority to regulate waste-producing processes at the plant." November, 1989 would be when the Act was scheduled to be implemented.

The state therefore tried to get more information from unclassified controlled nuclear information generally only accessible to DOE approved persons (Post, March 30, 1989). After the FBI probe, the Assistant Director of the Colorado Department of Health was disturbed. "For years local officials have been forced . . . to trust the Energy Department and Rockwell." This event simply made it clear that if those two wanted to do something and cover it up, it would be very difficult to find out anything (Post, June 11, 1989).

State health officials and EPA had been prepared to issue a permit for hazardous waste management to the plant. This would make Rocky Flats the first nuclear facility in the nation to complete the process of obtaining permits regulating waste management.

The FBI probe of Rocky Flats increased Senator Tim Wirth and Representative David Skagg's determination to establish an outside agency to oversee the Energy Department's management of weapons plants.

Meanwhile, Governor Roy Romer and Deputy Secretary of Energy, Henson Moore announced a joint plan between DOE and Colorado to monitor Rocky Flats. DOE would give the state \$730,000 immediately and then \$1.8 million a year to strengthen the state's monitoring mechanisms for:

- * Increased testing of the water of various cities
- * Inspection of incinerator for safety before start-up
- * Continuous air emission monitoring
- * Quicker clean-up of past disposal sites that might spread contaminants
- * Greater access to the plant by state and federal health and environmental officials
- * DOE was to pay \$700,000 for the first year of a health study of residents near Rocky Flats to determine plant effects on their health (News, June 17, 1989; Post, 24, 1989).

Secrecy Dismantled

Rockwell began running Rocky Flats under an "open door" policy. The most explicit analysis of the processes conducted at the plant were presented June 11, 1989. A drawing described the process. Plutonium was shipped to Rocky Flats, cleaned with acid baths and high voltage charges, then the wastes were either shipped away, incinerated or treated in sewage ponds leading into Great Western Reservoir or Standley Lake.

Two to four tons of plutonium passed through Rocky Flats each year. Most of it came from old nuclear warheads that had been stockpiled 20 years or more, from Amarillo, Texas. Some of the stockpiled plutonium decayed into americium.

Plutonium was recycled in Building 771. It was one of the oldest buildings and was suppose to be replaced by Building 371 in 1981. However, Building 371 never was used because of design flaws. Once the filtering process was completed in Building 771, the plutonium was taken to Building 707 where it was machined into softball-sized spheres which served as warhead triggers. They were then placed in radiation-proof containers which were sent back to Amarillo. There they were assembled into warheads. The triggers explode to create more energy which then splits the uranium atoms exploding warheads (News, June 11, 1989).

Health Risks

Potential Health risks to the workers and the community from Rocky Flats would come from:

- * plutonium - dangerous when inhaled or in the body; linked to brain tumors and cancers
- * solvents - used to clean equipment and machinery; linked to cancers and birth defects
- * dioxins - produced when some chemicals were heated or incinerated; linked to cancers.
- * heavy metals - when discharged into water could kill aquatic life (News, June 8, 1989).

The Denver Medical Society, representing 1,200 Denver physicians, called for Rocky Flats to be shut down immediately until an independent safety review board could make sure the plant was run safely and legally. The Society had "lost confidence" that DOE and Rockwell could protect the workers and residents from the tons of wastes produced at the plant annually. The Society was generally a conservative organization that stayed out of public issues. It decided to make a statement after the FBI raid on Rocky Flats.

Governor Romer was not pleased. He invited professional groups to work with his office before making "flamboyant press releases" (News, June 18, 1989).

Wastes

Thousands of waste streams were created at Rocky Flats as part of its operations. These added up to 23 million pounds of solid hazardous waste and 138 millions gallons of liquid toxins in one year. In 1988, Rocky Flats reported discharging 331,000 pounds of industrial solvents and coolants into the metro area's air. It discharged 64,180 pounds of sulfuric and other acids. It could burn up to 763,080 pounds of waste a year. These wastes were allowed by state permits (Post, June 11, 1989).

Environmental Risks

A May, 1989 DOE report suggested that Rocky Flats facilities would be damaged in the event of an earthquake. The plutonium facilities were being upgraded to withstand earthquakes and high winds (News, June 16, 1989).

Economic Contributions

The plant continued to be a regional economic boon. Average employee salary was \$48,000 for the 6,000 employees. The total plant payroll was \$217,784,000 in 1987. About 94% of the plant's Colorado vendor purchases were from area firms generating the equivalent of another full-time job in the region. The plant's total economic contribution to the area totaled nearly \$640 million and \$685 million to the state (Post, June 11, 1989).

Post-Shock Local Responses

Community Developers. Real estate developers wanted Arvada to annex the first phase of 18,000 acres next to Rocky Flats. The developers only wanted to be responsible for contamination of the property up to two years rather than for a long time. Developers claimed that the media had "blown [dangers] out of proportion" while environmentalists were against the annexation (News, June 24, 1989).

Workers' Responses. There were 5,227 Rockwell employees at Rocky Flats. They were, on the average, 41 years old and had been working there for 9 years. About 20% were women. Twenty percent held less than a Bachelor's degree. Sixty percent had a bachelor's degree. Fifty percent of the workforce was unionized. The largest Union continued to be United Steelworkers of America.

Workers said Rockwell began to place a greater emphasis on safety since 1986 when Dominic Sanchini became plant manager. Union pressure also helped management to take safety more seriously, claimed the workers.

Radiation monitoring occurred several ways. Workers received an annual physical on their birthdays. They were also monitored for radiation when they left Building 771. Usually the radiation was on the clothes. Once clothes were changed, workers generally were fine.

Employees described themselves as "patriots who believe nuclear weapons have helped prevent World War III." They were feeling the suspicions of their neighbors and families more strongly since the FBI raid (News, June 25, 1989).

Water Companies. Companies took advantage of the events at Rocky Flats. Thirty-two "cease and desist" orders were served against companies trying to scare citizens into buying their water or filters (Post, July 9, 1989).

City water was regularly tested by city chemists, and Colorado Department of Health and Rocky Flats officials. Broomfield developed 150 tests of the water in response to public concerns. If the radioactivity in Broomfield's water exceeded 50 picocuries per liter, then the city switched to Denver water supply while the problem was investigated (News, July 23, 1989).

Protesters. At the plant's location, 4,200 anti-nuclear demonstrators protested. Another 200 protestors showed up at the state Capitol urging that the plant be closed (Post, August 7, 1989).

On September 2, members of Greenpeace gathered at Stapleton Airport to demand the closing of Rocky Flats. The twenty protesters greeted tourists in radiation suits (News, September 2, 1989).

Wastes

DOE considered getting the Rocky Flats incinerator permitted and operational to get rid of 27,000 gallons of low-level mixed wastes at the plant (Post, September 2, 1989). The Colorado Department of Health and EPA agreed to allow the plant to stay open as long as its managers developed a waste treatment, storage and disposal plan for the wastes (News, September 16, 1989; Post, September 16, 1989). The agreement gave DOE one year to figure out how it could treat and store liquid radioactive wastes.

Rockwell's Performance and Reward

Rockwell's management evaluation was rated as excellent or very good in 19 of 21 reviews done by DOE from 1979 to 1989. This totalled \$49.2 millions in bonuses. The criteria emphasized production over environmental concerns. The new criteria developed by Secretary of Energy, James Watkins, made 51% of the performance criteria based on environmental, safety and health concerns.

Most of the bonuses were given when Rockwell improved manufacturing operations. Some of the bonuses were for less traditional reasons, such as promoting a ride-sharing program; creating positive tone for the plant in the media; for handling protests without any problems.

Bonuses were given even when there were clear environmental problems. In 1986, the company was given a bonus while EPA was fining Rockwell \$111,000 for violating federal PCB contamination standards. In 1988, general management was rated "very good" while there were 85 safety problems at the plant (Post, January 7, 1990).

Rockwell's Defense

Most of Rockwell's business focused mainly on aerospace and electronics. Although Rocky Flats was only a small part of its operations, over 50% of its 1988 contracts were with the U.S. government. The FBI probe did not hurt Rockwell's stocks (News, June 20, 1989).

Locally, Rockwell sent a letter to the surrounding communities and to the state health department requesting their water quality and soil contamination records since June 6, 1989 (Post, June 22, 1989).

Rockwell finally blasted the news coverage of the FBI probe. They blamed the government saying that they "deeply resent the way in which the government has created a strong perception on the part of the public". . . that they did not act responsibly (Post, September 8, 1989).

Two weeks later, Rockwell sued the Federal government claiming that it could not fulfill its contract with DOE without violating laws enforced by the U.S. EPA and the Justice Department. It wanted protection from prosecution for storing hazardous and radioactive wastes at the plant since there was no legal method of disposal. Also, it wanted to store residue containing recoverable plutonium, which the state classified as illegal wastes.

The Justice Department reserved the right to prosecute plant employees for past environmental violations, for making false statements, for perjury and for obstructing justice (Post, September 22, 1989). However it was willing to talk.

The following morning, DOW invited EG&G Inc. to manage Rocky Flats.

Rockwell's Farewell

Rockwell wrote an "open letter" to the people of Colorado defending its management of Rocky Flats.

We believe the people of Rocky Flats have performed their obligations responsible and honorably. We also believe that we have managed Rocky Flats with proper concern for public health, safety and the environment.

The important questions demanding public attention were: (1) What are the roles of various states and federal agencies with regard to environmental aspects of nuclear weapon plant operations? (2) How should DOE's budget be allocated between production and other priorities? (3) Should there be independent oversight of DOE plant operations? These need to be answered in a coherent national policy. The letter closed with best wishes to the new management company (News, January 3, 1990).

Phase VII - Cleanup and Start-up (1990-1991)

A third company was invited to manage Rocky Flats. "National security" secrecy was no longer central, but cleanup expectations dominated.

EG&G: New Management Contractor

EG&G company chairman was invited to manage Rocky Flats. About 30% of its business was DOE related work. It sought expanded involvement in long-term government contracts.

The company had 152 businesses making different types of equipment including instrumentation for underground nuclear tests (September 23, 1989).

Its early statements were similar to those made by Rockwell when Rockwell took over Rocky Flats. There would be greater emphasis on safety and environmental cleanup. The biggest problem was public suspicion of the plant (News, September 28, 1989).

Yet the times and laws had changed. In the 1950's the Price-Anderson Act gave companies broad protection. If someone was injured in an accident or the contractor was negligent, the government would pay. In 1988 the Act was amended to penalize companies for

safety violations. DOE proposed fining plant operators up to \$100,000 a day for continuing problems (New York Times, December 3, 1989).

Reactions to EG&G

Community Members. The Arvada city manager said that the replacement of Rockwell was not the central issue, but rather dealing with wastes. This latter problem was not solvable. Sierra Club members and other activists had similar reactions (Post, September 23, 1989).

Workers. The workers expected to be retained under the labor contracts they had already signed. Union members had developed a working relation with Rockwell, in the last three years, after having had numerous disputes over safety issues. "I'm not sure that replacing Rockwell is the answer. I'm reasonably sure that it's not. I am also sure that DOE has been the problem and found a scapegoat," exclaimed Jim Kelly, national staff person for the union and retired Rocky Flats employee (News, September 23, 1989).

Many workers were still angry at the FBI investigation and didn't want to accept the fact that Rockwell was breaking its contract.

Cleanup

Rocky Flats plant was added to the Superfund cleanup list. For the first time this made DOE responsible for cleaning up any contamination that spread off the plant site. This also required more public meetings and hearings on the cleanup programs (Post, September 29, 1989).

A DOE team of experts that reviewed Rocky Flats in June and July concluded that there was inadequate knowledge of the extent of pollution at the plant because old, inaccurate equipment was used. There was also poor quality lab analyses. The team recommended using new equipment, keep it calibrated, and training its users (News, October 5, 1989).

They also found that wells used to monitor groundwater pollution were inadequate. Rocky Flats officials reported upgrading the wells when they actually had not done so. Also, the waste generated by Rocky Flats had not been accurately assessed since 1987 (Post, October 7, 1989).

Environmental Risks

Officials diverted water from a holding pond into ditches so it would go around Standley Lake. Eventually the state wanted all water to be diverted from community drinking sources (News, October 5, 1989).

Wastes. Energy Secretary James Watkins said he would ask seven states near Denver to store radioactive wastes temporarily until a more permanent site was opened. Each state was to accept seven boxcars loads.

The locations chosen were primarily DOE weapons system sites. However, governors in the states reacted negatively. Washington, South Carolina, Tennessee, Nevada, New Mexico, all refused to accept wastes that were not theirs - and to protect DOE. Even the Defense

Department refused the materials. As of September 1, Idaho refused to accept any more of the wastes (Post, October 6, 1989; News, October 17, 1989).

Affected Workers

Widows. Widows of six workers of Rocky Flats sued Rockwell. Two widows won their cases, two lost, and one case was settled for \$11,000. The three cases included widows of Downing, Gabel, and Schamper. James R. Downing's body had 398 times as much plutonium in his lungs and lymph nodes as an average person living around Rocky Flats. He died of esophageal cancer at 44 years of age. He was a machinist in building 771, 777 and 776 where plutonium was processed. Mr. Downing got burns on both hands when a plutonium fabrication machine caught fire. Plutonium handling gloves ripped contaminating his hands and arms. He also inhaled plutonium when a box caught fire (Post, September 7, 1989; New York Times, November 18, 1989).

Mr. Donald Gabel was a janitor in Building 771. He worked within six inches from a radioactive pipe which said "do not loiter" next to it. He was often in accidents that exposed his face, heads and hands to radiation. He died of brain cancer at age 31.

Mr. John A. Schamper died at 58 of lung cancer. He was injured or contaminated at least 40 times. He absorbed 52.298 rems of radiation during his career at Rocky Flats - one of the highest radiation doses recorder there.

In every case, Rockwell refused to settle out of court. It spent much money defending itself (Post, November 20, 1989).

Whistleblowers. Two engineers testified before a House Committee in 1987 that a model shop, which was suppose to design weapons and produce prototypes, was being used to make jewelry and many lavish gifts. The three engineers who presented written testimony were repeatedly harassed and threatened by Rockwell and DOE officials. One was assigned to work in an area of the plant with high radiation and poor ventilation. He was also refused staff and technical support for his work. The engineers were told their security clearance would be removed. One engineer resigned (News, October 5, 1989).

Dave Navarette, one of the three, took an early retirement because of the harassment. He was being passed over for promotions and important assignments. He found that many of his friends deserted him. He lost his marriage and moved around many times before finally getting rehired elsewhere (The Camera, November 12, 1989).

Safety

Safety checks were instituted at Rocky Flats after the FBI raid. Monthly reports were made of employees' behavior which violated safety rules (Post, August 31, 1989).

In October, an independent inspector reported finding several pounds of radioactive plutonium in the ventilation ducts at the plant. This potentially could created a "criticality accident." These accidents could happen if the plutonium were concentrated enough, or if it came in contact with water or a person (News, October 7, 1989; Post, October 7, 1989).

Shutdown at Rocky Flats

DOE reported that it was temporarily shutting down the plutonium buildings at Rocky Flats for a plutonium inventory. This would also help the transition to EG&E giving the new company time to clean up the operations and address safety and environmental concerns raised by the state (New York Times, November 30, 1989; News, November 30, 1989; Post, November 30, 1989; December 1, 2, 1989).

A National Research Council report to DOE recommended that Building 371 at Rocky Flats should NOT be updated. The nation did not need more plutonium for its weapons. The report also proposed that the health, safety and environmental protection be increased at Rocky Flats (Post, December 21, 1989; News, December 21, 1989).

Workers' Health Risks

Berylliosis, an incurable lung disease caused by an allergic reaction to beryllium, a lightweight metal used in nuclear and aerospace industries, was discovered among Rocky Flats workers. The disease was discovered by physicians running a medical study for DOE and the National Institute of Health. About 30% of all people who contracted the disease usually died from it.

Ventilation systems and safety training programs were developed for workers who worked with beryllium. The first case was discovered in 1984. National EPA administrators refused to classify beryllium as a hazardous substance when Denver EPA requested that classification (Post, January 14, 1990).

So far 391 of 750 workers exposed to beryllium were tested. Eighteen had the disease. DOE requested that other workers be tested for berylliosis across the country. The Rocky Flats union leaders and Representative Pat Schroeder requested that the initial research findings be distributed to past workers as well (Post, January 17, 1989). In May, DOE announced plans to check 2,000 current and former workers for berylliosis (News, May 18, 1991).

DOE transferred the responsibility for studying the effects of radiation on workers to the Department of Health and Human Services as requested by Congress, labor unions, and communities near weapons plants. These groups had long remarked on the inherent contradictions of having production and the health and safety of workers as central concerns of the Department. President Bush also nominated a health physics expert as assistant energy secretary for environment, safety and health (Post, March 28, 1990).

The state health department, with DOE, developed a study of community health risks associated with nuclear power plants. A Rocky Flats Health Advisory Panel, chaired by Ellen Mangione, Director of Disease Control and Environmental Epidemiology at the state health department, would oversee the study (Post, September 27, 1990).

Environmental Risks

Colorado imposed the state's strictest pollution limits on two creeks that run through Rocky Flats. The creeks were designated "drinking water." They had to meet standards that

were 100 times more strict than statewide standards for toxic and radionuclides (News, January 4, 1990).

A year later, DOE gave \$10 million to officials of Broomfield, Westminster, Thornton and Northglenn to divert water from Rocky Flats' holding ponds away from the two reservoirs serving the cities. While DOE repeated that there were no dangers at this time, accidents could happen in the future (News, May 18, 1991).

Cleanup

Budget. Congressional representatives of the Defense Nuclear Facilities panel of the House Armed Services Committee toured Rocky Flats. They emphasized the difficulty of finding \$100-\$200 billion needed to clean the whole weapons system (News, January 17, 1990). These were continued visits of officials and technical experts who usually claimed there were many problems, a lot of money and time were needed to fix them, public health was not threatened, and things were getting better (News, January 21, 1991). Action rather than talk was needed!

Plan. EPA, Colorado Department of Health and DOE signed a plan setting deadlines for DOE to clean the soil and groundwater contamination in four areas at Rocky Flats. Public information sessions were held about the agreement. Scientists claimed the biggest problems were hazardous chemicals and that groundwater needed to be protected first. Residents worried more about radioactive materials and chemicals seeping to the surface at the plant. So, surface water near plutonium-tainted barrels were to be cleaned sooner than anticipated. Hillside 881, where workers dumped solvents and degreasers with poisonous chemicals, would be cleaned first (News, January 23, 1991).

Cleanup at Hillside 881 was halted because adequate records were not being kept and air pollution was not properly monitored. EPA and Colorado Department of Health officials requested the shutdown when they could not find any records on the cleanup project (News, March 29, 1991).

Workers and Community Residents' Lawsuits

Two mammoth class-action lawsuits were filed against Rockwell International and Dow Chemical Company by Rocky Flats workers (10,000 former workers and 300 current workers) and 50,000 community residents living within six miles of the plant. The worker lawsuits was filed by several trade unions, and the residents' lawsuit was filed by long-time residents and property owners of the area. The lawsuits sought:

- Independent study of health risks posed by the nuclear weapons plant
- Economic damages of \$250 million for property devaluation
- \$300 million for other damages.

Workers also claimed that stigma of their past employment prevented them from finding new jobs or health insurance (News, January 31, 1990).

A year later, U.S. District Judge Lewis Babcock ruled that the employee lawsuit should be heard under the Colorado Workers Compensation law. The law did not allow employees to sue a boss in order to study whether their workplace put them at risk for getting ill (Post, February 2, 1991).

Whistleblower. Former engineer, James S. Stone, filed a lawsuit in July 5, 1989, which was sealed due to the grand jury investigation into Rocky Flats. Stone's lawsuit alleged "wrongful conduct consisting of false records or statements, conspiracy to defraud the government, concealing of deficient deliveries of property and inducing the government to pay billions of dollar in violation of the False Claims Act." Stone was principal engineer in the Utility Design Department. He worker for Rockwell from November 1980 to March 17, 1988 (Post, November 14, 1990).

Renovation of Building 371?

DOE wanted to renovate Building 371, which cost over \$230 million to build and had never worked. DOE argued that this would cut the waste production of the plutonium process by 70% and cut worker exposure to plutonium by 50%. A Plutonium Recovery Modification Project would be built as an annex to Building 371. It could be used to decommission nuclear weapons and decontaminate equipment when the plant was closed.

Environmentalists and politicians proposed using the \$500 million to cleanup Rocky Flats and to prepare for dismantling, rather than extending plutonium production into the future (News, February 7, 1990; Post, February 7, 1990). Contrary to this position, DOE's congressional budget request for 1991 argued that the \$500 million was necessary to recycle plutonium for weapon production for 20 more years.

EG&G announced that plutonium operations would resume between April 1 and June 30th (News, February 24, 1990; Post, February 24, 1990). DOE approved EG&G's plan to restart plutonium-processing operations. The plans were made available for community review (News, March 10, 1990).

Both the House and Senate Armed Services Committee panels rejected DOE's request for funds to build the addition to Building 371. That request was opposed by Colorado's Representatives and Senator Tim Wirth as well as Governor Roy Romer (News, July 28, 1990).

The following year, the Department of Energy's 1992 budget request described serious problems with key fire alarms and radioactive safety monitors at the plant. This was contrary to the safety picture that EG&G had been painting. Representative David Skaggs asked that the Rocky Flats oversight committees examine the budget request to see if "problems" had been overstated (Post, April 27, 1991).

Restart Plutonium Processing

Building 559 would be the first building restarted in bringing Rocky Flats into plutonium processing. The Albuquerque supervisory office determined that Building 559 still had too many problems. Air ducts loaded with 28 kilograms of plutonium were cleaned in 1991. The problem had been identified a year earlier (News, March 29, 1990; Post, February 2, 1991). The plutonium had accumulated due to worker behavior. As filters became clogged and

automatically closed down operations, workers had punched holes in them so the air could pass through. The plutonium in the air attached itself to exhaust ducts or to other filters (The New York Times, March 29, 1990).

DOE suggested that it would be necessary to start up the plant in order to get rid of scrap plutonium rather than let the scraps lie around. The plutonium could then be stored safely in a vault (News, October 27, 1990; Post, October 27, 1990). In November, Energy Secretary James Watkins testified before Congress that there would be several negative ramifications for the nation's nuclear weapons arsenal if plutonium operations weren't resumed soon in Colorado (News, November 18, 1990).

Wastes

Contributors. Waste disposal records from the Atomic Energy Commission showed that liquid and solid wastes tainted with radioactive elements were routinely shipped to Rocky Flats for disposal in the late 1950's and early 1960's. The largest contributor was Adolph Coors, Co. when it did some defense research. Other contributing companies included Martin Aircraft Co., U.S. Geological Survey, Denver Research Institute and others. They could be liable for paying part of the cleanup at the plant (News, March 10, 1990).

Supercompactor. A supercompactor was ordered from Germany to reduce the volume of nuclear wastes at the plant (News, March 21, 1990). It would compact some of the wastes while the rest could be sent to a New Mexico repository, in salt caverns. This would be the nation's first permanent repository for low and medium level atomic wastes. Rocky Flats is expected to generate the most wastes for the repository (News, November 2, 1990).

Trust

EG&G started with the same pronouncements used by Rockwell. "We welcome a new era of openness," said B. Philip Warner, general manager of the Rocky Flats Plant (New York Times, February 15, 1990). About a week later, Bob Nelson, DOE's manager, was presented as an ordained Episcopal priest. Someone who could restore public trust through ongoing dialogue (Post, February 24, 1990). This information was presented to the public at the same time that the inconsistency between the DOE budget request and the local "safety" dialogue became apparent.

In the conversations about closing Rocky Flats, workers were told they could get other jobs. Jim Kelly, United Steelworkers of America, disagreed. Workers did not think they could find other jobs and were feeling threatened. They were anxious to start up the plant (News, February 2, 1991). Workers were angry at all the problems people kept finding at Rocky Flats. The basic fear was that plutonium production would not resume and they would lose their jobs (News, November 18, 1990; Post, November 18, 1990).

More dangerous radiation leaks were reported. New plant security guards were hired when some were fired for drug use and other unprofessional behavior.

People knew more about Rocky Flats because of DOE's new openness. People also had a greater mistrust of government (Post, November 18, 1990).

Lessons Learned From Rocky Flats

From 1951-1958, during the initial two phases of the development of Rocky Flats, the plant was not very visible to members of the surrounding communities. Dow Chemical Company seemed to work well with the Atomic Energy Commission to produce materials needed for the "national security" of the country. The plant was perceived to be a good neighbor.

Economic Development Benefits

The economic benefits of the plant were emphasized during its early periods. The plant fulfilled its economic development promises. It spent 75% of its operation costs in the region. The numbers of workers hired, the size of the payroll and the expenditures for materials and services were higher than what had been anticipated.

These economic benefits became less salient as they became accepted as part of the economic profile of the region. The economic benefits also became a minor part of the community discourse on Rocky Flats after 1970, as environmental and health issues became more understood and feared.

It wasn't until after Operation Desert Glow, in 1989, that issues of economic benefit became salient again. At that point workers began fearing loss of their jobs. Congressional representatives passed legislation which would insure that the workers would continue to hold their jobs during the "cleanup" phases of the operation. The economic ability of the region to absorb the 6,000 workers from Rocky Flats was debated.

Lesson 1: Economic contributions to a region are very salient during the initial "opportunity-threat phase" (Freudenberg and Gramling 1990) and the "normal development" phase of a project. These economic contributions are then "taken for granted" as the local social and political systems adapt to the economic activities of the plant.

Lesson 2: Government has been the institution receiving the cultural "trust" (Douglas 1985; Douglas and Wildavsky 1982). Community members and local leaders assumed that the government through its managers was taking care of the health of the workers and the community. Questions were not asked about the potential threats of plant activities for the local population and workers during the initial 20 years of operation.

Lesson 3: As risks became understood by local residents, the concern with environmental and health risks overrode the economic contributions of the plant. This will fragment residents creating "corrosive communities" (Edelstein 1988; Levine 1982; Couch and Kroll-Smith 1985). Workers began to feel their livelihood threatened.

Population

During the early phases of the development of the plant, the economic developments of the region pulled population close to the plant. Cities grew up around the plant.

Housing developments encroached on the plant site in spite of a large buffer zone around the plant. Real estate members attempted to change zoning laws (Logan and Molotch 1987) for their own benefits even when other agencies warned of risks in the area.

Lesson 4: Initial trust in the plant and short-sighted economic benefits motivated community members and some business people to settle and transact business as close to the plant as possible.

Environmental and Safety Issues

Environmental costs began to be identified in the 1970's. These concerns dominated the 1980's. In many ways these were the years when institutional trust was renegotiated.

Inconsistent reports about the plant were the catalyst for questions. People voiced their concerns. Institutional trust had eroded sufficiently to allow those voices to be heard. Local and national activists and protesters raised issues loudly. Local professionals with scientific knowledge became important.

Scientific debates developed over the evidence presented to support or refute local concerns. Science was being used as the institution to guide the "trust" of the residents and the workers. Political leaders also turned to this institution to learn what to trust. They no longer depended only on the work of the plant.

Dow Chemical Company was fired in 1975 as an institution which could no longer be trusted. The reason given for its "untrustworthiness" was "management errors of judgement and philosophy." Rockwell was hired to develop a new management style and philosophy. It developed an "open door" policy attempting to recapture the role of a "trusted" institution - it had nothing to hide.

Lesson 5: Inconsistencies created by information used for different purposes by the plant (e.g. presenting an innocuous perspective to local residents while a "danger" perspective to funding sources) become a catalyst for the development of "untrustworthiness."

Lesson 6: Research specialists became primary actors in developing new "trust" institutions. Monitoring processes was one attempt to develop trusted institutions.

Loss of Trust and Legitimacy

Operation Desert Glow was critical in reinforcing Rocky Flats' untrustworthiness. It was perceived as a statement from the Federal government that the local plant could not be trusted.

The shocked reaction by the political leaders of Colorado reinforced the lack of trust that had developed. Political leaders, community residents and workers responded with "anger." They had been "duped." They had placed their trust in an institution which had "lied" to them. The plant, the workers, and the communities were stigmatized (Edelstein 1988). They were losing from their associations with the plant.

When the new management company, EG&G, was hired, again there was an attempt to show that there was nothing to hide. More information was published about the production processes and the workers at the plant.

Again, DOE responded by firing the management corporation saying that a "new culture of safety" and "new professionalism" was needed in running the plant. DOE then became more active at the plant. Could DOE reclaim being the "trust"?

Since 1951 the management company presented itself as having things well under control. Accidents were minimized. The management company preferred to "turn a blind eye" rather than

to seek solutions to environmental and safety problems which developed. Community residents and workers "forced" the company to do otherwise. They did this by using protests, lawsuits, media, and policy-making.

Lesson 7: While DOE will support a management company as long as it is able to be a "trusted" institution at the local level, it will fire that company when trust is lost. This is especially true if the lack of trust begins to constrain the activities of DOE itself.

Lesson 8: It is doubtful that a management company will be able to not create any environmental or health damages to the local areas due to the very nature of the technologies. Not enough is yet known about the technologies. New hazards will yet be discovered. Their dangers are not known. This should be acknowledged from the very beginning so that the corrosion of trust does not develop so blatantly.

Trust

Initially, Dow Chemical Company and the Atomic Energy Commission stated that there were absolutely no threats to local residents and workers from the plutonium processing plant. They had rationally chosen a place which was safe, far away from people and in an area which was barren. Plutonium was not very well known in the early 1950's. Perhaps their claims occurred from lack of knowledge.

The second type of lying which occurred was due to the presentation of different "facts" for different audiences. The facts emphasizing the safety of the plant were presented to the local community. The company consciously chose NOT TO explore the possibility of the spread of plutonium in order to not KNOW about it. On the other hand, it was important to KNOW the failures of the plant in order to get funding to upgrade the plant. Apparent lying was created by inconsistencies in the stories.

The third type of "lying" involved conscious attempts to manipulate the perceptions of safety at the plant. Dow received a national industrial safety award the same year that it had a major fire, in 1957. Rockwell received ratings of "excellent" at the same time that there were major problems at the plant which were acknowledged internally by DOE. Yet, DOE was willing to back Rockwell's presentation as "safe" to local residents and workers. The annual "bonuses" were symbols used to reinforce the "trustworthiness" of the management company.

The fourth type of lying was conscious manipulation of company reports. The company claimed to have done things which it had not done. The "fixing" of the monitoring wells was one such example. Other times data were changed to reflect favorably on the management company.

Finally, the fifth type of lying blamed the loss of legitimacy on particular managers of the company. In attempting to regain "trust" DOE even used religious symbols. DOE's latest manager was presented as a lay-clergy. Religious institutions are responsible for certifying what is "trustworthy" in our society. Management and worker cultures were blamed for plant problems.

Before leaving this section, it is important to note that others also engaged in "lying." Clearly developers wanted real estate kept as safe as possible. They resisted acknowledging the risks created by the plant by developing housing as close as possible to the plant. They also resisted handing out warnings about the plant to new homebuyers (Stagl 1983).

Water businesses also took advantage of the risks. They increased the perception of water threats to increase their sales in the areas adjacent to Rocky Flats.

Lying is one way of managing situations which are uncertain. This is reinforced by expectations management companies set to be in control and have answers. At Rocky Flats and across the nation, the government is losing its "trust interpretation" role. There is a struggle to develop another institution which can be trusted to handle risks.

Community Response to Trust

During the 1980's issues of "failing trust" in Rocky Flats were dominant. Three community surveys measuring residents' reactions to Rocky Flats were fielded in 1982, early 1989, and 1990. In 1982, 1109 interviews were conducted with people who lived within 16 miles of Rocky Flats. The sample was stratified according to how far the respondents lived from Rocky Flats. Of these, 729 lived within a ten mile radius and 380 lived outside that radius from Rocky Flats. People who bought a house within 10 miles of Rocky Flats received "Rocky Flats Advisory Notice" between 1979 and January 1981 warning them of the existence of Rocky Flats. Others in the area received the "Rocky Flats Emergency Response Plan." People living beyond 10 miles from the plant did not receive any of this information.

The 1982 survey tested the knowledge and perceptions of the residents about Rocky Flats. Those who had received the Advisory Notices tended to know more about the plant and also had the stronger negative attitudes toward Rocky Flats than those living outside the ten mile radius. Those living outside the 10 miles, overestimated the risks of radiation from the plant but had a more positive attitude to the plant.

Between 30-40% of those interviewed were in favor of converting Rocky Flats to non-nuclear weapons production, or moving, or closing Rocky Flats. Many (44%) wanted to keep Rocky Flats because of the jobs that were at stake. Those who favored conversion, wanted to use that to keep the jobs of Rocky Flats.

One of the questions on the survey was, "Do you trust the information published by the Rockwell Corporation (Rocky Flats) about the risks?" "Yes, mostly, sometimes, seldom, no," were the response options. Those who had received the Advisory Notices showed a higher probability of trusting the information (35%) than those who didn't (30%). Those who received the information had an equally high percentage which seldom or never trusted the information (34.7%).

Consistent with past environmental studies (McStay and Dunlap 1983), women were more concerned about Rocky Flats than men were. They also had greater distrust (36%) of information [published by the plant] than did the men (31%).

There were strong regional differences to this answer. People living in Boulder, Colorado had the highest percentage (42.8%) seldom or never trusting the information. On the other hand, people living in Golden, Colorado had the greatest trust - only 14.4% answered that they seldom or never trusted the information. Boulder is a university town while Golden is populated with lower class workers.

The attitudes toward Rocky Flats were also reflected in the results to Ballot Item 6 "Proposed Initiative on Rocky Flats Conversion." This Ballot was on the state elections of November 2, 1982. This initiative would allow a voluntary checkoff system so citizens could

designate part of their income taxes to be used to publicize information about Rocky Flats and to help convert the plant to non-nuclear production.

Between 40-42% of the voters living within 8 miles from the plant favored the initiative. This went down to between 30-40% at 16 miles from the plant. Boulder was very different from other regions. Up to 65% of the voters were in favor of the measure to 10 miles from the plant. Farther than that, the percentage reduced to 55%.

In the early 1980's, the communities were not trusting the management company but residents were NOT willing to close the plant. The concerns about employment were still dominant. Those most opposed to the plant were not economically dependent on it.

In 1990, 229 Broomfield residents were interviewed by a grassroots organization called Neighbors Concerned About Rocky Flats. Most (54%) of the residents had lived in the Denver area for more than 20 years. Many had ties to Rocky Flats - 13% worked at Rocky Flats or had family members working there; 75% had friends there and 37% had neighbors employed there.

Fifty-three percent of the respondents expressed a negative attitude towards Rocky Flats. Twenty-seven percent were positive. However, regardless of their general attitudes, there were strong concerns about specific issues:

- * about possible health effects of plutonium (88%)
- * about toxic or radioactive wastes on the plant site (88%)
- * about contamination of the air, soil, or water of the neighborhood (87%)
- * about how Rocky Flats could affect them negatively (75%).

Over 75% of the residents gave great importance to the jobs and the general economic contributions made by Rocky Flats. Fifty percent ranked the fact that Rocky Flats "helps protect our country" as being important.

Residents also reported that their feelings about Rocky Flats had become more negative over time. They reported increased concern about the environment and cancer while having less concern about the economic importance of the plant.

Over 90% believed that a separate monitoring agency should be developed to prevent dangers to workers and the public. Almost 70% reported that the production process at the plant should continue to be stopped until proven safe. Only 33% would halt production permanently (Neighbors Concerned About Rocky Flats 1990).

A telephone survey of a random sample of 512 Colorado adults, conducted in 1989, asked the respondents to identify the greatest problems affecting the state. Thirty-six percent said that the poor economy was the greatest problem. Nineteen percent mentioned the environment and pollution.

Of environmental problems facing Colorado, the disposal of hazardous waste materials was seen as serious by 61% of the respondents. Air pollution (54%), contamination of underground water supplies (45%) and pollution of the rivers and lakes (42%) were the other top concerns among the citizens (Kramer 1989).

All of these surveys, except for the one conducted by the Neighbors Concerned About Rocky Flats, were conducted prior to the Operation Desert Glow. Since that Operation created the greatest mobilization against developing trust in the plant, I suggest that current lack of trust in the plant is higher than ever. Factions should continue to develop in the communities until

legitimate institutions are developed to interpret the trustworthiness of Rocky Flats and DOE. Inconsistencies are already beginning to emerge in EG&G's management.

Conclusion

In our country we continue using increasingly complex and dangerous technologies which are not fully understood. Perrow (1984) has warned us that we are to expect "normal accidents" - accidents will happen simply because of the nature of the technologies.

Accidents are a normal part of running a plutonium processing plant. Plutonium is so toxic and volatile that it will continue to create unexpected problems for workers and the community even with increased technological sophistication. In many ways, perhaps one lesson we can learn from Rocky Flats is that it is not possible to make the plant totally safe.

Perrow (1986) further suggested that more normal accidents will be accepted when "national security" is at issue. This is the situation with Rocky Flats.

In the past leaders of the production plant (DOE and the management companies) have insisted that they were in control of that technology. It was quite safe. As long as the government had the legitimacy of a trusted institution, this was not questioned. However this is no longer true.

Nevada can clearly expect "normal accidents" to occur. DOE is no longer trusted by many. At Rocky Flats trust has NOT increased over time. In fact it has clearly decreased. A new approach is needed.

Rather than trying to claim that "things are under control" and "there are no problems," it is wiser to develop more realistic scenarios. Expect normal accidents. Train managers and workers to think of this as a dangerous area. Allow for "danger pay." Acknowledge that when a new plant is developed, equipment and procedures may not be adequately safe. Today's technology and management structures simply are inadequate to the wastes which have been created by the nuclear weapons industry. To admit otherwise is to further invite and fan distrust and anger in the long-run.

Acknowledge that standards change over time. It is important to continually update the technology and processes to maximize safety factors in plants which monitor extremely toxic materials.

Human and technological errors should be openly acknowledged. Safety preparedness plans should be developed for workers and surrounding communities. External monitoring of plant operations has an additional benefit of providing an independent voice to help interpret the plant to the community and its workers.

These suggestions should help protect the next management company. Otherwise it will be fired as a scapegoat for a technology and management structures which are simply inadequate for today's challenge of handling radioactive and toxic wastes.

Bibliography

Newspapers and Local Publications

Boulder Mobilization News, Memorial Issue. Boulder, Colorado. July 25, 1978.

Grand Junction Sentinel, Grand Junction, Colorado.

Greely Tribune, Greely, Colorado.

Kramer, Kate. "Colorado Environment 2000." Denver, Colorado: State of Colorado. Department of Natural Resources. 1989.

Neighbors Concerned About Rocky Flats. "Rocky Flats Survey: Preliminary Findings." Broomfield, Colorado. Unpublished survey. 1990.

Nuclear Reports from the Rocky Flats Truth Force, No. 2, June 18, 1978.

Rocky Mountain News, Denver, Colorado, March 24, 1951 to May 18, 1990

The Daily Camera, Boulder, Colorado.

The Denver Post, Denver, Colorado, March 24, 1951 to May 18, 1990.

The Marketplace, Denver, Colorado

Social Science Publications

Couch, Stephen R. and J. Stephen Kroll-Smith. "Chronic Technical Disaster: Toward a Social Scientific Perspective." *Social Science Quarterly* 66, 564-575, 1985.

Douglas, Mary and Aaron Wildavsky. *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Berkeley, California: University of California Press, 1982.

Douglas, Mary. *Risk Acceptability According to the Social Sciences*. Social Research Perspectives. Volume 11. New York: Russell Sage Foundation, 1985.

Edelstein, Michael R. *Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure*. Boulder, Colorado: Westview Press, 1988.

Freudenberg, William R. and Robert Gramling. "Community Impacts of Technological Change: Toward a Longitudinal Perspective." Paper presented at the 1990 annual meeting of the Rural Sociological Society, Norfolk, Virginia, August, 1990.

Kasperson, Roger E. and K. David Pijawka. "Societal Response to Hazards and Major Hazard Events: Comparing Natural and Technological Hazards." *Public Administration Review* 45, 7-18, 1985.

Levine, Adeline G. *Love Canal: Science, Politics and People*. Lexington, Massachusetts: Lexington, 1982.

Logan, John R. and Harvey L. Molotch. *Urban Fortunes: The Political Economy of Place*. Berkely, California: University of California Press, 1987.

McStay, Jan and Riley Dunlap. "Male-Female Differences in Concern for Environmental Quality." *International Journal of Women's Studies* 6, 4, 291-301, 1983.

Perrow, Charles. *Normal Accidents: Living with High-Risk Technologies*. New York: Basic Books, Inc., 1984.

____. "Risky Systems: The Habit of Courting Disaster." *The Nation* 243, 11, 329-356, 1986.

Stagl, Rudi. "Impacts of the Disclosure of Rocky Flats on Perception and Real Estate Market." Berlin, Germany: John F. Kennedy - Institut für Nordamerikastudien. Unpublished paper, 1983.

**THE FEED MATERIALS PRODUCTION CENTER
IN FERNALD, OHIO: A CASE STUDY**

BY

RONALD A. HARDERT

Executive Summary

The problem under investigation in this report was the Department of Energy's Feed Materials Production Center near Fernald, Ohio. The purpose of the "Fernald" study was to shed light on the advisability of locating a high level, nuclear waste repository at Yucca Mountain in Nevada. Specific issues addressed in the report included: a physical comparison of the Rocky Flats and Fernald plants; the problem of nuclear exposure at the Feed Materials Production Center; possible political deception at Fernald; legal problems surrounding Fernald; any lessons that can be learned from Fernald that might be applicable to Nevada in the 1990s and beyond; and, community response to exposure to hazardous wastes, including the issues of trust and trustworthiness.

Methods employed in the present report included participant observation and interviews of those affected by possible exposure to radiation. Sources used in the study included: DOE documents, information supplied by DOE contractor, Westinghouse, hundreds of articles on Fernald published by The Cincinnati Enquirer newspaper, and early photos of the plant. The final version of this report included additional information about how people have been affected by the Department of Energy, NLO Inc. (former contractor at Fernald), Westinghouse, and the Feed Materials Production Center itself. It also stressed the issues of trust and trustworthiness in relation to reports of deception at Fernald from former nuclear workers and from concerned citizens living in the community.

The conclusions of this study were numerous and some of the implications surprising. Although Fernald and Rocky Flats are very different from a physical point of view, in both cases the surrounding communities were largely supportive of the plants' activities until off-site contamination was discovered. In the case of Fernald, it appears that the DOE, NLO Inc., and Westinghouse have been slow to publicly announce the discovery of radioactive contamination when it has occurred. This reported problem of deception and secrecy involving public health issues has done nothing to improve community trust in our institutions. More recently, the DOE and Westinghouse have attempted to repair their image of trustworthiness, mostly in communications with the media and the public. For example, Leo Duffy (who heads the nuclear waste program for the DOE) recently stated at a Quarterly Meeting on Fernald that the DOE had made some serious mistakes in the past. These include locating Fernald 20 to 30 feet above an aquifer which supplies Southern Ohio with half of its drinking water. Of course it is true that the plant was built 40 years ago, our leaders were in a hurry, and physicists did build the bomb in only 5 years. But, we also

need to know why deception was practiced 5, 10, 20, and 30 years ago, and whether or not our communities will be safe from toxic exposure in the future.

Another finding was that legal problems abound because of the Fernald experience. There have been individual lawsuits, class-action lawsuits by affected residents, and now a lawsuit by former Fernald workers. The DOE already has agreed to pay an unprecedented, multi-million-dollar, out-of-court settlement with one group of residents. Before this settlement was made, DOE spokespersons had characterized many of these citizens as ill-informed troublemakers. It is difficult to assess the amount of psychosocial damage that may have been done to this community, partly due to these types of assertions, which are classic examples of Blaming the Victim.

If there are any lessons that can be learned from the Fernald experience which might be relevant to Nevada in the 1990s and beyond, one message comes through loud and clear. The people of the state of Nevada need to be wary of locating any type of nuclear facility in or near their communities. The track record of the DOE has not been wholly negative, but there have been, and there remain, many serious problems. The main goal of this study has been to make the final report as honest and as effective as possible for the people of Nevada and especially for the community at Yucca Mountain.

FEED MATERIALS PRODUCTION CENTER
Fernald, Ohio

CONTENTS

I	Introduction	1
II	Comparison of Rocky Flats and Fernald	2
III	The Problem of Nuclear Exposure at Fernald	4
IV	Political Deception at Fernald	7
V	Legal Problems Surrounding Fernald	12
VI	What Can Be Learned From the Fernald Experience	14
VII	Community Response to Exposure to Hazardous Wastes	18
VIII	References	20

Introduction¹

Since the publication of Adeline Gordon Levine's Love Canal in 1982, sociologists, politicians, and the public have become increasingly concerned about the inadequacies of hazardous waste management policies, including the sites selected for the disposal and storage of hazardous waste (Peck, 1989). This concern includes a recent interest in the consequences of nuclear waste contamination in various parts of the United States and around the world. Some of this interest is expressed through analyses of risk management and some of it is demonstrated via social activism, as in the case of organized protest at Mercury, Nevada's Nuclear Test Site.

The present report on the Department of Energy's Feed Materials Production Center (or, more succinctly, "Fernald") located near Fernald, Ohio, is part of the larger Yucca Mountain Studies program supervised by William R. Freudenburg and John Gervers. The Fernald study is intended to shed light on the advisability of locating a high level nuclear waste repository at Yucca Mountain in Nevada. This report does not attempt to test any sociological theory. It is a description of the impact of a nuclear weapons plant on greater Cincinnati, Ohio, including the health, legal, and other psychosocial effects of the plant over a period of 38 years. Major topics discussed in this report include: a brief comparison of the Rocky Flats and Fernald facilities regarding their geographical and physical characteristics; potential nuclear exposure at Fernald; possible political deception at Fernald; legal problems; and community response to exposure to hazardous wastes. The major thrust of my report, however, is focused upon the Feed Materials Production Center itself and problems of human exposure and victimization.

In the Fall of 1984, the Fernald plant (see map on page 3) was identified as the source of uranium contamination for three private wells south of the facility. Since I was born and raised in nearby Cincinnati, and since my parents and an uncle still live within eight miles of the plant, I became interested in the problems reported in the local newspapers. Eventually the Fernald situation became my sabbatical leave research project for most of 1989.

Also in 1984, Charles Zinser rented a vegetable garden less than two miles from Fernald, for the express purpose of raising organic vegetables. He often took his two young sons along as he worked in this idyllic setting away from urban Cincinnati's noise

---

¹Acknowledgements: My special thanks to Mr. Thomas Bernhardt and Mr. and Mrs. Albert Hardert, Jr., for numerous Cincinnati Enquirer articles important to this study. I also appreciate Traci Goy's insights regarding some the legal repercussions of Fernald for the surrounding community.

and pollution (Magnuson, 1988). There was no apparent reason to fear Fernald for, like many Cincinnatians, the Zinsers thought the "Feed Materials Production Center" produced food for pets or farm animals. Milk cows grazed, and still do, by a creek named Paddy's Run which flows north to south on Fernald property within the plant's surrounding fences (Hardert, 1991).

In April 1986, the Zinsers' oldest son, Sam, was diagnosed with leukemia. Less than two months later, in May 1986, the Zinsers' younger son, Louis, followed with a bone tumor in his lower left leg. At age two, Louis lost the leg and, since there was no apparent cancer history in the family, doctors advised seeking an environmental cause. Subsequently, Charles Zinser had his garden soil tested, and the samples showed higher than normal levels of both Uranium 238 and enriched Uranium 235. Further, when the Zinsers sent Louis's amputated leg to the University of Waterloo for analysis, the tests showed ten times more uranium in the leg than would be expected to accumulate naturally in the lifetime of an adult (Zinser, 1988). Zinser explained, "The doctor said Louis could have eaten dirt and not got that much . . . . He said the only way he could have got that much would have been to breathe it" (Magnuson, 1988).

In the summer of 1991, I discovered another Cincinnati family with a set of problems similar to those of the Zinsers. This second family also has a son who had a leg amputated and now has a daughter diagnosed with leukemia. It may be only a coincidence, but these children spent summers at a religious camp located only two or three miles from Fernald. The camp was closed permanently by its religious sponsors in 1989.

Before delving more deeply, at this point, into how people may have been affected by radiation from Fernald, let us first turn to a brief, physical description of the Rocky Flats and Fernald plants.

Comparison of Rocky Flats and Fernald

The Rocky Flats plant is located 16 miles northwest of downtown Denver, Colorado, and 9 to 12 miles from Boulder, Golden, and Arvada (Coyle, et al., 1988). Nearly 50,000 people live within 5 miles of the site, over 300,000 live within ten miles, and about 2 million persons live within 30 miles of the plant.

Rocky Flats manufactures all plutonium parts (compared with Fernald's focus on uranium), as well as components for nuclear weapons, which are sent to the Pantex Plant in Amarillo, Texas (Russell, 1990). With the cessation of plutonium production at Hanford's N reactor, and the reduction in power levels at the Savannah River Plant since the Chernobyl accident, recycling of nuclear warheads at Rocky Flats had become the major means of providing plutonium for new warheads (Coyle, et al., 1988).

Historically, there have been over 200 fires at Rocky Flats since its start-up, and a 1957 fire in the plutonium production building reportedly released 26,000 millicuries of alpha radiation into the atmosphere (Coyle, et al., 1988). Further, from 1959 to 1969, an estimated 11 or more curies of plutonium were released from leaking oil drums (Coyle, et al., 1988). In 1989, the FBI raided Rocky Flats after being tipped that plant operators were hiding evidence of widespread radioactive contamination (Russell, 1990), and they found numerous violations of safety and health regulations (Jakubauskas, 1991). Rockwell International, the DOE contractor at the time, was fired and EG & G (Edgerton, Germestaussen & Grier) took over. Plutonium production shut down at the plant and cleanup operations, similar to those at Fernald, began. Over the years, 62 pounds of plutonium became trapped in one building's ventilation system alone--enough to fuel seven nuclear bombs. (Russell, 1990). More than 100 new workers were hired to bring the plant up to government standards, and resumption of plutonium and weapons production could occur within the year (1991), within the decade, or not at all (Jakubauskas, 1991).

The Feed Materials Production Center, which employs about 1,200 workers and covers a 1050 acre site, is another important link in the DOE's chain of 17 plants that comprise the U.S. nuclear weapons production system. Westinghouse has run Fernald for the DOE since January, 1986; but, before that, from 1951 through 1985, it was run by NLO, Incorporated, a subsidiary of National Lead. Fernald is called a "feed materials center" because it processed various uranium compounds into uranium metal, which it then "fed" to the rest of the U.S. nuclear weapons complex (Coyle, et al., 1988). The uranium metal created at the foundry within Fernald was then used as nuclear weapons parts and in the development of fuel rods for military reactors.

Along with the production area, there is a waste storage area at Fernald, that consists of six waste pits, several concrete waste silos, 80,000 steel drums, piles of coal ash, and a 6,500 ton mound of contaminated scrap metal. According to Dana Coyle, et al (1988), "The waste pits or settling ponds contain, in addition to more than 11 million pounds of uranium, a toxic soup of other radio-active substances" generated during 38 years of uranium processing. The two, K-65 silos contain radioactive waste (from the Manhattan Project) which leaks out from temporary covers in the form of cancer-causing radon gas and could become a problem in the event of a tornado (McKenna, June 5, 1990). There are thousands of barrels of radioactive and hazardous, chemical wastes stocked outdoors, and numerous barrels of radioactive thorium stored indoors. In terms of volume alone, Fernald is the third largest radioactive waste facility in the U.S., behind only Hanford in Richland, Washington and Savannah River near Aiken, South Carolina. By 1986, Fernald's "realm of waste" had grown to more than 1.1 billion pounds of radioactive and chemical materials (Brataas, October 19, 1986). By the summer of 1990, very little of this

waste had been moved offsite (Ullrich, July 5, 1990).

The Problem of Nuclear Exposure at Fernald

Uranium oxide dust emissions into the air and groundwater near Fernald have been a consistent issue for debate between the plant's managers and their critics (McKenna, December 31, 1988). Estimates of emissions into the air during the plant's 38 years of operation (it was essentially closed, except for cleanup, in July, 1989) reportedly have risen from 200,000 pounds in 1984 to 300,000 pounds by December, 1986 to 550,000 pounds by April, 1989 (McKenna, May 3, 1989). Based on soil samples and the plant's own production data, at least 600,000 pounds and perhaps as much as 3.08 million pounds (i.e., 1,540 tons) of uranium dust have contaminated the area around the plant--and those estimates could go higher (McKenna, May 3, 1989). The soil samples and computer modeling reportedly show that the topsoil within five miles of Fernald is covered with 22 to 1,100 pounds of uranium per square mile (Willette and McKenna, May 4, 1989). However, the extent of discrepancy in government reports of Fernald's emissions is such that it throws all the plant's data into doubt (McKenna, February 15, 1990). Internal memos indicate that the efficiency of stack scrubbers at the plant was much lower than formerly assumed (Willette and McKenna, May 4, 1989). Further, a plant memo says that a mill within the Fernald uranium foundry "leaked so much radioactive thorium that workers used a bucket to collect the dust" (Willette and McKenna, May 4, 1989). Thorium 230, as an example, has a radioactive half-life of 180,000 years, which means its daughter products will remain active pollutants for hundreds of thousands of years (Reader, 1980). Reportedly, about 14,300 pounds of thorium escaped from the plant into the surrounding countryside between 1951 and 1989 (Higginbotham, November 4, 1990).

Similar revelations have been made regarding Fernald's emissions into groundwater near the plant. All of the plant's waste sits atop the Great Miami Aquifer, a major drinking water resource about 20 miles northwest of downtown Cincinnati. Today, large amounts of radioactivity from runoff and from the waste pits combine to contaminate the aquifer. Filtrate from the pits combines with other effluents and with storm sewer water, and this combination is released into Paddy's Run Creek and areas under the plant. On May 16 and 17, 1990, more than 600,000 gallons of water overflowed a storm-water runoff basin and ran down Paddy's Run--an area previously mentioned in connection with uranium seeping through to underlying groundwater supplies (McKenna, May 23, 1990). Regarding the recent runoff, the DOE's site environmental manager said the water contained about three pounds of uranium, giving it a concentration of 500-600 parts of uranium per billion parts of water (McKenna, May 23, 1990). The proposed federal drinking-water standard for uranium is no more than 30 parts per billion, and the radioactive half-life of uranium 234 is 250,000 years (Bertell, 1985).

The DOE has known since late 1984 that the three private wells which draw on the aquifer south of Fernald were contaminated with uranium (McKenna, May 16, 1989). Some readings in those wells were 250 times greater than the maximum levels set by the Environmental Protection Agency (Coyle, et al., 1988). Bone and bone marrow radiation doses to people drinking this water were unacceptably high and the wells were closed (Coyle, et al., 1988). Since then, the DOE has been sinking test wells throughout the area and has discovered plumes of uranium moving south along Paddy's Run (McKenna, May 16, 1989) and into the Great Miami Aquifer (McKenna, October 25, 1990). According to plant consultants and environmental agencies, about 115 of the 180 test wells drilled since the summer of 1989 have revealed contaminated water, with uranium being found less than 20 feet beneath the surface under much of the Fernald plant (McKenna, October 25, 1990). Environmental officials fear this contamination could pose a threat to the entire aquifer, because the majority of the test wells are contaminated with uranium to some degree, including levels reaching as high as 10,000 parts per billion in six wells and 1,000 parts per billion in nine other wells (McKenna, October 25, 1990). The highest readings, however, were reported (McKenna) on February 8, 1990 when samples taken from beneath the plant held 696,000 parts of uranium per billion parts of water. Another "water pocket" discovered twenty feet below the plant's refinery showed contamination of 28,000 to 40,000 parts per billion. However, it took until August, 1990 for the DOE to publicly admit that cesium 137 had been released into Paddy's Run and that thorium 230 had been found in soil samples around the Fernald site (Higginbotham, August 30, 1990).

After extensive review of government documents, the six Fernald waste pits were found to be the primary cause of groundwater contamination at the plant (Coyle, et al., 1988). These pits are not isolated from the groundwater system and some pits are actually being fed by springs. It appears that recent construction at Fernald will, at best, transplant some radiation from the private drinking wells into the Great Miami River and to a larger downstream population, while leaving the heart of the contamination problem--the six waste pits--untouched (Coyle, et al., 1988). Part of the waste problem at Fernald is the relatively small facility site, only 1,050 acres compared with Rocky Flats' 6,550 acres and Hanford's 570 square miles, and the fact that more than a million people live within a 20 mile radius of the plant. Ironically, in early 1951, the old Atomic Energy Commission--predecessor to the present DOE--was warned by the U. S. Geological Survey that, due to the hydrogeology of the area, ground-water contamination could occur at Fernald if the wastes "were not handled carefully" (Peck, March 18, 1987).

Regarding nuclear exposure, the situation at Rocky Flats seems similar to that at Fernald. Colorado populations at risk are those that use water from Broomfield Great Western Reservoir and Standley Lake, both of which have been polluted by plutonium 239

(radioactive half-life = 24,400 years) from the Rocky Flats plant. Storms and other natural occurrences could stir up the radioactive sediments and expose people using these water sources to increased radioactivity. In the early 1970s, Dr. Carl Johnson, former Director of the Jefferson County Board of Health, documented elevated cancer rates for males and females living in residential neighborhoods near Rocky Flats (Johnson, 1981). And, medical records of 14 Rocky Flats plant employees who have contracted cancer indicate there is a "consistent pattern of exposure to radioactive materials" (The Cincinnati Enquirer, November 19, 1989). A third study of Rocky Flats found the death rate from brain tumors among white, male workers to be twice that of a similar group not exposed to radiation Cobb, June 1989).

Regarding potential health problems at Ohio's Fernald plant, Marvin Resnikoff (Neus, 1990) has predicted an additional (i.e., beyond the expected) 185 cancers in the neighborhoods around the plant due to residents' exposure to the various types of radiation mentioned earlier. Dr. Alice Stewart, a British epidemiologist and leading authority on the effects of radiation on humans, thinks that people living close to Fernald "have suffered worse than those at Three Mile Island" (McKenna and Neus, April 28, 1989). This hypothesis relates to the fact that Fernald has been contaminating the environment with low level radiation for 38 years, while Three Mile Island was one large, but short-lived, accident. The DOE's recent transfer to the Department of Health and Human Services of the health and work records of 600,000 American nuclear weapons plant workers might unravel some of the mystery (The New York Times, January 5, 1991). But, this assumes a number of things: that the health data will be released in a form that can be analyzed by independent researchers, i.e., complete with some type of worker identifiers; that the data on worker radiation exposures are fundamentally correct, as monitored by film badges worn by plant personnel; and, that long-term, independent funding can be assured, especially given the methodological complexities involved in this type of research.

Meanwhile, it took the DOE nearly six years (Fall, 1984 until Spring, 1990) to agree to fund most of the cleanup at Fernald (McKenna, April 10, 1990). And, within the total projected cleanup cost of \$130 billion or more for all 17 U. S. weapons plants (PBS, September 11, 1990), it is worth noting that Fernald is now projected as a top recipient of money for cleanup (Higginbotham, January 13, 1991). The DOE's five-year plan for cleanup has earmarked \$26 billion for cleanup activities at the 17 plants in its network, including \$2,238,499,000 for the Feed Materials Production Center. The largest amount allotted is the \$8,013,831,000 projected for the Hanford Reservation, by some accounts the most polluted and dangerous site in the weapons complex (Higginbotham, January 13, 1991).

Political Deception at Fernald

The point of departure for the present report actually occurred in Spring, 1989 when my wife, Linda, and I were taking photos of the Fernald plant as part of my sabbatical leave project. The facility had been the object of some criticism by The Cincinnati Enquirer since the Fall of 1984, after the uranium contamination had been discovered in Lisa and Ken Crawford's private well and in two other private wells south of the plant. In the process of taking photos near the north entrance of Fernald, Linda walked several feet past the final sign that serves to identify the plant. After taking her photos, she turned around 180 degrees and noted another sign painted on the back of the last identifying sign. It depicted a person whispering into the ear of another the words, "Button Up." Obviously, this sign is normally seen only by those who come to Fernald on official business or who work at the plant. Equally deceptive to us were the plant's water towers, the tops of which are now painted in a blue and white checkerboard pattern. Before 1986, when Westinghouse took over plant operations from National Lead, Fernald's water towers were painted in the military's traditional red and white checkerboard squares. This fact, coupled with cows grazing on plant property and the sign identifying the facility as a "Feed Materials Production Center" did lead many greater-Cincinnatians to think the plant produced cattle feed or pet food (Magnuson, 1988). We have interviewed dozens of local persons who did not know that Fernald was a weapons factory until the media revelations in the Fall of 1984, although Westinghouse officials regularly deny this.

As suggestive as the above examples are, it is difficult to prove that the DOE's reported deception was deliberate; we felt we had to delve a lot deeper into the problems of power and secrecy even to infer deception.

The issue of nuclear radiation exposure is problematic enough, but the issue of nuclear deception, and how it may have been rationalized in the past, is equally troublesome because of its insidious nature. For example, we have the case of Daniel J. Arthur, who monitored safety practices at the Fernald plant from May, 1984 until March, 1986 (Brataas, October 19, 1986). Arthur says that plant managers falsified data from water well samples to conceal evidence of groundwater contamination. The well in question, "No. 1 Shallow," was part of a protective pumping program intended to intercept uranium contaminants that were migrating from a waste pit toward the plant's own supply wells. On November 27, 1984, Arthur noted that No. 1 Shallow could not have been tested because someone had removed its pump from the ground; and plant technicians told Arthur that the pump had been out of the ground since June, 1984. Yet "test data obtained by The Cincinnati Enquirer shows a recorded uranium value of 9 micrograms of uranium per liter of water for test well No. 1 Shallow on November 27,

1984"² (Brataas, October 19, 1986).

Arthur said supervisors explicitly ordered him not to include information about the pump being pulled from the No. 1 Shallow test well in his report. In October, 1986, he told Cincinnati Enquirer reporter Anne Brataas, "If that's not deception, I don't know what is" (Brataas, October 19, 1986).

Another noteworthy case is that of Herbert Kelly, who worked at Fernald for 27 years and now has lung cancer (McKenna, February 4, 1990). On one hand, Kelly relates, "I saw fumes out there so bad, birds would fly out from roosts in the buildings and fly into the fumes and fall down dead . . . . Hydrofluoric acid would overflow so often, your shoes would get eaten off in a week" (McKenna, February 4, 1990). But, Kelly was cautioned by plant officials never to talk about his work (i.e., "button up"). Fernald's operations were classified throughout the 35-year tenure of National Lead, Kelly's former employer. He was told, "This is a military secret. If you're caught talking about it in a bar, or even to your family, you will be thrown in prison" (McKenna, February 4, 1990). Tragically, Kelly also was told, "This won't hurt you" and "you'll live longer if you breathe this stuff" (McKenna, February 4, 1990). Eventually, two doctors appointed by the Ohio Industrial Commission found that Kelly's lung cancer was directly traceable to his work at Fernald. Analysis of this evidence suggests that the perceived need for secrecy, coupled with power, can lead to deception and consequent lack of trust.

Other contradictions emerge in the study of Fernald which suggest possible deception and may have negative psychosocial effects on the community. Louise Roselle, an attorney for plant workers and nearby residents in a class-action lawsuit, claims that plant officials never admitted to any releases of cesium from Fernald until the DOE reported on August 30, 1990 that cesium 137 was detected in fish samples from a nearby creek (Higginbotham, August 30, 1990). The August 30th Cincinnati Enquirer article also states that thorium 230 is present in a waste silo and in soil samples taken from the Fernald site. Yet Roselle points out (Higginbotham, August 30, 1990) that plant officials previously told the community there was no thorium 230 at Fernald. Whoever turns out to be correct in these matters, it is curious that the DOE took from the Fall of 1984 until August, 1990 to publicly admit that cesium 137 and thorium 230 are present in and around the plant. Similarly, Lisa Crawford, a leader of the Fernald residents finds it curious that she did not learn of her own well's contamination until five years after the first positive test

---

²This November 27, 1984, value (which was within U. S. Environmental Protection Agency guidelines for uranium in drinking water) is reported in the 1984 Environmental Monitoring Report produced by National Lead for the DOE.

(McKenna, May 3, 1990). Regarding a more recent discovery of contamination in another private well south of Fernald, Crawford said, "They [DOE] knew in January, and here it is May? This is not right . . . . They should notify people as soon as possible" (McKenna, May 3, 1990).

Regarding Foucault's (1977) contention that we should look to the periphery of the power structure in order to understand how power works, an analysis of Fernald's local management is instructive. According to written testimony from a recent Fernald trial in Cincinnati (Kaufman, Neus, and McKenna, June 7, 1989), the president of the firm (NLO) that managed Fernald between 1981 and 1986 never understood his environmental duties. When asked in the deposition if the U.S. government required compliance with environmental laws and regulations NLO President, Fred W. Montanari, responded: "Not to my knowledge" (Kaufman, et al., June 7, 1989). When asked if he had any federal DOE orders concerning environmental protection, he said, "I'm not sure what a DOE order is" (Kaufman, et al., June 7, 1989). Montanari's testimony was important evidence presented by attorneys in a class-action suit on behalf of 14,000 persons who have lived and worked within 5 miles of Fernald since operations began in October, 1951.

A number of other issues related to the plant bear closer scrutiny. First, there are discrepancies in DOE reports of the total amount of uranium emissions into Greater Cincinnati air during Fernald's 38 years of operation (McKenna, June 7, 1989). As noted earlier, estimates of uranium emissions into the air have risen from 235,400 pounds in 1985 to 3,080,000 pounds by 1989. Second, the latter figure may not be high enough, we are told, because Fernald personnel often did not check emissions at all. And third, the method for calculating the amount of uranium dust leaking from the plant may have been defective, for it was based on assumed scrubber efficiencies supplied by the manufacturers of the pollution control devices. The calculation ratio assumed that the stack scrubbers caught 83 percent of the dust passing through them and allowed 17 percent to pass into the air. But, if the scrubber was not working at peak efficiency, the ratio used to estimate the leak would give an answer that was too low. Thus, the worse the scrubbers got, the better the emissions numbers looked. This uncertainty has haunted DOE emissions reports since 1984 (McKenna, June 7, 1989).

Regarding the problems just noted above, U.S. Representative Thomas A. Luken (D-Cincinnati) found a remarkable similarity between what the FBI is investigating at Denver's Rocky Flats weapons plant and confessions of activity at Fernald that were filed in the class action lawsuit against the Cincinnati plant (AP and Cincinnati Enquirer, June 7, 1989). While Luken found it commendable that the Department of Justice and the DOE are recognizing possible criminal activity at Rocky Flats, he also found it unfortunate that these agencies have not been as

aggressive at Ohio's Fernald. Luken implied duplicity, if not deception, on the part of the DOJ when he said they were "turning loose a horde of lawyers in Cincinnati to deny similar activity that they previously bragged about."³

Other issues related to the plant itself deserve to be mentioned and, in some cases, analyzed. Fernald officials now agree with critics that "some environmental factors . . . are affecting vegetation, fish, birds and small mammals" near the plant (McKenna, June 7, 1989). In a study funded by Westinghouse, three Miami University of Ohio researchers found abnormal growth patterns and genetic abnormalities in animals and plants residing on the 1,050 acre plant site (McKenna, June 7, 1989). But, a DOE contractor in Tennessee called the report "inadequate" and "fraught with statistical errors" (McKenna, June 7, 1989). Thus, there is no agreement, at this point, on what stresses in the environment may be causing the problems. It is interesting to note that the DOE wants to buy beef from a local farmer whose 130 dairy cows graze on Fernald property, for the purpose of performing tissue samples (Higginbotham, November 15, 1990). The U.S. Department of Agriculture performed tissue samples on cattle within a five-mile radius of Fernald in 1989, but the findings of that study were never published (Higginbotham, November 15, 1990). It also may be of interest that, in spring 1989, I interviewed a local resident who had worked at the dairy farm in question, and he related having "witnessed the birth of a two-headed calf at the farm." The resident and I walked along the creek bottom (Paddy's Run) out of which the Fernald cattle normally drink, and we could find no signs of small animal life of any kind.

According to Tom Carpenter of the Government Accountability Project (Washington, D.C.), Fernald officials are interested in more than tissue samples from (lower) animals. In a letter to the editor of The Cincinnati Enquirer, Carpenter (May 22, 1989) says,

It was Fernald officials . . . who literally dissected Fernald employee corpses without the knowledge or permission of the families of the victims. In an agreement with coroners throughout Southern Ohio dating back to the 1960s, Fernald health physicists were appointed "agents of the coroner" whenever a Fernald employee died, and therefore attended autopsies, obtained tissue samples, and even the corpse of the deceased employee. Fernald officials then wrote up

---

³Luken did not run for re-election in the Fall of 1990, but was highly critical of the DOE for barring the press from accompanying him on a tour of Fernald in April of the same year (McKenna 1990, p. F-1).

"scientific papers" discussing the results of their grisly efforts."

If all or even any of the above is true, it would certainly suggest the existence of secrecy, deception, and duplicity. As might have been predicted by Foucault (1977), periphery officials are mentioned above, not the central power, i.e., the DOE.

When I first read Carpenter's letter, about all I could do at the time was to take the material under advisement for contemplation at a later date. That later time came in the Summer of 1990, when I learned of the death of Renae Cook on November 6, 1989. I had learned about Renae earlier through a local plant official, who pointed out that she was Manager of Community Relations at Westinghouse (Fernald) and someone I ought to meet. (That conversation was in March of 1989, while I was working on my sabbatical leave project at Fernald). When I asked my Westinghouse acquaintance what Renae had died of, he said spontaneously, "cervical cancer." Then I asked how long she had worked in the nuclear industry. His immediate response was "most of her adult life." The question arises, how did the Westinghouse official know all of this detailed information about the death of Ms. Cook when none of it appears even in a fairly detailed eulogy published by Westinghouse? (Westinghouse, December, 1989). This linkage, which was "backstage" and almost accidental, is the type of knowledge that is beyond normal science as most of us know it. Is this merely another coincidence or is it an important connection among several classes of facts?

Assuming that at least some of the examples of nuclear deception noted above have validity, I finally address the issue of whether or not the Fernald situation is only the microcosm of the nuclear weapons macrocosm. A thumbnail sketch of the U.S nuclear weapons industry does indicate that Fernald and Rocky Flats may be only the tip of the nuclear deception iceberg. The use of secrecy has been a given at all seventeen of our nuclear weapons facilities, but several situations deserve special mention because they either involve deception or border on deception. For example, in the 1940s and '50s massive doses of radioactive iodine 131 were deliberately released across the Pacific Northwest from the Hanford Reservation in Washington State (Cobb, June, 1989). The releases came without warning and some details are still classified. According to Time Magazine (Magnuson, October 31, 1988), the reason for the release was that Hanford's managers "wanted to see if they could reduce the amount of time uranium must be cooled before being processed into plutonium, presumably to increase production." As local farmer Tom Bailie put it, "We are victims of this

---

"This DOE practice of "body-snatching" has been confirmed recently in an article by Hamilton (July/August, 1991).

mismanagement" and "I really think someone should go to jail for manslaughter" (Cobb, June, 1989). Perhaps the fact that the DOE has finally, officially admitted the releases may serve as a type of vindication for those who later developed thyroid cancer (Schumacher, July 24, 1990).

Similarly, two congressional committees have revealed that the Savannah River Plant in South Carolina has experienced numerous reactor accidents that have been kept secret from the public for as long as 31 years (New York Times, November 2, 1988). Physicists termed the accidents among the most severe ever documented at an American nuclear plant. Further, the Inspector General of the Nuclear Regulatory Commission reported that a former chief of staff of the NRC gave false and contradictory information to Congress and delayed an investigation of unsafe conditions at the Nine Mile Point nuclear complex in Oswego, New York (Wald, June 20, 1990). The fact that a former chief of staff at the NRC gave false information documents the fact that deception does occur at top levels, as well as at the periphery. Finally we have the somewhat humorous case of the non toxic, but still damaging, security leak revealed in Harper's Magazine (June, 1990). One morning in March, 1990, a DOE employee faxed the daily list of agency mishaps and accidentally sent it to all 50 of the nation's governors, instead of sending it to the DOE regional offices. The DOE requested that all copies be destroyed, and the errant employee was fired the day after the leak (Murphy, May/June, 1990a). In addition to this long history of apparent secrecy and deception, the DOE has been building a plutonium processing center at the Savannah River weapons plant for seven years without public hearings or a formal review of environmental effects (Cincinnati Enquirer, November 10, 1990).

Legal Problems Surrounding Fernald

Not until uranium oxide was discovered in Lisa and Ken Crawford's water supply in 1984 did Fernald area residents begin to understand some of the negative consequences of nuclear weapons production. In Fall, 1984, under the leadership of Kathy Meyer, more than 14,000 citizens living within the 5 mile radius of the plant formed Fernald Residents for Environmental Safety and Health; and, in 1985, Ken and Lisa Crawford sued the original plant operator, National Lead of Ohio (Murphy, May/June, 1990b). The suit sought damages for the loss in value of the Fernald residents' property and for the mental anguish they experienced. It did not seek damages for health effects, since they have yet to be established by scientific studies of the immediate area. More than three years after the lawsuit was filed, DOE attorneys for NLO acknowledged in court papers that: there had been uranium leakages since the plant opened in 1951; more than one hundred tons of uranium had been released into the air; 74 tons of uranium had been dumped into the Great Miami River; and that another 337 tons of uranium could not be accounted for. The DOE lawyers also said that

NLO should not be held liable for the radioactive leakage, because their contractor had operated the facility within the safety guidelines of its contract with the DOE. (Hedges, October 23, 1989).

U.S. District Judge S. Arthur Spiegel, who was appointed to the case, requested a summary trial which began June 5, 1989. The courtroom procedure avoided the time and expense of a full trial (McKenna, June 4, 1989), and it forced both sides to evaluate the strength or weakness of their arguments and the other side's evidence. Attorneys for each side presented their best evidence to a six person jury. The jurors' decision was not binding but indicated how a full trial might end, theoretically encouraging the parties to settle before the full trial started (Kaufman and Neus, June 8, 1989). Spiegel ruled that the chief executive officers of the companies named as defendants - NLO Inc., Fernald's former operator, and its parent company, NL Industries Inc., must be at the trial. The defendants requested a closed trial, but Spiegel wrote in a court order these "are matters in which the public has a vital interest" and decided to keep the trial open (McKenna, May 25, 1989). Plaintiffs asserted that their property values declined, and three homes were said to have lost \$80,000, \$40,000 and \$10,000, respectively, in value. Fear of Fernald reportedly had left possibly 50 percent of its neighbors with some kind of psychological disorder (Kaufman, June 13, 1989).

The summary-trial jury awarded a \$136 million verdict against NLO Inc. While not binding, the verdict was the best evidence of public outrage over the vast environmental neglect in the nation's nuclear weapons program (Kaufman, June 22, 1989). The DOE, in assuming the defense for NLO, negotiated a \$78 million settlement with Fernald residents to compensate them for a drop in their property prices, the costs of medical monitoring, and the emotional damage caused by their awareness of long-term exposure to radioactive substances (Murphy, May/June, 1990b). A portion of that money also would be available to owners of commercial or industrial property within five miles of Fernald. Henry A. Gill, Jr., attorney for the defense maintained that NLO violated no applicable environmental protection and pollution control laws. The agreement stipulated that DOE would deposit the settlement money in Cincinnati banks by October 15, 1989 (Kaufman and Neus, July 1). As of November 10, 1989 DOE still had not deposited the money for the settlement. Citizens' attorney Stanley Chesley asked Judge Spiegel to require the class action defendants to post a \$156 million security bond. Chesley said, "the United States and the defendant can treat a judgment enforcing the settlement as they have the settlement itself, by thumbing their noses at the court and ignoring their obligations to pay" (Kaufman, November 10, 1989).

Finally, on February 17, 1990 Judge Spiegel ordered the U.S. government to pay \$16 million of the \$73 million within 30 days.

He said, "The patience of this court is exhausted." He also imposed 10 percent annual interest on the unpaid portion of the settlement. On March 15, 1990 the DOE wired the promised \$16 million down payment. Attorney Chesley was quoted as saying, "The system works" (Kaufman, March 16, 1990). As of December 25, 1990, 7,000 Fernald residents, who had spent two years continually working or living within two miles of the plant, had been paid \$500 each (Kaufman, December 25, 1990).

The legal problems surrounding Fernald are not over, however. Some 6,000 Fernald workers have filed a \$1.6 billion lawsuit against their employer for alleged exposure to radioactive substances on the job (Murphy, May/June, 1990b). In June, 1990, in a precedent-setting decision striking down the DOE's time honored "sovereign immunity" (i.e., "cooperative law" in legal circles), a federal appeals court ruled that the state of Ohio could fine the DOE \$250,000 for violating pollution laws (Russell, 1990). And, Ohio State Attorney General Anthony J. Celebrezze, Jr. has filed contempt of court charges against the DOE and Westinghouse for allegedly violating a cleanup agreement (Murphy, May/June, 1990b). Finally, Energy Secretary James Watkins has announced that Fernald will close down as a uranium foundry; and the EPA apparently has become the final arbiter in disputes over the eventual Fernald cleanup (Russell, 1990).

Next we turn to a discussion of Fernald in relation to a possible, high level waste repository at Yucca Mountain.

What Can Be Learned From the Fernald Experience

A number of additional problems related to the Feed Materials Production Center have come to light in recent months, as reflected in interviews with Fernald residents and in some fairly critical articles in The Cincinnati Enquirer. These problems may be of interest to the people of the State of Nevada as they continue to weigh and consider the proposed Yucca Mountain nuclear waste repository. A continuing (i.e., unresolved) Fernald problem is that of the K-65 silos. "In addition to the waste pits, 9,000 tons of uranium and radium residues from production of the first atomic bombs are stored in two huge concrete silos located at the western end of the site" (Coyle, et al., 1988). The radium, a decay product of uranium, emits a radioactive gas, radon. Because of cracks in the K-65 silos, concentrations of escaping radon gas at the base of the silos were measured at 100 percent of Department of Energy occupational limits (Coyle, et al., 1988). Tests to identify the exact contents of the silos are vital before officials can determine how best to clean up the area; and the silos are thought to be leaking radioactive chemicals into the ground water (Higginbotham, October 26, 1990). Earth has been mounded on the sides of the silos to reduce radon levels, but the silos continue to leak radiation from the roofs (Coyle, et al., 1988). Cleanup at Fernald will likely slip off schedule because of the incomplete

test data on some of these hazardous wastes (Higginbotham, October 4, 1990). The U.S. EPA has approved a stop-gap solution to improve plant safety until the actual cleanup project begins in 1992. Workers are putting a one foot layer of clay inside the silos to curb radon emissions and add support (Higginbotham, October 26, 1990).

Bechtel National, Inc. (July 28, 1990, p. 3) discusses the cracks in the concrete surface of the silos in a July, 1990 evaluation for the DOE, and they raise an additional concern. Although protective plywood covers for the domes of the silos were constructed and installed in January, 1986 Bechtel's recent findings (July 28, 1990, p. 16) show that the silo concrete has lost at least 60 percent of its design strength and confirm an earlier (1985) finding that the silo domes might fail under tornado conditions. There is also the potential for K-65 residues to become airborne during a tornado event (pp. 16 and 90). The exposure pathway for radon, assuming a one hour inhalation period (i.e., an evacuation could not be implemented in that time frame), would result in a 130 millirem exposure to the general public, "an unacceptable level of risk" (p. 90). In fact, the Bechtel evaluation further indicates that "chronic exposure to the radon releases currently being experienced by the workers and the general public exceed ARARS [applicable requirements] and will in all likelihood increase as the silo domes continue to degenerate" (p. 72). Meanwhile, the NRC's revised radiation standards require that by January, 1993, the nuclear industry assure that: the maximum exposure to the general population from atomic facilities be no more than 100 millirems per year, and that atomic workers be exposed to no more than five rems of radiation a year, with no exceptions for special conditions (AP, December 12, 1990).

Some newer revelations (i.e., within the past year) only seem to add to the total amount of "nuclear stew" already generated at Fernald. While DOE records show that a record high estimate of 75,565 pounds of uranium were released from the plant in 1955, almost a ton of uranium reportedly escaped from Fernald as late as 1989, according to the DOE (Higginbotham, November 12, 1990). Also in 1989, treated waste water containing 1,854 pounds of uranium flowed into the Great Miami River, while the wind carried away about 66 pounds (Higginbotham, November 12, 1990). The average uranium concentrations in 1989's monthly milk samples from cows that graze on the plant property was below the laboratory's minimum detectable level; but this interpretation could be deceptive since the contamination would settle in the animals' fatty tissues, not in their milk. Results showing that the October 1989 milk sample contained more than 18 times the usual amount of radiation were discounted by the DOE as erroneous, because the control sample from an Indiana dairy showed similar results and Fernald officials had not detected any unusual uranium releases at the time (Higginbotham, November 12, 1990).

Another Fernald mystery that could prove worrisome is the discovery of a "railroad-car-sized vault" buried near an abandoned road on the edge of the facility (Higginbotham, October 2, 1990). The vault is thought to contain highly radioactive materials similar to the Manhattan Project wastes stored in the plant's K-65 silos, according to Graham Mitchell, Fernald manager with the Ohio EPA (Higginbotham, October 2, 1990). Still other recent discoveries include: sites near Fernald that have been contaminated since the 1960s by two local chemical companies (Higginbotham, October 29, 1990); a mound of radioactive waste that rose from a lagoon at Fernald and was pushed under water to reduce the hazardous emissions (Higginbotham, October 25, 1990); dried radioactive waste that was jutting above the water line in a 24 foot deep waste pit (Higginbotham, December 20, 1990); the leakage of 2,676 pounds of radioactive sludge from elevated storage tanks (Cincinnati Enquirer and AP, February 13, 1991); and, the discovery by DOE officials that a plume of uranium-laced water is traveling through the aquifer under Fernald and has reached a distance at least one and one half miles south of the plant, possibly tainting another private well (Higginbotham, January 14, 1991). These discoveries all have implications for any future behavior at Yucca Mountain.

There have been a few bright spots related to the Fernald situation. Some cleanup and re-packaging of radioactive waste has been achieved since the plant stopped production in July, 1989. The government plans to retrain Fernald uranium workers to help with cleanup procedures (Higginbotham, October 3, 1990); Fernald workers are being trained to respond to natural disasters, such as earthquakes and tornadoes (Higginbotham, November 26, 1990); and, as mentioned earlier, radiation limits have been revised downward (AP, December 12, 1990). More important, the DOE has agreed to help pay for a new water system for Crosby Township residents near Fernald (Miller, March 3, 1991). The government is planning to contribute \$3 million to an estimated \$12.5 million project to supply public water to all of Crosby Township (AP, May 1, 1991). Residents there now rely on wells, rain cisterns, and private suppliers, as do residents in some other townships within the 5 mile radius of Fernald (Collins, April 10, 1991).

Conversely, there have been some recent setbacks. Cleanup delays at Fernald have cost the DOE \$100,000 in fines, the largest ever paid to the EPA by another government agency (Willette, May 14, 1991). Further, a recent DOE memo indicates that there have been cuts in the budget for cleaning up waste at DOE sites (Willette, April 19, 1991). Senator John Glenn interprets these cuts to mean that "production is again being given a blank check at the expense of cleanup and at the expense of the Americans who face risks from exposure to dangerous substances" (Willette, April 19, 1991). Given the fact that the Army is finding it too costly to clean up 1.4 million rounds of unexploded ammunition at Jefferson Proving Ground near Madison, Indiana (Cass, April 7, 1991), one

wonders if it ever will be possible to clean up a much more complicated type of military waste at Fernald. Testifying at a DOE hearing in Cincinnati, Arjun Makhijani (January 14, 1991), an expert on energy and environmental research, said:

It's time to stop using the word 'clean up' because it's not honest. You cannot clean up radioactivity--you can just move it around. Who wants it? Nobody wants it.

Perhaps this is why researchers David Pijawka, Alvin Mushkatel, and Marilyn Dantico are finding so much resistance to the idea of locating a nuclear waste facility at Yucca Mountain (ASU, Spring, 1991). Pijawka says, "People perceive very high risk from the repository, but they also feel vulnerable" (ASU, Spring, 1991). Many Nevadans believe that the federal government does not have credibility in managing a waste repository, and that the DOE used illegal and unfair procedures in selecting the site. The Arizona State University study also examined the economic risks of the waste facility. The analysis showed a common community perception that even a minor, relatively harmless mishap associated with the facility might result in out-migration, loss of tourism, and reduced local investment (ASU, Spring, 1991). However, the ASU researchers recommended that the DOE might gain more acceptance for the waste facility by working more closely with state agencies and local citizens.

Perhaps state agencies and local Nevadans have yet to learn that the DOE would like to store up to 70,000 metric tons of high level waste at Yucca Mountain, and that they would like to be able to retrieve this material from the repository for up to one hundred years, in the event that new technologies for treating the material are developed in the future.

As the preliminary draft of this report was almost completed, a six-year-old letter was released in Cincinnati on June 11, 1991 that seems to confirm 30 years of management cover-up of contamination risks at Fernald (Kaufman, June 11, 1991). The June 12, 1985 letter was from Linda Munson, a consultant at Battelle Pacific Northwest Laboratories in Richland, Washington. The letter was addressed to Robert B. Weidner, head of NLO's health, safety and environmental division of Fernald until the end of 1985. The subject of the letter was a proposed picnic for Fernald employees and their families at the Feed Materials Production Center. Munson referred to the picnic as "an extremely poor idea," since even the "clean zone" of the plant was contaminated (Kaufman, June 11, 1991). And, if NLO took precautions to warn the visitors, Munson further warned, "workers are very likely to learn that they have frequently been leaving the plant contaminated" (Kaufman, June 11, 1991). She added that this would be a "more compelling reason" to drop the picnic idea than the likelihood of contaminating

picnickers (Kaufman, June 11, 1991). Attorneys for the Fernald workers called the letter a "smoking gun," which they plan to use in proving that NLO kept employees ignorant of the risks of producing uranium for the Pentagon.

Community Response to Exposure to Hazardous Wastes

On July 16, 1991, the Quarterly Meeting on Fernald was held in nearby Ross, Ohio, and there were some important revelations by DOE and EPA officials. Leo Duffy, who heads the DOE waste program, said, "There are a million cubic meters of nuclear waste [at Fernald] that have to be disposed of." This is due to the fact that the plant is situated "only 20 to 30 feet above the aquifer, and the aquifer supplies Southern Ohio with half of its water." Duffy added that "the Yucca Mountain evaluation will take 20 years" and that "it will take one hundred billion dollars to solve the problem." Members of the audience were relieved to hear Mr. Duffy say that the DOE had "made mistakes in the past," but that "we try not to do anything in secrecy any more."

At the same July 16th meeting, Jack Craig (DOE) explained the status of the "removal action" at Fernald. Craig described five different waste sites at Fernald and confirmed the fact that "radium is producing radon gas in the K-65 silos." He announced that the K-65 silo contents sampling began on July 16, 1991, and that it was scheduled to be finished by August, 1991. Craig described various other aspects of the removal action, including the fact that Bentonite (a clay mixture) "will be pumped into the K-65 silos on top of the waste to keep the waste from blowing away during a storm or tornado." Ray Hansen (DOE) announced that Fernald's low level waste is already going to (Mercury) Nevada and that "57 million pounds of uranium waste has to be removed" from the Fernald site. Regarding thorium oxide in Silo 8, Hansen said, "Two million pounds of thorium has been declared waste at this point"; and, "200,000 drum equivalents have been moved offsite, but there are many tons to go." Finally, the EPA's Fernald project manager Catherine McCord announced that "vitrification is being seriously considered for waste from the K-65 silos." She also said that tests of vitrification are going on now at Hanford using material from Fernald.

On August 24, 1991, The Cincinnati Enquirer published an article by Elizabeth Neus which tends to support DOE claims of a speedy removal of waste from Fernald. Neus said that the DOE has approved transfer of most of the 1,100 metric tons of thorium stored at the plant. Lisa Crawford's reaction to this report was "We'll believe it when we see it," since FRESH has been told for over a year that the thorium would be shipped out (Neus, 1991). The community's response to DOE's promises for cleanup at Fernald has been mixed. Some citizens, who were formerly hostile toward NLO, Westinghouse, Fernald, and the Pentagon have begun to take a more sympathetic view. For example, 2,000 people were taken on a

tour of Fernald to get a first-hand view of DOE attempts at over-packaging and cleanup (Higginbotham, Sept. 23, 1990). Some were reportedly impressed with what the DOE and Westinghouse have accomplished. And, it is true that production shutdown activities at Fernald do include re-training, finding jobs for released workers, and "safe shutdown." But Kurt Finsterbusch's description (Peck, 1989, p. 60) of the "reaction phase" of typical community response to exposure to hazardous wastes remains a vivid "snapshot" of the entire Fernald experience for Lisa Crawford and others in the Cincinnati area,

The reaction phase found victims complaining and demanding actions from the authorities who usually acted slowly, stingily, and inadequately. The victims, therefore, had to organize and escalate their pressure on the authorities to investigate, stop further pollution, decontaminate and compensate. Their pressure tactics were only partially successful. Meanwhile polluters continued polluting an average 4.1 years after public discovery of the problem.

According to Finsterbusch (Peck, 1989, p. 60), the "resolution stage" will involve the removal of immediate danger, but little removal of the actual toxins. Waste pits will be covered, wells closed and/or capped, toxic emissions lowered to "safe" levels, and people moved off contaminated land. Polluters will not be prosecuted, they will pay only a few fines, and in a majority of cases no compensation will be paid to victims.

More than the economic cost of the Nuclear Age, however, it is the human cost that troubles many social scientists, as reflected in the experience of the Zinser family and many others who trusted our government. As Dr. Alice Stewart, the British epidemiologist expresses it, "At the end of every statistic is a person, and something that happened to that person" (McKenna and Neus, April 28, 1989). It remains to be seen whether or not a groundswell of moral indignation will develop against these plants and if that public opinion will be enough to close down the nuclear weapons industry permanently.

References

- Arizona State University Research. (1991, Spring) Nuclear waste and government distrust. Vol. 6, No. 1, p. 6.
- Bechtel National, Inc. (1990, July 28). K-65 silos removal action at the feed materials production center--Fernald, Ohio--for the United States Department of Energy.
- Bertell, R. (1985). No immediate danger. Summertown, Tennessee: The Book Publishing Company, p. 34.
- Brataas, A. (1986, October 19). Pit liner failed twice. The Cincinnati Enquirer, pp. A-1 and ff.
- Brataas, A. (1986, October 11). Ex-safety official: Tests faked. The Cincinnati Enquirer, p. A-20.
- Cass, C. (1991, April 7). Dud ammunition being left behind. The Cincinnati Enquirer.
- Carpenter, T. (1989, May 22). Fernald information must not be withheld." The Cincinnati Enquirer.
- Cobb, C. E., Jr. (1989, June). Living with radiation. National Geographic, pp. 403-437.
- Collins, B. L. (1991, April 10). Water service. [Letter to the editor]. The Cincinnati Enquirer.
- Coyle, D. et al (1988). Deadly defense: Military radioactive landfills. New York: Radioactive Waste Campaign, pp. 115-120.
- Foucault, M. (1977). Power/knowledge: Selected interviews and other writings, 1972-1977. New York: Pantheon.
- Hamilton, M. (1991, July/August). Body snatchers. Mother Jones, pp. 15-16.
- Hardert, R. A. (1991, Spring). Nuclear exposure at Fernald, Ohio: You can't go home again. The Institute Report, 3(1), 1, 2, 7-10. Tempe, Arizona: Arizona Institute for Peace Education and Research.
- Harper's Magazine. (1990, June). How I learned to stop worrying. p. 25.
- Hedges, S. (1989, October 23). Bomb makers' secrets. U.S. News & World Report, pp. 22-28.

- Higginbotham, M. (1990, August 30). Reports reveal more hazards at Fernald. The Cincinnati Enquirer, p. C-2.
- Higginbotham, M. (1990, Sept. 23). Visitors note clean look, safe equipment. The Cincinnati Enquirer, p. A-1.
- Higginbotham, M. (1990, October 2). Buried box holds a mystery. The Cincinnati Enquirer, p. A-1.
- Higginbotham, M. (1990, October 3). Employees will train for cleanup. The Cincinnati Enquirer, p. E-1.
- Higginbotham, M. (1990, October 4). Silo test delay stalling Fernald cleanup. The Cincinnati Enquirer, p. B-1.
- Higginbotham, M. (1990, October 25). Water to cover nuclear waste. The Cincinnati Enquirer.
- Higginbotham, M. (1990, October 26). Sample retrieved at Fernald. The Cincinnati Enquirer.
- Higginbotham, M. (1990, October 29). Plants could add to worries. The Cincinnati Enquirer, pp. A-1 and A-8.
- Higginbotham, M. (1990, November 4). Resident's questions grew to citizen's group concerned by Fernald. The Cincinnati Enquirer.
- Higginbotham, M. (1990, November 12). Fernald lost ton of uranium in '89. The Cincinnati Enquirer, pp. A-7 and A-9.
- Higginbotham, M. (1990, November 15). Officials seek to test Fernald cows. The Cincinnati Enquirer, pp. B-1 and B-2.
- Higginbotham, M. (1990, November 26). Fernald workers train for natural disasters. The Cincinnati Enquirer.
- Higginbotham, M. (1990, December 20). Fernald cleans up emissions hazard. The Cincinnati Enquirer, pp. B-1 and B-2.
- Higginbotham, M. (1991, January 13). Fernald may signal failure. The Cincinnati Enquirer, pp. B-1 and B-3.
- Higginbotham, M. (1991, January 14). Radiation test results on water are mixed. The Cincinnati Enquirer. January 14.
- Jakubauskas, C. (1991, March 25). An inside view of the Rocky Flats plant. High Country News, p. 15.

- Johnson, C. (1981). Cancer incidence in an area contaminated with radionuclides near a nuclear installation. Ambio, pp. 176-182.
- Kaufman, B. L. and Neus, E. (1989, June 8). Gloomy report opens Fernald trial. The Cincinnati Enquirer.
- Kaufman, B. L. (1989, June 13). Testimony challenged. The Cincinnati Enquirer.
- Kaufman, B. L. (1989, June 22). Verdict in the summary trial reflects the public's outrage. The Cincinnati Enquirer.
- Kaufman, B. L. (1989, November 10). Lawyer accuses DOE of stalling. The Cincinnati Enquirer.
- Kaufman, B. L. (1990, March 16). DOE sends portion of debt for Fernald. The Cincinnati Enquirer.
- Kaufman, B. L. (1990, December 25). New round of Fernald payouts set. The Cincinnati Enquirer.
- Kaufman, B. L. (1991, June 11). Lawyers: Letter proves Fernald cover-up. The Cincinnati Enquirer, p. D-1.
- Kaufman, B. L. and Neus, E. (1989, July 1). DOE offers \$78 million settlement. The Cincinnati Enquirer, July 1.
- Kaufman, B. L., Neus, E., and McKenna, M. A. J. (1989, June 7). Fernald's boss was in the dark. The Cincinnati Enquirer, pp. A-1 and A-6.
- Magnuson, E. (1988, October 31). They lied to us. Time, pp. 60-65.
- Makhijani, A. Testifying at a DOE Public Hearing in Cincinnati, Ohio on January 14, 1991.
- Malloy, P. J. (1990, January 3). Newsletter. New York: Radioactive Waste Campaign.
- McKenna, M. A. J. (1988, December 31). Memo raises Fernald figures. The Cincinnati Enquirer, pp. A-1 and ff.
- McKenna, M. A. J. (1989, May 3). Estimates soar for radiation lost at Fernald. The Cincinnati Enquirer, pp. A-1 and ff.
- McKenna, M. A. J. (1989, May 16). Uranium found in soil. The Cincinnati Enquirer, pp. A-1 and A-12.

McKenna, M. A. J. (1989, May 25). Fernald trial to be open.
The Cincinnati Enquirer.

McKenna, M. A. J. (1989, June 4). Fear meets power in
courtroom. The Cincinnati Enquirer.

McKenna, M. A. J. (1989, June 7). Figures deceptive in
gauging emissions. The Cincinnati Enquirer, p. A-6.

McKenna, M. A. J. (1990, February 4). 2 fights for ex-
Fernald worker. The Cincinnati Enquirer, A-1 ff.

McKenna, M. A. J. (1990, February 8). New water threat at
Fernald. The Cincinnati Enquirer, pp. A-1 and ff.

McKenna, M. A. J. (1990, February 15). Scientist disputes NLO
Inc. The Cincinnati Enquirer.

McKenna, M. A. J. (1990, April 10). Fernald cleanup set to
begin. The Cincinnati Enquirer, p. A-1.

McKenna, M. A. J. (1990, May 3). Private well tainted by
Fernald uranium. The Cincinnati Enquirer, p. A-1 ff.

McKenna, M. A. J. (1990, May 23). Tainted water overflowed
near Fernald. The Cincinnati Enquirer, pp. E-1 and E-2.

McKenna, M. A. J. (1990, June 5). Twister could have spread
Fernald radiation. The Cincinnati Enquirer, p. A-6.

McKenna, M. A. J. (1990, October 25). Fernald may be threat
to aquifer. The Cincinnati Enquirer, pp. E-1 and E-2.

McKenna, M. A. J. and Neus, E. (1989, April 28). Worse than
3 mile island. The Cincinnati Enquirer, pp. C-1 and
C-2.

Miller, M. (1991, March 3). DOE will help pay for Crosby water
system. The Cincinnati Enquirer.

Murphy, J. (1990a, May/June). A non-toxic but still damaging
leak. Public Citizen, p. 20.

Murphy, J. (1990b, May/June). The battle over nuclear
America. Public Citizen, pp. 16-20.

Neus, E. (1990, February 5). Nuclear arms plants topic of 3
speakers. The Cincinnati Enquirer.

Neus, E. (1991, August 24). Dangerous thorium to be shipped
out. The Cincinnati Enquirer.

Peck, D. L., editor (1989). Psychosocial effects of hazardous toxic waste disposal on communities. Springfield, Illinois: Charles C. Thomas.

Peck, L. (1987, March 18). "Agency reported on potential Fernald danger in 1951." Gannett News Service reported in The Cincinnati Enquirer.

Public Broadcasting System. (1988). Poison and the Pentagon. Aired at various times in Phoenix, Arizona, by KAET-TV.

Public Broadcasting System. (1990). NOVA: The bomb's lethal legacy. Aired in Phoenix, Arizona, on September 11.

Reader, M. with Hardert, R. A. and Moulton, G. L., Atom's eve. New York: McGraw-Hill, p. 26.

Russell, D. (1990). In the shadow of the bomb. The Amicus Journal, 12 (4), 21.

Schumacher, E. (1990, July 24). Radiation report is vindication. Seattle Times.

The Associated Press. (1990, December 12). Radiation limits revised. The Cincinnati Enquirer.

The Associated Press. (1991, May 1). Fernald area may get public water hookup. The Cincinnati Enquirer.

The Associated Press and The Cincinnati Enquirer, (1989, June 7). Government probes nuclear arms plant, p. A-6.

The Cincinnati Enquirer. (1989, November 19). Radiation exposure claimed.

The Cincinnati Enquirer. (1990, November 10). Plutonium plant tested in secrecy.

The Cincinnati Enquirer and the Associated Press. (1991, February 13). Ton of radioactive sludge leaks at Fernald.

The New York Times. (1988, November 2). S. Carolina a-plant hid 31 years of reactor accidents, probes reveal.

The New York Times. (1991, January 5). Energy agency gives up radiation study.

Ullrich, D. A. (1990, July 5). Statement of David A. Ullrich, Acting Director, Waste Management Division, U. S. Environmental Protection Agency, Region V, Before the

Transportation and Hazardous Materials Subcommittee of the House Committee on Energy and Commerce, pp. 1-5. Also in 1990, see Advanced Sciences, Inc. International Technology Corp. Engineering Evaluation/Cost Analysis/Waste Pit: Responsiveness Summary--Feed Materials Production Center (Fernald, Ohio). Prepared for U.S. Department of Energy Oak Ridge Operations Office (August). FMPC.003.6. For the K-65 silos, see Bachtel National, Inc., 1990. Engineering Evaluation/Cost Analysis: K-65 Silos Removal Action at the Feed Materials Production Center, Fernald, Ohio for the United States Department of Energy (July), FMPCREV2.WP.

Wald, M. L. (1990, June 20). Nuclear official gave false report, inquiry finds. The New York Times, p. 12.

Westinghouse Materials Company of Ohio. (1989, December). A special tribute to Renae Cook. FMPC Update, p. 8.

Willette, A. (1991, April 19). DOE memo reveals cuts in cleanup budget. The Cincinnati Enquirer, p. A-6.

Willette, A. (1991, May 14). Fernald fine seen as victory. The Cincinnati Enquirer.

Willette, A., and McKenna, M. A. J. (1989, May 4). Bucket caught Fernald radioactive dust. Gannett News Service and The Cincinnati Enquirer, pp. C-1 and C-2.

Zinser, C. (1988, October 30). Interview with Charles Zinser on National Public Radio.

LOVE CANAL 1978 - 1991
A CASE STUDY OF THE SOCIAL IMPACTS OF HAZARDOUS WASTES

By

ADELINE GORDON LEVINE

LOVE CANAL, 1978 to 1991
A case study of the social impact of hazardous wastes

Adeline Gordon Levine
SUNY/Buffalo

EXECUTIVE SUMMARY

Introduction

The term "Love Canal" has become the worldwide symbol for the societal problems that accompany the disposal of toxic wastes. Because it was the first time that a large residential neighborhood was contaminated by materials disposed of in what was then a routine manner, the case attracted media attention then and has stayed in the public eye ever since. It is 15 years since the Love Canal became known worldwide as an environmental problem, long enough so that we can trace the course of problem solution there.

To summarize the events, in 1976, several government agencies became aware that a semi-suburban residential section of Niagara Falls, New York had been contaminated by a long forgotten buried chemical waste dump site, used by the Hooker Chemical Company between 1942 and 1952. In the glare of great media publicity, some government agencies, particularly the New York Department of Health began to work on the problem. Based on reports of increased miscarriages, in the late summer of 1978 the Health Commissioner announced that the area was a health hazard. However, the effects on health were studied sporadically, never thoroughly and systematically. In 1978 and 1979, homes nearest to the disposal site were purchased by the state, people began to move out and an organized citizens group pressed for further home purchases. In 1980 a larger area was designated for home purchases; by 1991 59 families remained of the original 1000+ families. A great deal of remediation work was done in the 1980s to contain the canal leakage, and to clean out contaminated sewers and creeks. Over half of the larger area designated in 1980 was declared "habitable" and by mid 1991, 24 of the homes sold to the state had been purchased by new owners; 14 of these are now occupied.

Lawsuits were launched against the Occidental Chemical Corporation (Hooker's parent company) in the late 1970s and early 1980s. Hundreds of individual suits were settled out of court in 1983; others are still pending. The EPA filed suits which are still in preparation. New York State's suit came to trial in the autumn of 1990, and by summer 1991 the trial phase is almost complete, with damages of some \$750 million under consideration.

This paper is directed to policy makers trying to anticipate what may happen if residential areas are purposefully contaminated, if people living there find out about it, and if government agencies have to address the problem. The purpose of this case study is to describe and analyze the events that have transpired at Love Canal, to illustrate dilemmas, problems, factors that I will call issues, that probably will be present in any technological disaster. Although the cause of the event will differ, as will the history of each place and the particular people involved in each case, we can anticipate that there will be diverse actors with differing expectations, needs, goals and interpretations of the events that occur, depending on their stake in the outcome of the entire event. In every one of these environmental cases, the stakes are huge: people's lives, homes, health,

reputations, political and professional careers are at risk along with huge financial costs to the taxpayers and powerful business interests. And in every technological disaster, there are issues that must be considered, if not dealt with.

The issues will be inherent in the situation, no matter how intelligent, well trained, highly motivated and well intended the individuals who find themselves in the midst of such an event.

Issue 1. Environmental problem solutions occur in a complex, multilayered system of government agencies with differing but overlapping jurisdictions, missions and resources. Accommodation and cooperation among them may be difficult to achieve.

Issue 2. The presence of resources to solve problems may affect which problems will be selected for solution, and the method to be used in the attempt. Problems definition determined by available resources may appear irrational to some actors and lead to conflict.

Issue 3. The definition of problems and acceptable solutions will be determined by each set of actors' interests. When the several groups have different interests, their views may lead to conflict.

Issue 4. Environmental problem solution is costly. Because there are diverse sets of actors with different jurisdictions, liabilities, and resources, there will be conflicts over the question: Who pays the bills?

Issue 5. The speed and certainty of decision making depend in part on an adequate knowledge base. In most environmental contamination cases, because the problems are new in kind or degree, there may be a very small knowledge base -- scientific, or experiential-- to draw upon in proceeding to address the problems.

Issue 6. If there is little in the way of scientific information, the difficulties in obtaining it, will go beyond the normal problems of scientific methodology. Political considerations will be involved in the process from beginning to end.

Issue 7. To minimize conflict, trust must be maintained among all the actors in the situation. Once trust has eroded between citizens and their government, it is very difficult and costly to try to reestablish it. It may be necessary to create new social mechanisms to allow work to proceed in a situation of low trust.

Issue 8. All scientific work is influenced by its social surroundings, as is any other cultural production. The social setting of government agencies and citizens may affect the scientific product.

Issue 9. Our tradition of democratic participation has extended in recent years to the solution of environmental problems. Citizen participation in some form is to be expected and may be required by law. However, citizen participation is not simple to put into practice, for either the government agencies, or for the affected citizens.

Issue 10. Environmental problems are broad in scope, involving many areas of people's lives, the community and the greater society. Inevitably these problems require interdisciplinary work. Scientists and other professionals from diverse backgrounds must

learn work together.

Issue 11. Decisions are likely to represent compromises among a variety of interests. These compromises may be misunderstood or not accepted readily by the affected populace or the general public.

Issue 12. Critical contingencies may arise which will undermine planned solutions. Unexpected difficulties occur because all or most of the attention and resources have been directed to the most immediate and most solvable problems.

Issue 13. Every solution to the physical environmental problems will have social impacts. The physical environmental problems may appear to be the most straightforward and relatively easiest to address. However, even they are enormously complex and the solutions may affect the lives of the residents adversely.

Issue 14. Manmade environmental problems are highly publicized. Given this social structural fact, the consequence is that while formal credentials and experience are necessary they may not be sufficient for professionals who must work in the spotlight.

Issue 15. The safest assumption is that experts will vastly underestimate the efforts and resources required to solve the problems caused by serious pollution of the environment.

1. **BN**: **The Buffalo News**
2. **CDC** or **USCDC**: Centers for Disease Control, a division of the U.S. Department of Health and Human Services.
3. **DEC** or **NYSDEC**: New York State Department of Environmental Conservation.
4. **DOH** or **NYSDOH**: New York State Department of Health.
5. **EDA**: Emergency Declaration Area (the region around the Love Canal, established in 1980. People living in the EDA were eligible to have their homes purchased by New York state.)
6. **EPA** or **USEPA**: US Environmental Protection Agency.
7. **ETF**: Ecumenical Task Force.
8. **FEMA**: Federal Emergency Management Agency
9. **HHS**: US Department of Health and Human Services.
10. **LCARA**: Love Canal Revitalization Agency (the ad hoc agency established in 1980 to administer funds for home purchases and revitalization of EDA).
11. **LCHA**: The Love Canal Homeowners Association.
12. **LCIC**: Love Canal Indicator Chemicals
13. **LUAC** Land Use Advisory Committee
14. **NG**: **Niagara Gazette**.
15. **OTA**: The US Congress Office of Technology Assessment.
16. **TRC**: The Technical Review Committee, established in 1983, and composed of representatives from the DEC, DOH, EPA and CDC.

LOVE CANAL, 1978 to 1991
A case study of the social impact of hazardous wastes.

Adeline Gordon Levine
SUNY/Buffalo

CASE STUDY

Introduction

The term "Love Canal" has become the worldwide symbol for the societal problems that accompany the disposal of toxic wastes. Because it was the first time that a large residential neighborhood was contaminated by materials disposed of in what was then a routine manner, the case attracted media attention then and has stayed in the public eye ever since. It is 15 years since the Love Canal became known worldwide as an environmental problem, long enough so that we can trace the course of problem solution there.

To summarize the events, in 1976, several government agencies became aware that a semi-suburban residential section of Niagara Falls, New York had been contaminated by a long forgotten buried chemical waste dump site, used by the Hooker Chemical Company between 1942 and 1952. In the glare of great media publicity, some government agencies, particularly the New York Department of Health began to work on the problem. Based on reports of increased miscarriages, in the late summer of 1978 the Health Commissioner announced that the area was a health hazard. However, the effects on health were studied sporadically, never thoroughly and systematically. In 1978 and 1979 homes nearest to the disposal site were purchased by the state, people began to move out and an organized citizens group pressed for further home purchases. In 1980 a larger area was designated for home purchases; by 1991 59 families remained of the original 1000+ families. A great deal of remediation work was done in the 1980s to contain the canal leakage, and to clean out contaminated sewers and creeks. Over half of the larger area designated in 1980 was declared "habitable" and by mid 1991, 24 of the homes sold to the state had been purchased by new owners; 14 of these are now occupied.

Lawsuits were launched against the Occidental Chemical Corporation (Hooker's parent company) in the late 1970s and early 1980s. Hundreds of individual suits were settled out of court in 1983; others are still pending. The EPA filed suits which are still in preparation. New York State's suit came to trial in the autumn of 1990, and by summer 1991 the trial phase is almost complete, with damages of some \$750 million under consideration.

This paper is directed to policy makers trying to anticipate what may happen if residential areas are purposefully contaminated, if people living there find out about it, and if government agencies have to address the problem. The purpose of this case study is to describe and analyze the events that have transpired at Love Canal, to illustrate dilemmas, problems, factors that I will call issues, that probably will be present in any technological disaster. Although the cause of the event will differ, as will the history of each place and the particular people involved in each case, we can anticipate that there will be diverse actors with differing expectations, needs, goals and interpretations of the events that occur, depending on their stake in the outcome of the entire event. In every

one of these environmental cases, the stakes are huge: people's lives, homes, health, reputations, political and professional careers are at risk along with huge financial costs to the taxpayers and powerful business interests. And in every technological disaster, there are issues that must be considered, if not dealt with.

The issues will be inherent in the situation, no matter how intelligent, well trained, highly motivated and well intended the individuals who find themselves in the midst of such an event.

Issue 1. Environmental problem solutions occur in a complex, multilayered system of government agencies with differing but overlapping jurisdictions, missions and resources. Accommodation and cooperation among them may be difficult to achieve.

The questions here are which government agency is going to take charge of the problem? Will no one want the problem? Will there be "turf battles?" Will there be a proliferation of ad hoc agencies? Our interwoven system of city, county, state, and federal government can lead to problems being "nobody's baby", or being divided among a number of agencies, with precious resources expended on wading through bureaucratic red tape. Multiple agencies have been involved at Love Canal from the beginning, including new committees and task forces designed to represent multiple agencies and thus cut through the "red tape" problem expeditiously. Such new agencies and multi-agency committees have their own complexities.

***

From 1976 to the spring of 1978, the city of Niagara Falls, the county and state health departments, the state department of conservation, and the US Environmental Protection Agency had all been aware of a growing problem in the Love Canal neighborhood. No agency "claimed" the problem. The spate of environmental laws passed in the early 1970s, along with laws pertinent to chemical wastes, seemed inappropriate or had not yet been completed with implementing regulations. Finally, the New York Department of Health (NYDOH) took the lead, began to meet with neighborhood residents, and do some preliminary studies of health effects. After the Commissioner of Health announced that that the area was a health hazard, in August 1978, New York Governor Hugh Carey established the Love Canal Interagency Task Force to coordinate the work of the nine state agencies involved in addressing the Love Canal problems.

The Interagency Task Force seemed to work fairly harmoniously, even though it had two levels of administration and action, one in Niagara Falls and one in Albany. A multi-tier system means that those actually working with the problem may not be viewed as truly being in charge. The leader of the major organized citizens' group often bypassed the local task force director, saying that he did not make the ultimate decisions and she wanted to go "straight to the top."

The state and federal agencies sometimes experienced friction in their relationship, for example on a couple of occasions when the EPA made announcements to the residents about health studies without discussing them first with the NYDOH. And, there were always difficulties perceived by the state in collecting promised funding from the federal government, whether through the EPA or the Federal Emergency Management Agency. The "feds" on the other hand protested that forms had not been filed properly, necessary conditions met and the like.

When the federal and state executive staffs worked together in the summer of 1980, to hammer out an agreement to fund a wider buyout of Love Canal homes, some of the difficulties in cooperation between the two staffs resulted in grudging concessions which hurt the residents. For example, no properties could be purchased by the state unless they were owner occupied homes. This meant that people who had bought a home for income purposes, young couples whose parents had made the original purchase because they had the down payment and a credit rating, or the people who fled when the first announcements of danger came out, were left fighting, sometimes for years for fair treatment (see Levine, 1982).

Later, in 1983, the Technical Review Committee was established to coordinate the work of two federal agencies and two state agencies. This committee will be described below under Issue 7.

Issue 2. The presence of resources to solve problems may affect which problems will be selected for solution, and the method to be used in the attempt. Problem definition determined by available resources may appear irrational to some actors and lead to conflict.

Questions about homes and neighborhoods, remediation, and effects on health and environment have occurred and can be anticipated when contamination occurs at populated sites. In a social sense, in terms of what the policy maker must anticipate, the causal agent, whether buried chemical wastes, polluted water supplies, underground mine fires, nuclear wastes, or whatever, does not matter. However the environmental disaster was initiated, the human problems will be present and pressing.

What will be the specific problems addressed by the government? How will the problems be selected? Will the problems the government chooses to work on or emphasize be viewed by the affected people as the appropriate or most important problems?

***

The Love Canal Interagency Task Force decided to pursue three goals: to implement the purchase of the homes in the neighborhood nearest to the Canal; to supervise remedial work to reduce the dangers of the abandoned waste site; and to assess the effects of toxic exposure on people's health and the environment. Working singly and under various coordinating administrative arrangements, federal and state agencies have continued to work ever since on the three intertwined questions. The first two, what to do with the houses and the immediate neighborhood of Love Canal, and how to remediate the most obvious environmental damage, have received the most official attention. There has been less attention paid to the third question: what have been -- and what might be -- the effects of exposure on people's health and on the environment.

When Dr. David Axelrod became Commissioner of Health for New York State in January 1979, one of his first acts was to request help from the U.S. Environmental Protection Agency (EPA) and the National Institutes of Health, in conducting comprehensive studies of the impacts that Love Canal had on human health. It was fully a year and a half later, the autumn of 1980, before the Centers for Disease Control (CDC) initiated plans for a major study, which would utilize the medical faculty of the nearby State University

of New York at Buffalo. This effort was in the midst of the detailed planning phase, when the federal Office of Management and Budget slashed it as part of the budgetary restraint introduced by President Ronald Reagan's administration.

There have been a few health studies conducted at Love Canal (see Issue 6.) but they did not answer the questions to anyone's satisfaction. To this day, former Love Canal residents are concerned and uncertain about how their health was affected by exposure to toxic wastes.

Issue 3. The definition of problems and acceptable solutions will be determined by each set of actors' interests. When the several groups have different interests, their views may lead to conflict.

Residents and agencies may have different "philosophies" about how to define the problems to be solved. The agency workers may begin by thinking that their helping goals are shared by the affected people, but rather quickly, they find themselves on one side, with the people they are trying to help on the other. Each side will view the problems from the perspective of their interests. The interests of the citizens concerned with their health and safety and protection of their economic base will differ from those of government officials concerned with accountability, limitations in the use of resources, and precedent setting.

****

The question of problem definition was always a source of controversy at Love Canal. In general, the affected residents wanted a problem solving policy which would be flexible and open ended. That is, they felt that since the problems were unprecedented, the government should broadly define the help to be given: wait and see what needs to be done, and then do it. The Task Force however defined the problem to be solved as those problems for which there were resources available. Thus, remediation of the disposal site itself has been expensive, but relatively uncontroversial: it had to be done and there were sources of funding, through the EPA's demonstration grants for example.

However, when people's homes adjacent to the disposal site were purchased by the state in the autumn of 1978, they were initially told it was because their homes were in an area that was hazardous to their health. When funding was available for remedial construction purposes (to control leakage) and for no other reasons, then the home purchases and moves were justified as necessary for remedial construction to proceed. Quickly, the idea that people's health had possibly been affected began to be denied by the Task Force, while it remained an important issue to the residents.

In addition, an early regional study showed there were over 600 toxic waste sites in New York state. The government became concerned about precedents they set with any actions ("are we supposed to buy out all of western New York?" was a common phrase) and the residents were concerned about getting help for themselves ("I don't care what they do anywhere else. Get me out.")

Later, after the state of New York had purchased most of the homes in the Love Canal area, there were controversies about what to do with the neighborhood. The people who thought it should not be resettled were among the groups who had moved out. The residents remaining, and the various government agencies were interested in restoring and resettling the neighborhood, and have pursued this route until the present time.

Issue 4. Environmental problem solution is costly. Because there are diverse sets of actors with different jurisdictions, liabilities, and resources, there will be conflicts over the question: Who pays the bills?

****

The question of responsibility and liability has been present from the very beginning at Love Canal. Over 1300 individual lawsuits against the Occidental Chemical Corporation were settled out of court for \$20 million in December 1983 (Urban et. al. v. Occidental Chemical Corporation et al.) In December, 1979 the US Environmental Protection Agency filed lawsuits totaling \$124 million against Occidental (U.S.A. v. Hooker; Molotsky 12/21/79), and those have not yet reached a trial stage. In April 1980, New York state filed lawsuits asking for \$365 million. Federal Judge John Curtin found Occidental liable, and the trial to determine damages, ongoing since October, 1990, in the federal court for the western district of New York state, is currently winding down (Herbeck, 10/21/90; McMeekin, 6/18/91). With New York State seeking punitive damages, the possibility exists of a judicial judgment of three quarters of a billion dollars.

The immensity, complexity and expense of these trials struck me in a down to earth way, one day in the mid 1980s when I visited the courtroom during one of the preliminary procedural discussions and counted 22 attorneys representing the various parties.

Issue 5. The speed and certainty of decision making depend in part on an adequate knowledge base. In most environmental contamination cases, because the problems are new in kind or degree, there may be a very small knowledge base --scientific, or experiential-- to draw upon in proceeding to address the problems.

****

From the beginning, there were extraordinary difficulties for the concerned government agencies working at Love Canal. Hasty decisions were made at high levels, under extreme public pressure to "do something" about a situation that was unprecedented, where the existing environmental and disaster legislation did not seem adequate, where there was uncertainty about the exact nature and extent of toxic chemical exposure and where there was little solid scientific information about the effects of long term exposure to low levels of chemicals, on people and the environment. The information about physical effects of long term low-level residential exposure to buried toxic wastes is still scanty.

The local history, of people, physical setting, and events is often crucial and known best to the residents. The agencies and researchers who come to the area to study and work may be quickly labeled as "outsiders" deserving of little respect because they don't share knowledge common to residents. At Love Canal, people felt they had important information to share with the government agencies, for example about long buried ponds and streams that may have been routes for the transmission of leachates. They resented being shut out of decision making, and formed powerful groups which insisted on being heard. Thus, in contrast to the conditions under which most government decisions are made, at Love Canal the process included the affected people to some degree, almost from the beginning. The inclusion of the affected people beyond the merest token effort, was not something the government agencies sought; it was forced upon them by the vigorous

and persistent efforts of organized residents of the Love Canal area who have continued to work, for over a decade, to keep some control over their lives by making meaningful contributions to the problem solving process.

Issue 6. If there is little in the way of scientific information, the difficulties in obtaining it, will go beyond the normal problems of scientific methodology. Political considerations will be involved in the process from beginning to end.

Over the years, there have been sporadic attempts to supplement the inadequate knowledge base by means of scientific studies conducted in this publicized, politicized setting, with very high stakes dependent on the results.

***

Prior to the aborted 1980 effort, the few health studies done at Love Canal included a survey of health histories, limited liver assays, and a check of tumor registries, done by the New York Department of Health, and an exploratory chromosomal damage study under EPA auspices. There were also a telephone survey of reported illnesses among residents, a study of children's growth and development, studies of peripheral nerve transmission, and studies of field mice, done by independent scientists. The results were subject to severe scientific criticism, sometimes in a neutral, objective manner and sometimes not. The studies done with the most resources were those conducted by the New York Department of Health. In this situation where so much was unknown, unusual patterns of symptoms were not treated by the government health agency researchers as important clues to pursue in a serious fashion, but rather, individual reports were repeatedly dismissed as anecdotal. A valuable opportunity to learn was lost. In addition, there were serious methodological flaws in the DOH surveys. Independent scientists' limited, exploratory studies assumed an unwarranted importance, when the Department of Health held onto its results over the years.

At times, findings from formal research became part of the armament for a struggle that was ongoing between the government which was trying to contain an escalating situation, and the Love Canal residents who wanted to have the maximal protection government resources could provide. At one point, the only findings which all "sides" agreed on was the increased miscarriage rates and low birth weights among women living adjacent to the Love Canal or along its drainage routes. These findings were then subject to interpretations and policy decisions by government agencies and residents, which reflected each side's interests and viewpoints. The Department of Health said that fetuses were important to study as the organisms most vulnerable to toxic health effects; the way to protect fetal health was to move out all the pregnant women. The residents said that if fetuses were most vulnerable, that indicated that everyone was in danger and therefore everyone should be moved out (Levine, 1982: Chap. 5 & 6; also Goldman et al., 1985; Heath et al. 1984; Paigen et al. 1985; Rowley et al. 1983). These interpretations and policy recommendations differed depending on personal cost and public accountability considerations.

Issue 7. To minimize conflict, trust must be maintained among all the actors in the situation. Once trust has eroded between citizens and their government, it is very difficult and costly to try to reestablish it. It may be necessary to create new social mechanisms to allow work to proceed in a situation of low trust.

The Love Canal case shows how complicated it is to make a scientifically based decision which will eventually have huge financial and political implications. The event I will describe at length was one where a scientific panel was established to help in making decisions about what to do with the abandoned homes purchased by the state in 1980. Among other things it shows how politics affects science and what is involved for scientists working outside their accustomed habitats.

The details are idiosyncratic to this case, but departures from scientific norms have occurred over and over when 'real world problems' are involved. The social context surrounding the use of scientific method is far more complex than a context in which scientists are working for and reporting to other scientists who share their scientific culture with its assumptions, values and norms for behavior. When issues of public policy are involved, different social groups, with various interests, influence the processes of designing studies, collecting data, drawing conclusions, and reporting and criticizing research reports (Stone and Levine, 1986:820).

####

a. Events leading to the establishment of a scientific panel.

In May 1980, the Environmental Protection Agency (EPA) was widely perceived as badly bungling the task when it disseminated information from an exploratory report of the incidence of chromosomal damage among a sample of Love Canal residents. In the aftermath of the announcement of the report, the dramatic actions of the Love Canal Homeowners Association leaders who held two EPA officials "hostage" for several hours, and a virtual storm of publicity, President Carter declared the neighborhood to be in a state of emergency. The Federal Emergency Management Agency was thus able to provide \$15 million in loans and grants to the State of New York. With \$5 million from the State's Urban Renewal funds there was now a sum of \$20 million to be used to "revitalize" the neighborhood, as well as to purchase the homes of residents in the Emergency Declaration Area (EDA), who wanted to be rid of their otherwise unsellable homes. New York state established an ad hoc entity, the Love Canal Revitalization Agency (LCARA) to implement this process through purchasing homes, overseeing the maintenance of the neighborhood, and to some extent making plans for future use. LCARA's membership included city officials and community representatives (Levine, 1982:Ch. 8).

It was in part to try to speed the "revitalization" process that the Environmental Protection Agency began in 1980 to conduct a massive, multimillion dollar study of the soil, air and water of the Love Canal neighborhood.

"In the summer of 1982, the results of that study were unveiled with a good deal of fanfare. The testing had shown that the Love Canal neighborhood was no more contaminated than comparison areas. The federal Department of Health and Human Services decided that the area was as habitable as the control areas, contingent on provisions that the storm sewers be cleaned and that provisions be made to monitor the canal to prevent future leakage of chemical leachates.

A good deal of criticism followed the issuing of the 1982 report. Within a year, an evaluation report by the Office of Technology Assessment for the United States Congress criticized the data collection and conclusions drawn in the earlier report (OTA, 1983); the author of the EPA report provided lengthy interviews to the newspapers in which he stated that the EPA study had been much too influenced by political factors (MacClennan, 1983); one of the field directors for the study was indicted ... [and found guilty]... for falsifying his scholarly credentials; and a consulting company preparing to install a containment wall for the canal to prevent future leakage, discovered upon taking test borings that contaminants were present in soils where the EPA report had stated that they could not be found....

It is not an unusual step for political figures to appoint committees or commissions of prestigious people and to direct questions for resolution to such a group, in the hope that the commissions' perceived neutrality and prestige will remove political taint from their recommendations (Yesley, 1975). In August 1983, in response to community anger and the general mistrust generated by the EPA's report and the subsequent events, the EPA took the unusual step of initiating and heading an interagency committee, which they called the Technical Review Committee (TRC). The members are representatives of the New York state Department of Environmental Conservation; the Centers for Disease Control, a federal health agency; the New York State Health Department; and the EPA. The formal purpose of the committee was "to provide coordination and oversight for all aspects of the remedial program at the Love Canal." (EPA, May, 1985:1-6)." (Levine, 1986:820-21)

The Technical Review Committee proceeded with its work in a complicated social system, where they had to answer to three different constituencies: the four agencies they represented (USEPA, USCDC, NYSDOH, NYSDEC), the scientific community of researchers and potential critics both inside and outside of government, and concerned citizens -- the interested and involved lay public. "Each of these groups in turn were complex in their composition, with differing outlooks, interests, points of view, and factions" (Stone and Levine, 1988: 136).

The TRC undertook two major sets of activities and thus, from the beginning, the TRC supervised them simultaneously. One major activity of the TRC was to administer and supervise the physical remediation program at Love Canal.

"Remediation projects ... rested with the [New York State Department of Environmental Conservation], whose director presented progress reports on work achieved at each TRC meeting. Thus, minutes of the TRC meetings reflect the dualism of the Technical Review Committee's activities: studying habitability, and simultaneously changing the physical conditions which could influence a habitability decision." (Stone and Levine, 1988: 135)

The second activity, the committee's attempt to settle the question of habitability of the Love Canal area, received the most public attention. In order to produce a set of

recommendations that would be scientifically valid and credible to the public, the TRC impaneled a group of ten scientists and engineers to offer recommendations and opinions and thus "to assist in developing habitability criteria" (EPA, May, 1985:1-6). The final decision about the habitability of the area was to be the responsibility of the New York State Commissioner of Health.

b. The scientific panel: process, content, social setting.

Process. After deciding that habitable means "suitable for human habitation," the scientific panel developed criteria for the measurement of habitability. Following that, pilot studies and then data collection were done by the TRC consultants. After each of these three stages, a process of peer review took place. Finally, all the information was sent to Commissioner Axelrod in the summer of 1988.

The first stage, deciding on habitability criteria, took the longest (fall 1983 to late spring 1986, including peer review); the next stages took a year each, for a total of five years. The process speeded up as the TRC and its consulting company gained experience in soliciting and using scientific expertise. The lengthy process could be attributed to the difficulty of the problem, the cumbersome procedures and the TRC's desire to ascertain that this time every i was dotted and every t crossed. However, a more cynical interpretation was possible.

At the same time that habitability was being discussed, defined, peer reviewed, and pilot studied, the process of "remediation" was going on.... to remove toxic chemicals from the area, beyond the initial work done on the canal area itself (barriers, clay cap, collection wells etc.). So, the longer the process to define and measure habitability, the lower the level of habitability-threatening indicator chemicals one can expect to find. Clearly, the question of whether the Love Canal ever posed a threat to health and habitability in the past is decreasingly likely to be validly addressed, the longer the process takes. This much was recognized and explicitly stated by the TRC ... [NYSDOH and USCDC, 1985:7-13.] However, it is also evident that the longer the decision process takes, the more likely the conclusion will tilt in the direction of finding the area habitable." (Stone and Levine, 1988: 137).

Content. The panel was faced with a number of choices. The panel members circulated drafts and working papers for each other's comments and their ideas were threshed out in open meetings, with interested members of the public in attendance. Time was allotted for the lay people to present their ideas and comments and to ask questions. All the public meetings were recorded by court stenographers, and transcriptions were available to the public upon request (Stone and Levine, 1988: 137)

The panel had lengthy discussions to decide the following:

- a: what was to be the unit of analysis (the entire Emergency Declaration Area, sub-neighborhoods, or individual homes and yards).
- b: whether to use absolute standards or a comparative approach.
- c: whether to measure all chemicals known to be present, or a relevant subset.

- d: what aspects of the situation to examine (environmental effects, health effects, social/psychological considerations).
- e: whether to include risk assessment...
- f: whether the defined conditions of habitability could be made contingent upon acceptable remedial work and maintenance of installations (see Stone and Levine, 1988: 138-9).

The final definition of habitable was "suitable for normal residential use without any restrictions." (NYSDOH, Sept. 1988: 7). The panel decided that the habitability of the area depended upon an acceptable level of remediation of the contaminated creeks and sewers, and provisions for maintaining permanent containment of the chemicals in the disposal site.

The operationalizing of the habitability definition was tailored to the situation, and probably unlikely to be totally applicable to other situations, or even other locations. In the Love Canal setting, the final consensus was that the unit of analysis was to be sub-neighborhoods, which were combined into 7 sampling areas. The decision about habitability was to be based upon the presence of three selected Love Canal Indicator Chemicals (LCIC's) in residential air, and eight LCIC's in the soil. The chemicals were chosen by the scientific panel based upon available information about chemicals disposed of at Love Canal, their toxicity, and the practical consideration of limiting the search to a few of the most dangerous chemicals. Relevant federal or New York State standards, criteria, and guidelines were to be used, where they existed. In fact, the only known applicable guideline is a federal (CDC) standard of 1 part per billion (ppb.) for dioxin in residential soil. Therefore, for other LCIC's in the soil, and for analyses of residential air, a comparative approach was decided upon -- comparing Love Canal findings with Western New York areas having similar physical and socio-economic features.

For comparison purposes, the panel recommended that neighborhoods should be as similar as possible to the Love Canal area in physical and socio-economic aspects, differing only by being located at least one mile from a known chemical dump site. After a thorough search of the region, the staff reported that it was impossible to locate such a neighborhood one mile from a known chemical dump site, and the criterion was altered to one-half mile. On this basis, two neighborhoods were identified in the towns of Cheektowaga and Tonawanda, in Erie County.

Two additional comparison neighborhoods were added after the pilot study. During this phase it was discovered that there were high levels of two of the soil LCIC's at Love Canal, relative to the other indicator chemicals. This finding led to modifications in the full-scale habitability study. Following up on the first pilot study finding, the NYSDOH conducted another study of soil in the EDA and other Niagara Falls area sites, and found that the two chemicals in question were prevalent elsewhere in Niagara Falls, so they may have come to the EDA from a non-Love Canal source. To gain more data on this hypothesis, the soil study design was expanded to include comparison areas in Niagara Falls. One of these comparison areas -- Census Tract 225 -- was only a couple miles to the northeast of the EDA.

One implication of the reliance on comparative findings was consistently pointed out by critics of the comparative approach. Some of the chemicals deemed most harmful at Love Canal may indeed be widely distributed in Niagara Falls and the entire Niagara Frontier area, with its long history of heavy industry and chemical manufacturing. Toxicity elsewhere does not make Love Canal "habitable" in the ordinary sense of the word, even

by comparison; rather it could raise serious question about the "habitability" of many other areas in the region. In addition, the use of Census Tract 225 was assailed on the grounds that it was too close to the EDA to provide an appropriate "clean" comparison area.

As for the air tests, there were virtually no LCIC's detected either at Love Canal or in the comparison areas. The air study design was altered to eliminate comparisons. Instead, it was decided that all Love Canal homes would be sampled for air LCIC's, and any positive reading would be followed up. Only one air detect showed up in the full study, and it proved negative, suggesting that the design might not have provided for enough resampling of each dwelling at different times.

Because the existing health studies were both sparse and the focus of extensive criticism and political maneuvering, the scientific panel decided not to include studies of health effects in the knowledge base for the habitability decision, nor were risk assessments developed. These omissions led to widespread misunderstanding later, about the implications to be drawn when the Commissioner of Health announced his decision about the habitability of the area.

Issue 8. All scientific work is influenced by its social surroundings, as is any other cultural production. The social setting of government agencies and citizens may affect the scientific product.

Citizen participation is a given these days, often mandated in environmental laws. Since the late 1970s, the Love Canal citizens groups have served as a model for people in other contaminated areas. They are now a force to be taken into consideration in preventing or solving environmental problems.

####

The scientists and engineers who comprised the panels of experts at Love Canal did their work in a social setting where they were responsible to and interacting with not only their peers in the scientific community, but also with the general public, the media, the TRC, and perhaps most challenging of all, the Love Canal residents themselves. Because citizen participation in scientific deliberation and public policy making about chemical waste problems is still a new phenomenon, it deserves some extended comment. The residents were involved first with the TRC, and then with the various scientific panels which established criteria and then peer reviewed at every stage.

"When the EPA official who chaired the TRC called its first meeting to order, the committee knew it would face Love Canal residents who had already shown the power and influence they could wield through their organized efforts" [at the very beginning of the Love Canal crisis (summer 1978), government officials had tried to define the geographic area at risk very narrowly. Those efforts were frustrated. As a consequence of citizens' united efforts, the areas declared to be at enough risk to justify government purchases of homes were initially established adjacent to the Canal site, but then were widened to include hundreds of homes and federally subsidized apartments that comprised the Emergency Declaration Area of 1980 (roughly a five block expanse to the east, west

and north of the canal area.) It was the organized citizens who alerted the mass media, and Congressional representatives, who then requested the OTA evaluation of the EPA's 1982 habitability report. The OTA's criticisms effectively put the brakes on what had been a rather headlong rush by the EPA to see the Love Canal area reinhabited.

At their first meeting then, in the summer of 1983, the assembled TRC representatives of state and federal agencies found themselves in a structural and relational situation of great complexity. They were all aware of the proven and potential strength of the organized citizens. Some were still smarting from the negative publicity generated by the 1982 EPA report, an event which was only the most recent in the controversial, sometimes clumsy series of citizen-government interactions that took place from the very beginning of the Love Canal crisis. In addition, the federal funding being sought for cleanup work, was, hopefully, to come from the federal EPA Construction Grants Program, authorized under the Clean Water Act (1980), which mandated citizen participation as a condition of release of money. There were then, strong incentives for the TRC to court the citizens, and it was no surprise when the committee announced that it would encourage and welcome citizen participation (Stone and Levine, 1988: 139-141).

Issue 9. Our tradition of democratic participation has extended in recent years to the solution of environmental problems. Citizen participation in some form is to be expected and may be required by law. However, citizen participation is not simple to put into practice, for either the government agencies, or for the affected citizens.

***

One of the first actions announced ...[by the TRC]...was the establishment of a NYSDEC Public Information Office in the EDA [Emergency Declaration Area] itself, in March, 1983. Set up to conform with Clean Waters Act requirements for citizen participation, it was located in an abandoned house in the Love Canal neighborhood, and staffed by a Citizen Participation Specialist. The office served the function of providing an "address" for contacts between citizens and government agencies. The office is the repository of all documents relevant to Love Canal, and maintains a library of all written records relating to the habitability study ... Another major step was the announcement of the TRC decision to have all its meetings open to the public.

These actions did not satisfy all the initial citizen demands, however. While the DEC information office, with its gifted Citizen Participation Specialist, earned praise and the trust of all parties from the very beginning, the open meetings, and other aspects of citizen participation were matters that had to be worked out over a period of time. At first, the TRC members acted as though 'citizen participation' meant the members of a lay audience would passively listen to announcements, and that 'open

meetings' should be held in ways to best enable the committee to make their transportation connections. The first TRC meeting for example, was held at the Buffalo airport, some 20 miles from the Love Canal and inaccessible by public transportation. The decision led to vociferous protest from interested groups of citizens. All subsequent meetings were held at a hotel near the Love Canal, and easily accessible to Niagara Falls residents.

During the early organizing period, while the TRC members were learning to structure meetings and other contacts so that citizen participation took place in a way that made sense to the citizens, the latter were also learning that they were not as organized as they had assumed they were. Several citizen groups had developed soon after the beginning of the Love Canal crisis in 1978. While each group had somewhat different goals and ideas of how to proceed, all were strongly motivated to get attention and help from what was mutually perceived as a bureaucracy reluctant to act. For the first two years, the groups were ably represented by the Love Canal Homeowners Association (LCHA), which was far larger than the other groups, well organized, and headed by an outstanding leader, Lois Gibbs.

By 1982, the LCHA was a skeleton and Gibbs had left the Niagara Falls area. The TRC, preferring to work with one group of people who could legitimately represent all the citizens, requested that such a group be established. Shortly thereafter, meetings were called by some of the residents, for the purpose of deciding upon mutual goals and selecting a representative group to work closely with the TRC. Those attending the first couple of meetings included the remnants of the active core of the LCHA, tenants of the federally subsidized housing project, senior citizens, homeowners still living in the Emergency Declaration Area (EDA), people who owned property in the EDA (other than their own residences), homeowners living on streets directly adjacent to the EDA, and also members of the Ecumenical Task Force [ETF], a professionally led, citizen staffed organization, active in the area since the late summer of 1979.

Setting any but the broadest goals proved to be impossible, as did choosing representatives. Even the goal of merely sitting in the same room began to seem unachievable. Some of the EDA residents wanted to move, if they could command a price for their homes which seemed more reasonable to them than what the state's appraisers had suggested. Some of those still living in the EDA, and all of the people living on streets adjacent to it, were eager to have the area speedily declared safe and habitable. The LCHA and ETF members doubted that the area could ever truly be safe for human habitation, given the lack of information about the location and effects of the leachates; they wanted stringent standards used in tests of habitability and some felt that even considering reinhabiting the area raised serious moral questions. Some of the EDA residents thought the area was safe to live in; senior citizens and other tenants were worried about where they would find homes if the area was

declared uninhabitable. The other-than-residence property owners were anxious about recouping their investments. The LCHA members were viewed as inappropriately involved, at best because they had already moved out, and at worst as trouble makers who had helped create the problem because they had been at the forefront of citizen-government battles. The ETF members were definitely interlopers, outsiders, despite the Love Canal residents on their staff. By the end of the second meeting, people were almost literally 'at each others throats'.

A representative group never was selected. Instead, interested citizens attended TRC meetings, and asked questions as individuals. An attorney articulated the concerns of the tenants' group. Question can be raised about the 'representativeness' of citizen representation. As a consequence of the early, explosive meetings of the citizen groups, and also because of the lengthy, tiresome process of meeting repeatedly with the TRC and the panels of scientists, some of the more moderate citizens may have ceased to participate. Among the handful of citizens who faithfully attended every meeting may well have been people not representative of any group, who were simply expressing their own personal concerns, which might or might not be shared by others. However, whenever 'hot issues' came up, many more local residents attended meetings. Thus, even less representative people kept alive the possibility for a broad spectrum of active citizen participation.

It is not possible to predict how the entire process would have gone, had the citizens managed to keep their differences hidden, as they had done during the days when the LCHA imposed order on divergent groups. However, it was clear the TRC members understood that the citizens were not the monolith they had feared at first. In a sense, the TRC and the citizens learned to work together; not in total harmony, but as familiar, tested opponents.

At the meetings, the TRC members listened to each and every question and comment, responding in ways that became increasingly acceptable, as they learned how to show appropriate attention to the concerns of participating citizens, and to convey information in understandable terms ... [However,] it may well be that by paying full attention to every individual citizen's comments, questions, and requests, the entire process of deliberation was slowed considerably.

There are some interesting examples of the way public pressure affected the utilization of scientific expertise, and how scientists learned to deal with an engaged public. When the TRC impaneled the first group of experts, they made tentative agreements with several scientists, and then simply announced their decisions and actions to an audience at a TRC meeting. The citizens made a few angry comments about perceived highhanded action. When an audience member asked whether the experts' resumes would be available, one of the TRC members (perhaps in an attempt to be reassuring) said words to the effect that the selected experts were so prestigious that it was not necessary to read their resumes, and indeed it would be insulting to request them. In response, the Ecumenical Task Force and the Love Canal Homeowners Association members

publicly insisted upon seeing resumes and suggested two well qualified scientists to be included on the panel. The TRC agreed to ask them to participate, and the two joined the scientific panel after its first meeting.

At another meeting, when a citizen asked about peer review of the expert scientists' work, the same TRC member claimed that the work of the scientists chosen by the TRC could not be reviewed because there simply were no peers competent to judge their work! Again, response from the public was forcefully indignant. Peer review in fact became an important part of the process.

...there are lessons... (here)...for citizen participation. Even if it is mandated, making public participation happen requires effort, skills, and persistence on the part of citizens. Bureaucrats and consultants are paid for their efforts. Citizen involvement is voluntary, and onerous in personal terms; more than 30 open meetings have taken place during the 5-year period discussed, and the process is not yet complete. The wishes of some sub-groups of citizens may not be represented. The officials' assumption is that if there is no protest from citizens, then the latter approve of what is being proposed or done. Therefore, in the Love Canal community, public vigilance has become institutionalized in a certain way, as has official responsiveness. The expectation may exist that the Love Canal pattern of interaction is a "model" for future examples of officially-sponsored science in search of answers/solutions to problems of potential wide impact. However, it is more likely that each new occurrence will require that new working relationships be established between citizens and responsible agencies." (Stone and Levine, 1988: 141-143).

Issue 10. Environmental problems are broad in scope, involving many areas of people's lives, the community and the greater society. Inevitably these problems require interdisciplinary work. Scientists and other professionals from diverse backgrounds must learn work together.

***

When the panel of scientists began to meet, they had to learn to work in an almost unprecedented way. Science is seldom conducted in a 'fishbowl' of potential public scrutiny. Scientific research projects are not usually designed in the presence of lay audiences, with every disagreement and decision recorded by court stenographers, and with news reporters in attendance. Their obligation to respond to citizens also influenced how the scientists performed their role. They learned to attend politely to citizens' questions, and to respond in a frank and forthright manner, using language that was comprehensible to an audience of concerned non-scientists.

Furthermore, while interdisciplinary work is not unknown, it is not the norm for scientists from engineering, biological and physical sciences, and social science disciplines to work in joint endeavors. During their

early meetings, the scientists and engineers on the panel initiated the process of working together as a group, explaining their divergent views, exploring ways to set reasonable goals, learning about available data, deciding what further data they would need, and planning what their final product should be. This process was not a perfectly smooth one. For instance, the two sociologists on the panel were subjected to barely veiled instructions from some of their fellow panelists about what constituted 'real science'. After the sociologists forcefully insisted that the appropriate unit of analysis was small neighborhoods within the larger EDA, and distributed an excellent rationale for their decision, they gained respect as fellow professionals who could contribute a good deal to the enterprise.

The scientific group was diverse in another way. They had different attitudes and knowledge about the entire controversial, stormy Love Canal story, as it had unfolded during the preceding years. They had varying degrees of compassion for the Love Canal residents' current and past situation. They also had different understandings and attitudes about the Love Canal residents' shared mistrust of the government agencies which comprised the TRC. Some of the scientists felt more comfortable (identified) with the government officials whose behavior, speech and general styles were congruent with their own, than they did with the Love Canal residents. However, about four months after the panel's deliberations began, an event occurred which was to alter the perceptions of the panel about the socio-political context in which they were working.

One of 'givens' of the problem they were addressing was that the Love Canal had been covered with a thick clay cap during the first phases of physical remediation. That cap was to remain inviolate. At a TRC meeting, the night before a scientific panel meeting, the NYSDEC representative was forced to admit that a rumor was true. He intended to insert several hundred barrels of leachate sludge into the Love Canal, by creating a trench in the clay cap. When the citizens attending this meeting protested vociferously, he took the stance that the decision was his to make and he would not change it. The next morning, a LCHA leader presented the scientific panel with pictures of the barrels of sludge, and distributed a description of the DEC representative's statement. Since this was the first inkling that the panel had of the intended violation of the protective clay cap, the scientists as a group were stunned and outraged. They expressed their anger, threatened to dissolve the panel, and insisted on a revocation of the burial decision. The sense of their deliberations that day shows that they suddenly had a feeling of group loyalty: '[we] scientists against those bureaucrats.' Even those scientists who had been least sympathetic to the Love Canal people's views of the trustworthiness of government agencies, expressed feelings of empathy with the citizens via a via the agencies.

Issue 11. Decisions are likely to represent compromises among a variety of interests.

These compromises may be misunderstood or not accepted readily by the affected populace or the general public.

This is illustrated by the aftermath of the Health Commissioner's decision.

***

By June, 1988, the five year, \$14 million Love Canal Habitability Study was finally completed. (Porter, 1989). The tasks of establishing criteria for habitability, collecting and analyzing soil and air samples from the EDA and the four comparison areas, were all done. The studies had been subject to public criticism and peer review at every stage. In July, the final report was sent to Health Commissioner Axelrod for his deliberations. On September 27, 1988 he announced his decision at a public meeting held in the firehouse at the southern edge of the neighborhood, a site where dozens of meetings had been held over the preceding decade to discuss the progress of the Love Canal problems and solutions.

For research purposes, the EDA had been divided into seven sampling areas. Dr. Axelrod stated that the four sampling areas to the north and west of the abandoned disposal site "meet all of the habitability criteria and may be used for residential or other purposes" and that the 3 sampling areas to the east and south "do not meet the criteria established for habitability... [T]hus, the areas are not suitable for normal residential use without remediation of the contaminated soil...[H]owever these areas may be used for other purposes (e.g. commercial, industrial) without remediation". (NYSDOH, 1988:1).

The Commissioner elaborated in a statement accompanying the report: "For those areas declared habitable, revitalization programs must await development and approval of an overall land use plan. Any such plan must take into account the continuing remediation activities planned for the EDA, including the upcoming dredging of... [two creeks, bordering and crossing the EDA]...People should not be encouraged to move into areas which will be heavily affected by this work." (Axelrod, 1988).

In the areas declared not to meet the habitability criteria for residential resettlement, Commissioner Axelrod said "... this decision is not a determination of an immediate health threat to the individuals and families still living there. It is, however, a determination that whatever the level of risk associated with the presence of the measured indicator chemicals, that risk exceeds the risk posed in comparison residential areas." (Axelrod, 1988).

He concluded by pointing out that the State Disaster Preparedness Commission was the authority which could coordinate the work of other agencies, and "expedite state assistance" to them, and that he was the head of that commission. (Axelrod, 1988).

The local newspaper's front-page headline on the following day glowingly trumpeted "75% of Love Canal Livable". (NG: 9/28/89). The mayor of Niagara Falls had explained the importance of the decision a few days before, when he noted that over 700 homes had been taken off the tax rolls at a loss of some \$2 million a year, and that "...more than that has been the terrible, traumatic stigma on Niagara Falls, because of Love Canal..." (MacClennan, 9/25/89). But the solution was not to be so simple for the Love Canal residents reading the headlines about the decision, nor for the members of the various government agencies and the public involved in the Love Canal problems. I will summarize the events of the next few months, by briefly discussing the three issues that

have been of concern since "day one" at Love Canal: health, remediation and homes.

Health. When Dr. Axelrod announced his decision, there were 71 families living in the EDA, divided almost evenly between the "habitable" and "uninhabitable areas". Their first response to the Commissioner's decision almost uniformly was one of confusion. Those living in the habitable areas questioned why no one was to move in, or why the area was declared habitable before the creeks were cleaned; those living in the uninhabitable areas found it hard to understand why an area that they were not told to leave did not meet habitability criteria. The idea that the levels of contamination found were higher than those found in comparison areas, but yet were at low levels, (NYSDOH, 1988:29) was difficult to grasp, as was the difference between "habitable" and "safe". Families living outside the EDA, but on the banks of the creeks to be cleaned were not only confused, but in some cases were also angry that their homes were not included in the EDA, with the opportunity to sell their homes to the state.

As mentioned earlier, the criteria underlying the habitability decision did not include studies of the effects on the health of people exposed to toxic chemicals at Love Canal. However, because the state's highest ranking health official made the statement concerning habitability, people -- both lay and professional -- assume that surely some sort of health assessment was the foundation for the habitability decision. That inference certainly could be drawn from the Commissioner's announcement where he states that "...government has a responsibility to exercise public health judgments on behalf of its citizens. In the specific case of Love Canal, this responsibility follows directly from the potential of adverse consequences to human health posed by the pollution of a residential community with toxic chemicals..." (Axelrod, 1988:1).

The perceptions held about the health effects at Love Canal are important because it is the landmark case, the precedent setter. All decisions made there have the potential for affecting the course of problem solution at other toxic waste disposal sites across our country. [I have heard comments such as, "If there is nothing wrong with people's health at Love Canal, then (Place X,Y,Z) certainly couldn't have hurt anyone."]

Currently, health studies of Love Canal residents seem to be "on a back burner". In the late 1980s, the New York Department of Health began to prepare a registry of current and former residents of the Love Canal area. The preparatory work included reviewing and organizing data collected by the department between 1978 and 1980, only part of which had been computerized. There were a few public meetings, with the most recent one on November 28, 1988. My notes from that meeting indicate that Dr. James Melius who chaired the session focused on plans to develop an advisory panel to provide "input" on who should be included in studies, what illnesses should be studied (in addition to cancers included in the tumor registry), and how and when to do studies.

Homes. To show the range and complexity of some of the homes-related problems which surfaced in the wake of Commissioner Axelrod's decision. I will draw first upon my field notes to describe the issues I learned about in just one day's visit to Love Canal, one week after the habitability announcement. It is important for the reader to contemplate the costs of resources involved in dealing with the problems that were discussed in just the one day.

On that September day in 1988, when I visited the site, first I spoke to the DEC Citizen Participation Specialist, a knowledgeable and well regarded young woman. She was very

tired. "Day and night" she said, "the phone has been ringing off the hook," with callers who wanted to share their concerns with her and also beg her for information.

The majority of the 71 families still residing in private homes were elderly, unwilling or fearful of moving, unable to imagine how they could afford to move if they wanted to. The pressures on them were increased by four contingencies. First, there was a deadline on the purchase of homes by the state, at that time less than a year away. Second, they did not know whether homes would be purchased at 1980 or 1988 prices (all homes purchased since 1980 had been based on the 1980 market evaluations, and housing prices had risen considerably during those years). Third, people were concerned about the general maintenance and the security and safety of the neighborhood. Despite security services provided by LCARA, there was a constant problem of people using the empty houses for various reasons, with some looting, vandalism and arson of empty homes. In addition, it was important to the current residents that all the empty homes be maintained and their lawns mowed, to keep the neighborhood from looking wild and unkempt.

Their fourth concern was about who would be living in the neighborhood. On the heels of Axelrod's announcement, State Senator John Daly proposed using the New York State Affordable Home Ownership Development Program to encourage first time home buyers with low and moderate incomes to buy and rehabilitate houses in the habitable portions of the EDA (Lacey, 9/30/88). To those still living in the EDA, this meant that they could not themselves purchase other EDA homes and did not know who might move into these homes. Very quietly people talked about their uneasiness about the race and social class of potential purchasers under this program. One man summed it up for me, "I want to stay in my house, but I want to see what the neighborhood will be like and then decide whether I want to move or not."

At Love Canal, repeated incidents have shown that it is particularly important that health workers, and health researchers be knowledgeable about the details of the entire event and the range of problems within which health issues are nested, if they are to work with residents affected by technological disasters. On the evening before my visit, a well-meaning DOH official who had had almost no previous contact with Love Canal residents met with a group from the area that did not meet the habitability criteria. He wanted to help alleviate what he assumed would be their most pressing fears, the possible threat to their health of remaining in their homes. In the course of that meeting, he suggested to the residents that they might be able to move from their homes to empty houses in the habitable sections. His audience became very distressed, much to the bafflement of the health official. They were concerned about how they could afford to move, who would do the packing, how they could leave their familiar homes and places, and for some, how they could afford to pay taxes in a different municipality [the Love Canal EDA encompasses land both in Niagara Falls, and in Wheatfield, NY]. The discussion grew quite heated. One 88 year old had a mild heart attack after the meeting, went to the hospital and was reported to be in the intensive care unit the next day, when I spoke with the now-downcast DOH official.

Later in the day there was a public meeting of the Love Canal Revitalization Agency. The possibility of moving into homes in the habitable area did in fact appeal to a few people and the matter was brought up that evening at the public meeting. The motion was made to allow people to sell their homes to LCARA, and then to rent other homes from the agency. Although the motion did not pass, the LCARA later asked the State Attorney General about whether it was possible to do such a thing, given the fact that he had warned that agency during the previous year not to sell any homes until an

Environmental Impact Statement was filed. A few weeks later, the Attorney General said he would "neither support nor oppose" an application to modify a court order prohibiting anyone from letting anyone move into the canal area." (MacClennan, 11/12/89). However, he specified conditions which dampened any enthusiasm remaining for this proposal. For example families would sell their homes to the agency, and then would be allowed to rent only on a month to month basis, and would have to agree in writing to be subject to eviction on 60 days notice. (MacClennan, Paul 11/12/89).

One matter of importance to the residents at the LCARA meeting was addressed to their satisfaction when the agency board voted to extend the home purchase deadline for two years. During that meeting, LCARA's executive director announced that in fact, the agency had only \$130,000 left and he did not know whether further funds would be forthcoming from the Federal Emergency Management Agency (FEMA). Other problems the LCARA board members dealt with that evening included the necessity to prepare an environmental impact statement before any homes could be sold; the question of the agency's being sued if it sold homes and people did develop illnesses; the meaning of "habitable" and "not habitable"; the risk of contamination from the dewatering and incineration facilities; a request for the extension of the reduction of property taxes for people still living in the EDA; the management of a few rental properties by LCARA; the upkeep of the EDA neighborhood and problems with the security staff; and maintenance of the existing homes in terms of heating and inspection.

Once again, the proliferation of agencies (discussed above under Issue 7) was of importance. Earlier in the day being described, the LCARA board had discussed an additional problem at its executive meeting held before the public meeting took place. The problem was the LCARA relationship to the Land Use Advisory Committee (LUAC) established by Commissioner Axelrod, when he announced the habitability decision. This committee was to be composed of private citizens. Although the Commissioner stated that the Land Use Advisory Committee was to "provide LCARA and the State with advice on the future of the Love Canal EDA" (Axelrod, 9/27/88), the Love Canal Revitalization Agency, which had been working for nine years, was not certain whether they were to make recommendations to the Land Use Advisory Committee, or vice-versa. This confusion was mirrored by the latter group at their first meeting, when the Land Use chair announced that "We will be the source of the recommendations for land use...I have been assured by Dr. Axelrod that this committee will make those recommendations." (MacClennan, 11/11/89).

Within a few months however, the two groups -- LCARA and the Land Use Advisory Committee -- had developed a working relationship. In fact, the LCARA group had become accustomed to working in a social system composed of many agencies, not only the Land Use Advisory Committee, but also the TRC -- itself composed of representatives from two federal and two state agencies -- as well as the Niagara Falls Board of Education which owns a school and other property in the EDA, and also the Niagara Falls Municipal Housing Authority. An experienced journalist pointed out one of the consequences:

"No single official, agency or governmental jurisdiction is in control, nor is there any movement to coordinate the various fiefdoms involved in the restoration of the nation's Number One toxic neighborhood." (MacClennan, 2/20/89)

Issue 12. Critical contingencies may arise which will undermine planned solutions. Unexpected difficulties occur because all or most of the attention and resources have been directed to the most immediate and most solvable problems.

The process of "groupthink" may prevent "negative thinking". Social mechanisms should be in place to act as constructive doomsayers from the beginning to anticipate and work with "worstcase scenarios".

***

In mid-July, 1989, the Land Use Advisory Committee submitted its final report, recommending that "the EDA areas declared habitable by the Commissioner of Health should be revitalized for residential use" (Harrington, 1989). The committee had heard from a number of people who presented various uses for the land, which assumed that the area was clean, safe, and carried no stigma. A minority report was included which dissented from advising residential use. However, despite that dissent, and despite protests by activists and a state senator opposed to resettlement of the area in the absence of health studies and risk assessments, the resettlement move stayed on track. In September, 1990 the state court ruled that the essential environmental impact statements had been filed and that the home sales could proceed under the auspices of LCARA (Simon, 1990).

Despite LCARA's hope that the entire neighborhood would be viewed as an attractive place to live, there have been some flies in the ointment. Within a few days after the judge gave his consent for the sales to proceed, the state attorney general notified the LCARA that they must stop using a very polished audio tape extolling the area or be charged with deceptive advertising (MacClennan, 9/14/90). A larger obstacle has been the problem of securing mortgages for the potential home buyers. [When the matter of mortgages was raised by citizens at LCARA's public meetings, the response was that the homes must be readied first before that issue could be undertaken. I do not know the behindthescenes story about the mortgage problem.] Local banks have been reluctant or unable to issue mortgages because the underwriters fear liability in the case of toxic waste problems in the future (Simon, 10/10/90). State Senator John Daly has been trying to find solutions by working with SONYMA, New York state's mortgage agency (Buffalo News, 10/30/90) but with little success. To the same end, Congressman John LaFalce has sponsored a bill which would absolve lenders to small businesses of responsibility for cleanup of hazardous waste sites, currently required under the "Superfund" laws (White, 9/7/90, Zremski, 6/16/91). In addition, the LCARA itself has been investigating the possibility of holding mortgages (Scelsa, 2/10/91).

On June 28, 1991, I learned from the LCARA office that there were 59 families left in the Love Canal neighborhood, of the original group of residents. Thirty-two of these families live in the "habitable" areas, and 27 in the "uninhabitable". Since the late summer of 1990 when the first home (in the "habitable area") was sold to a new resident twenty-three more have been sold. Fourteen families have moved into their new homes. There are discussions ongoing about the possibility of the agency offering to underwrite mortgages, to encourage the sale of the remaining homes in livable condition.

Issue 13. Every solution to the physical environmental problems will have social impacts.

The physical environmental problems may appear to be the most straightforward and relatively easiest to address. However, even they are enormously complex and the solutions may affect the lives of the residents adversely.

***

A good deal of remediation work has been done at Love Canal, with large engineering projects ongoing most of the time since 1978 when the area was first declared a health hazard. In addition to maintaining and monitoring the existing remediation facilities at Love Canal, the next major problem to be addressed was the cleaning of the creeks. Not only did the creeks have to be dredged, but the resulting contaminated sediments (some 35,000 cubic yards) had to be disposed of along with the wastes from construction and from sewer cleaning, as well as the sludges from the treatment plant, (which has been in place since 1979, collecting overflow leachates from the Canal and running them through carbon filters). (NYSDOH, 1988: 27-28; see also NYSDEC, #1-15).

The problem of disposal of the wastes was a thorny one. At first, the plan was to build a "containment facility", basically a landfill. Congressman John LaFalce asked the Office of Technology Assessment (OTA) to evaluate technologies for burning the residues instead and upon receiving a favorable answer, he convinced the EPA and the DEC through a "two year torrent of meetings, telephone calls and sleep-inducing technical letters and reports" to choose that option. (Turner, 11/9/87).

However residues to be burned must be stored and "dewatered". To accomplish this, the New York Department of Environmental Conservation sponsored a massive construction project resulting in a facility 25 feet high, with a ground area of three football fields, all on the land immediately adjacent to the Love Canal disposal site (see MacClennan, 11/16/88). Again, nothing at Love Canal seems to happen in a simple fashion [assuming the construction of such a modern pyramid can be thought of as simple]. The \$12.3 million contract was awarded in April, 1988 from a design which cost \$1.3 million (BN, 4/3/88). The storage facility was to be completed by mid-October 1988, with the target date for the creek dredging to be late spring or summer, 1989. The creek cleanup was completed on time (McMeekin, 11/1/89), but the storage facility was not completed until a year after its due date.

Meanwhile, Occidental Petroleum, the parent company of Hooker Chemical, sought and finally obtained governmental authorization to build a storage and dewatering facility and also to destroy the contaminated wastes, both from Love Canal and from other of the company's local sites. By April, 1989, that proposal was well under way, with the company's request for a temporary permit to start building the facility. (McMeekin, 4/21/89), and the permit was approved in July (BN 7/23/89). The existing laws call for the responsible companies to participate as much as possible in the cleanup of hazardous waste sites. In practice, an unanticipated consequence at Love Canal was the parallel development of private and tax-financed storage facilities, which may prove to be an unnecessary duplication and a waste of financial resources.

The magnitude of the cleanup work was important to the residents of the area. Not only did the Health Commissioner state that no one should move into the "habitable" areas of the EDA until the creeks were cleaned, but in addition, the construction project itself was of huge proportions. A question was raised at the time about how safe and comfortable it would be for people to live in a neighborhood where a project was ongoing which "will

require moving an estimated 40,000 truckloads of clay and dirt" (MacClennan, 11/16/88). In the next year, Occidental was awarded the permit it sought from the DEC to process and store the wastes. The route for moving the 40,000 truckloads was under consideration for some time, with Occidental seeking permission to haul the materials on the state expressways, but as of August, 1989, using Niagara Falls city streets as the truck routes for the transportation of the contaminated soils. (McMeekin, 8/1/89)].

Issue 14. Manmade environmental problems are highly publicized. Given this social structural fact, the consequence is that while formal credentials and experience are necessary they may not be sufficient for professionals who must work in the spotlight.

****

To put it simply, a high level of personal integrity, honesty, consistency, and good sense are essential characteristics along with high expertise, for those people who will be in the public eye as they deal with environmental problems in populated areas.

Issue 15. The safest assumption is that the efforts and resources required to solve the problems caused by serious pollution of the environment will be vastly underestimated.

This has been true at every step of the way at Love Canal.

**** ****

REFERENCES

- Axelrod, David
1988 "Habitability Decision: Love Canal Emergency Declaration Area."
Albany: NYSDOH. (September 27 statement.)
- Buffalo News (BN)
4/3/88 "Falls firm's low bid of \$12.3 million wins contract for cleanup of
creeks." B-5.
8/25/88 "Love Canal containment work lags, faces spring completion." B-1.
3/9/89 "Love Canal panel suspends work during new toxic-waste study."
7/23/89 "Occidental gets permit for wastes." C-3.
- Goldman, Lynn R., Beverly Paigen, Mary M. Magnant and Joseph H. Highland
1985 "Low birth weight, prematurity and birth defects in children living
near the hazardous waste site, Love Canal," Hazardous Waste &
Hazardous Materials. Vol.2, #2:209-223.
- Harrington, Donald T.
7/11/89 Letter to Dr. David Axelrod, Commissioner NYSDOH.
- Heath, Clark W., M. R. Nadel, M. M. Zack, A.T.L. Chen, M.A. Bender, J.
Preston
1984 "Cytogenetic findings in persons living near the Love Canal," Journal
of the American Medical Association. Vol.261, #11 (March 16):
1437-1440.
- Herbeck, Dan, "Trial to start this week in Love Canal suit." BN: B-1+
- Lacey, Marc
9/30/88 "State housing program can help to resettle Love Canal," BN:B-12.
- Lester, Stephen U.
5/8/89 Private Communication.
- Levine, Adeline Gordon
1982 Love Canal: Science, Politics, and People. Lexington, MA: Lexington
Books.
1986 "Love Canal: An Update, pp. 817-824 in Becker, H.A. and A.L.
Porter, Impact Assessment Today. Utrecht, The Netherlands:
Uitgeverij Jan van Arkel.
- Love Canal Land Use Advisory Committee (LUAC)
2/21/89 "Love Canal Land Use Advisory Committee Public Hearing," Niagara
Falls, NY:DEC Public Information Office.

MacClennan, Paul

- 9/25/88 "As state ruling nears, return to Love Canal may have begun," BN: A-1.
- 11/11/89 "Will determine fate of Canal, Panel says," BN: C-10.
- 2/20/89 "Love Canal revitalization awash in overlapping agencies," BN: C-1.
- 3/1/89 "New cache of toxins unearthed near Love Canal," BN: C-1.
- 3/14/89 "Work on Love Canal dioxin site set for May," BN: B-5.
- 4/3/89 "Right hand doesn't know what left hand is doing," BN: H-12.
- 9/14/90 "Home buyers misled, state contends," BN: C-1.

MacClennan, Paul and Joann Scelsa

- 11/12/89 "Efforts to move in Canal area may be OK'd," BN: C-5.

McMeekin, Carolyn Kuma

- 4/21/89 "Occidental seeks authority to build storage facilities," NG: 4-A.
- 4/22/89 "Canal residents speak out," NG: 1-A.
- 3/4/89 "Toxic find may ruin Canal study," NG: 1-A.
- 5/12/89 "Love Canal ruling stands," NG 1-A.
- 8/1/89 "Oxy awaits approval to haul toxics on state roads," NG:1-A.
- 8/4/89 "Canal cleanup's last phase starts at Black Creek," NG:1-A.
- 11/1/89 "Love Canal cleanup finished," NG: 8-A.
- 6/18/91 "Love Canal trial winding down," NG: 3-A.

McNeil

- 3/30/89 "First unit is leveled at LaSalle," NG:1-A.

New York Department of Environmental Conservation (NYSDEC)

- 1983-88 "LOVE CANAL LANDFILL." Albany: NYDEC Department of Solid Waste.
- 4/5/89 News release.

NYSDEC and NYSDOH

- 4/5/89 "Niagara Community Church Information Sheet."

New York Department of Health (NYSDOH)

- 1988 "Habitability Decision: Report on Habitability Love Canal Emergency Declaration Area." Albany, September.
- 1988 "Habitability Decision: Report on Habitability, Love Canal Emergency Declaration Area," Albany, NY. (September 27).
- 4/11/89 Letter from William Stasiuk, and agenda for May 10 and 11 meeting.

NYSDOH and DHHS/CDC

- 1985 Love Canal Emergency Declaration Area: Proposed Habitability Criteria, November.

OTA

- 1983 "Habitability of the Love Canal Area: An analysis of the technical basis for the decision on the habitability of the Emergency Declaration Area--a technical memorandum." Washington, D. C.: U.S. Congress, Office of Technology Assessment.(June).

Paigen, Beverly, Lynn R. Goldman, Joseph H. Highland, Mary M. Magnant and A.T. Steegman, Jr.

1985 "Prevalence of health problems in children living near Love Canal," Hazardous Waste & Hazardous Materials. Vol. 2, #1: 23-43.

Porter, J. Winston

1989 Letter to Dr. David Axelrod, USEPA (Received on Jan. 10).

Rowley, M.H., J.J. Christian, D. K. Basu, M. A. Pawlikowski, and B. Paigen

1983 "Use of small mammals (voles) to assess a hazardous waste site at Love Canal, Niagara Falls, New York," Archives of Environmental Contamination and Toxicology. Vol 12: 383-397.

Scelsa, Joann

2/10/91 "Love Canal agency to issue mortgages," BN: B-5.

Simon, Peter

9/10/91 "Home Sales given OK at Love Canal," BN:C-5.

Stoline, Michael R.

5/10/89 letter to Dr. William Stasiuk, NYSDOH.

10/10/90 "Mortgages delayed at Love Canal," BN:A-1.

Stone, Russell A. and Adeline G. Levine

1988 "The question of habitability of Love Canal: the role of scientific expertise and technical data in establishing criteria," pp.132-146 in Environmental Dispute Resolution in the Great Lakes Region: A Critical Appraisal. Edited by Lynne S. Bankert and R. Warren Flint. Great Lakes Program, SUNY/Buffalo: Great Lakes Monograph #1.

Turner, Douglas

1987 "LaFalce persistence aids Canal cleanup," The Buffalo News. Nov.9:C-3).

USEPA

1985 Love Canal Emergency Declaration Area. Draft Habitability Criteria. Available from D.E.C. Information Office, Colvin Blvd., Niagara Falls, N.Y. (May).

White, Glen

9/7/90 "LaFalce: Bill not tied to canal home sales," NG: 1-A+.

11/15/90 "Mortgage funding close for Canal home buyers," NG: 1-A.

Yesley, Michael S.

1978 "The use of an advisory commission". Unpublished Mss. Washington, D.C.:National Commission for the Protection of Human Subjects, U.S. Department of Health and Human Services. (March).

Zremski, Jerry

6/16/91 "LaFalce assailed over bill on Love Canal," NG:B-3.

SOCIAL IMPACTS OF TOXIC CONTAMINATION

BY

STEVE KROLL-SMITH AND STEPHEN R. COUCH

Executive Summary

In contrast to the relatively constant number of natural calamities, hazards and disasters produced by human technology are increasing both in number and in the amount of financial, social and human devastation they cause. The increased capacity of societies to understand natural disasters contrasts sharply with their initial bewilderment over a variety of complex issues posed by technological hazards and disasters, especially those dealing with environmental contamination. However, just as societies have developed some capacity to understand how people and groups respond to and cope with natural hazards and disasters, so we are in the midst of developing such capacities in relation to hazards and disasters of human origin. Through an increasing number of case studies, we are finding that technological hazards and disasters produce effects quite different from those which accompany natural calamities.

This report is one of a series of case study summaries commissioned by the Nevada Nuclear Waste Project Office under Task 9.3. In it, we summarize the conclusions we have reached after conducting extensive research in three contaminated communities. Through these three cases and an examination of the literature, we describe and explain individual and social responses that appear to be common in cases of toxic contamination, and which we believe would likely take place if contamination were to occur at Yucca Mountain.

The report is divided into four sections. The first section focuses on hazardous waste as a human threat. We examine what hazardous waste crises, including those produced by radiation, have in common, and how these common characteristics differ from those found in natural disasters. While there are several ways of conceptualizing the sources of threat in hazardous waste disasters, this report relies on the variables duration, invisibility and blame. Duration, or the long-term nature of threats caused by hazardous

wastes, focuses attention on the experience of contamination as a chronic state of dread, frequently lacking a worst point from which victims can project a safer future. Invisibility --- the fact that many of the dangers presented by hazardous wastes, and many of the wastes themselves, cannot be readily perceived by our senses --- insures that the "real" scope and depth of the danger will never be unequivocally determined, but instead will be constantly debated and politicized. Thus, controversy over the magnitude of danger is likely to become a serious source of social psychological trauma and community disorganization in its own right. Finally, blame attribution, or the fact that humans caused the problem and are expected to alleviate it, introduces a powerful set of emotions that is likely to create a climate of "we versus them" that is difficult, if not impossible, to resolve. It is also anticipated that these variables interact with one another to amplify the adjustment problems posed by environmental poisoning.

We follow this discussion with brief community profiles of the cases we studied. Centralia, Pennsylvania, was a community of about 1,000 people when an underground mine fire began just outside the borough in 1962. Efforts to control the fire have failed to this day. In 1983, Congress authorized \$42 million to relocate Centralians who wished to move; all but about 50 people have relocated to other communities.

The other two communities (whose names we cannot reveal because of litigation proceedings) are located in the western United States. One is surrounded by about two dozen small- to medium-sized industries and has had its land and wells polluted by several toxic chemicals. The other community was contaminated when a coal company reduced the water table, thereby releasing toxic gases into area homes.

While the sources of contamination differed, the human and social reactions were similar in a number of important ways. In the third section of this report, we examine the relationships between toxics, adaptation and social change. In this section, which is illustrated with material from our case studies, we reach the following conclusions:

1. In adapting to the threats created by environmental contamination, many individuals experience a very high level of stress and negatively alter their conceptions of themselves. This is due to a number of factors, including concern over, and stigma accompanying, pollution of our bodies by toxic substances; a lack of adequate cultural norms describing how we should respond to contamination; powerlessness to change or control the situation; and a loss of trust in the ability and intentions of others (whether they be friends or neighbors, government officials or corporate executives) to provide help, support and protection from harm.

2. Stress on individuals is also due in part to uncertainty over the nature and amount of danger the contamination poses. In most all cases of toxic contamination, the evidence is ambiguous and open to multiple interpretations by community residents and scientific experts alike. Individuals come to hold very different perceptions of what is happening and how dangerous the situation is.

3. These differing perceptions become hardened into threat beliefs, which are views of reality shared and supported by a number of people in the community. Biospheric contamination more often than not creates situations where no one interpretation of the crisis can be agreed upon, and where competing interpretations evolve into competing belief systems. What emerges are contradictory views of the same world: It is dangerous and uninhabitable

--- you should be concerned; No, the environment is safe --- you should get control of yourself.

4. As groups emerge holding competing threat beliefs, social conflict within the community increases. This conflict, and the increased demands put upon local government by other problems related to the contamination, overwhelms the ability of local government to deal with the situation. This, in turn, encourages the development of alternative leadership and competing citizens' groups, which, in turn, increases social conflict. The type of conflict which typifies toxic contamination situations tends to disrupt or destroy a community's ability to supply its members with important community resources and tears apart the social fabric which binds communities together.

5. One of the reasons for individual and community difficulties in responding to toxic contamination is the focus on, but inability to control or abate, the physical contamination itself. To date, the official response to toxic contamination has been less concerned with the protection of community social well-being and more intent on mitigating or controlling the hazard. This response overlooks social and human dimensions of the problem while focusing on the extremely difficult (or often impossible) task of physical hazard containment or abatement. The bureaucratic nature of large government agencies exacerbates these problems by increasing communication difficulties between government and contaminated communities. All of these factors lead to the creation and maintenance of much hostility, misunderstanding and loss of trust between government agencies and the communities for which they are responsible.

6. Toxic contamination creates not just psychological, but also social, stress. Community functions are often devastated by toxic contamination crises. Disrupted community functions may be economic in nature and range from

curtailment of production activities and lost jobs, to concern over products produced in a community. Socialization to skills and values can be affected, as schools are judged to be unsafe, and community-wide values erode. Social control often breaks down, as norms of civility no longer apply, and hostility and crime increase. Participation in traditional community-wide activities decreases, while participation in conflict-prone hazard-related activity rises. While providing new sources of mutual support for its members, emergent groups often create a "we versus them" environment in which community-wide support networks are diminished and replaced with networks of conflict.

This report's final section briefly reiterates our conclusions about the deleterious psychological and social effects of toxic contamination on people and their communities, and mentions some implications of those conclusions for the Yucca Mountain situation. We believe that the findings of our case studies and many cases cited in the literature are directly relevant here. Radioactive waste possesses characteristics which are central to producing the individual and social responses that we found in the cases we examined. Its potential danger lasts a very long time; it is invisible; humans produce it, are expected to keep us safe from it, and will be blamed if anything goes wrong. Therefore, should a radiation leak take place at the site, we would expect a process such as that described in this report to take place. Furthermore, given the ambiguous and terrifying nature of toxic hazards in general, and of radioactive wastes in particular, this destructive social process and its deleterious effects on people may take place even without actual contamination. This may occur if local residents fear the possibility of eventual contamination and do not trust the ability of responsible institutions to protect them from harm. Unfortunately, in the communities we studied, increased knowledge about the potential risks of the hazard, and

increased contact with even the best intentioned government agencies, led to greater fear of the hazard and diminished trust in government to protect its citizens from harm.

Part One:

Hazardous Waste as Human Threat

Deliberating the pros and cons of a high level radioactive waste repository is a matter of extreme scientific complexity. But more than the concerns of "hard" science need to be taken into account. Radioactive waste is arguably the most extreme member of a class of fear-producing agents commonly referred to as "hazardous waste." Under the umbrella term of hazardous waste is found an array of items considered by most people to be direct threats to their physical well-being; among them are inorganic and organic chemicals, sulphur, methane and other toxic byproducts, hospital debris such as vials, needles and surgical clothing, and the byproducts of our nuclear energy and defense programs: radioactive waste.

The questions of how people respond to the dangers of hazardous waste, how they perceive and make sense out of the scope and degree of danger, how they organize their personal conduct in response to it, and how their family, friendship and community organizations change because of it, are topics of keen interest to social and behavioral scientists. This report examines the human and social responses to hazardous waste in three separate communities. It is our professional opinion that the particular problems we are going to document are part of a broader cluster of problems that are, with minor variations, found in all human communities contaminated by hazardous waste.

The universal character of these problems invites the use of the term syndrome. For example, in all the cases of community contamination that we have studied, residents experienced a marked decline in their willingness to trust local government, state and federal government agencies, and parties

responsible for the pollution. In some cases, people even lost trust in one another and in themselves.

It is the predictive quality of syndromes that is most important here. It is our professional opinion that the specific problems documented in this report (and in other reports issued by our colleagues) are reliable predictors of what Nevada can expect if there is off-site contamination from the proposed radioactive waste repository.

This report is subdivided into four sections. In the first section we sketch out a modest conceptual scheme based on the idea that the threat of exposure to hazardous waste disrupts the routine relationship between people and the environment and is the source of profound social and psychological trauma. To underscore the particularly debilitating consequences stemming from human exposure to environmental toxins, we will periodically compare them with the problems posed by natural disasters in the United States; indeed, we find that in general, the public perception that their environment has been contaminated is likely to trigger profound personal and social disruption that is greater in scope and degree than the disruption experienced in the wake of a natural disaster.

The second section is a short description of the three cases we examined. This is followed by a section that presents evidence from the cases to illustrate the following four points:

1. Exposure to hazardous waste is likely to result in loss of self-esteem and personal efficacy.
2. Because evidence of the scope and degree of contamination is usually ambiguous, people develop very different perceptions of the danger.
3. People exposed to hazardous waste are likely to develop collectively shared beliefs about danger that impair their sense of well-being and also

create enmity and misunderstanding between themselves and others, including technical agency personnel.

4. Hostility and enmity lead to (often severe) conflict within communities and between communities and outside organizations.

5. Therefore, communities exposed to toxic contamination are likely to become disorganized and thus less able to provide residents with important features of social life, such as civic pride and mutual support.

The fourth and final section is a short summary of the key problems in individual and social adaptations to hazardous waste and their implications for siting a high level radioactive waste repository at Yucca Mountain.

A Conceptual Prelude

We begin with a true story. The city of Rio de Janeiro in Brazil is a sprawling metropolis of over ten million people. It harbors hundreds of thousands of peasants in city areas called "favelas." A favela is a shanty town made of abandoned sheet metal, cardboard, wood, rope, and other discarded urban junk. Life is hard in the favela. There is neither sewerage nor electricity and streets are little more than footpaths widened to accommodate the ox cart. But perhaps the most distinctive feature of these urban slums is the city's periodic attempts to demolish them. Embarrassed by the growing number of favelas, Rio's local government periodically sends bulldozers through the makeshift houses, knocking them down and sending the residents scurrying for cover. But the peasants are tenacious. As soon as the government's bulldozers have left, they return and rebuild their houses.

This cycle of building, destroying and rebuilding has been going on for decades. Recently, however, peasants in several dozen favelas abandoned their houses voluntarily and are not returning. It was not the fear of the

awesome bulldozer that drove them from their homes. Rather, the cause of the peasants' self-imposed exile was the contamination of their drinking water by untreated sewage and industrial waste. The land that was once home to thousands of people who were sufficiently persistent to thwart the government's violent efforts to dislocate them, is now a vacant space, traveled through but no longer lived in.

Of the several possible lessons in this account of the favela, two stand out. First, the government's bulldozers destroyed the peasants' houses, literally knocking them down and rolling over them, not once, but time and time again. In spite of the violent destruction of their houses, however, the peasants returned to the same place and rebuilt. Thus, to physically destroy a house does not appear to be sufficient grounds for people to relocate, in spite of the fact that the bulldozers would return. The second lesson stems from the relationship between the poisoned water supply and voluntary relocation. The peasants, who otherwise tolerated substantial misery, decided they could not live with contaminated water. Thus to damage a natural resource may justify voluntary relocation to another, safer, habitat.

We see direct and instructive parallels between the favela example and the predicament of modern American communities faced with the threat of hazardous waste. Like the Brazilian peasants, Americans do not seem to be strongly adverse to periodic damage to their houses, stores and streets. If we replace the Brazilian government's bulldozers with natural disasters such as tornadoes and earthquakes, dozens of American communities are buffeted, battered and, in extreme cases, leveled by nature's wrath every year. But in only the most extreme cases are these damaged communities abandoned. On the contrary, most of them are rebuilt, frequently with better materials and

more efficient designs and amenities. Noting the remarkable recovery of most modern communities struck by natural calamities, one researcher coined the term "amplified rebound" to describe the process by which a town or city becomes a more desirable place to live after a disaster (Fritz 1961). While it would probably not be accurate to label the rebuilding of a favela shanty town an "amplified rebound," in both cases the destruction of the built environment does not dissuade survivors from trying again.

The similarity between Americans and Brazilian peasants also extends to their respective responses to the contamination of essential environmental resources. In both cases, the marked tendency is not to remain in the community, but to abandon it. Consider, for example, the primary human response to the environmental contamination of the Love Canal, of Times Beach, of Savannah Place, of Centralia, of Ponca City; in each of these cases and in dozens of others, people walked away from their homes, their neighborhoods, their communities. These modern ghost towns are testimony to the human fear of contamination.

Toxic contamination or hazardous wastes may well not destroy buildings or streets. What is destroyed when chemicals leach through underground swales and dioxin dust settles on roadways and gardens is the primary relationship between a community and its environmental resources. When the water is no longer safe to drink, when the air is thought to be poisoned, or when the ground is contaminated, there is no opportunity for "amplified rebound." The houses and stores may remain, but the community ceases to exist or become an empty shell; even if people do remain in their community and homes, their feelings about both may undergo profound changes.

One conclusion to be drawn from this comparison between the favela and the contemporary American community is that traumatic and massive destruction, the

trademarks of both the government's bulldozers and a natural calamity, are not the only measures of disaster impact. People can be victims of disaster agents that do not violently kill them or destroy their houses, but rather create profound and often lasting doubts about their health, perhaps rob them of feelings of self-worth, and, in some cases, force them to abandon their houses while facing the risks of foreclosure and lost credit.

What is it about the toxic contamination of essential environmental resources that is likely to trigger intense fear? Erikson puts the emphasis on contamination, suggesting that poisonous chemicals or radioactivity "contaminate rather than merely damage." Aversive agents that "pollute, befoul (and) taint," are experienced and responded to quite differently from those that "just create wreckage" (Erikson 1991:15).

Our research and that of several social psychologists suggests that a primary consequence of the experience of toxic contamination is pronounced threat. Threat is marked by a feeling that danger is very close and it is "central to the production of psychological stress in human beings" (Vyner 1988:66). The potential for trauma caused by threat is directly related to the degree of presence of three variables: 1) duration; 2) degree of hazard invisibility; and 3) the attribution or assignment of blame (Bolin 1985, Kroll-Smith and Couch 1990). The longer the duration of the threat, the more it is both environmentally and medically invisible, and the greater the degree of human accountability in creating it, the greater are its adverse effects on an individual's emotional well-being. Let us briefly consider each of these factors.

Duration

Toxic contamination may be triggered by an explosion, by a train derailment or by a slow leak. Whatever the cause of the contamination, however,

experience has taught us that it is almost impossible to clean it up. Consider, for example, that currently fewer than one percent of the Superfund sites have been completely restored. Thus, living with the threat of environmental contamination is frequently a chronic day-in and day-out experience (Baum, Fleming, and Davidson 1983, Couch and Kroll-Smith 1985).

To say that the threat of disaster is sometimes greater than the actual destruction of disaster is almost a truism. As Lang and Lang note, "Waiting for bombs to fall can seem almost as unnerving as the impact of the bomb itself" (Lang and Lang 1964:70). The victim fears that threat is omnipresent. Experiencing a long-term threat is likely to produce chronic anxiety and apprehension, which in turn generate additional anxieties and stress responses. Over time, as Vyner argues, people "begin to live in this now dangerous contaminated world in much the same sense that Vietnam veterans continue to live in the jungles of Vietnam" (Vyner 1988:120).

Invisibility

Moreover, most contaminants are environmentally and medically invisible. Several studies conclude that the degree of threat experienced is related to the degree of uncertainty or ambiguity of environmental cues perceived to be issuing from the source of threat (Baum, Fleming, and Davidson 1983, Bolin 1985, Kroll-Smith and Couch 1990, Vyner 1988). The fact that most toxic contamination is not detectable by the senses but requires sophisticated monitoring technology denies individuals a fundamental measure of control over the hazard agent.

Behavior sufficient to avoid the hazard agent is not possible when individuals cannot estimate the extent of potential injury and damage. Thus, they cannot reasonably predict when the hazard is going to harm them. The more invisible the hazard agent, the more difficult it is for people to receive

feedback on just how effectively they are coping (Baum, Fleming, and Davidson 1983). Is closing the window or adding additional insulation sufficient to protect us? Is it enough to postpone a shopping trip if an acrid odor fills the air? Volatile gases and organic compounds leaching through underground swales are the source of several critical questions that are perceived by many lay persons and experts alike as impossible to answer:

1. Is invisible pollution present in my house?
2. Is my body tissue actually absorbing this contamination?
3. If I am absorbing the contaminant, is the absorbed dose dangerous?
4. What affect will the contamination have on me in the future? (Vyner 1988:14).

To the extent that people believe there are no definite answers to these and similar questions, it is impossible for them to determine with any degree of certainty if they are in danger. Thus victims of toxic pollution often experience a loss of that primordial sense of invulnerability that makes effective coping possible. The shattering of the belief in invulnerability means that the person is now forced to live with the feeling of being unprotected and insufficiently defended from a hostile environment (Janoff-Bulman 1985). Thus, they live with the threat as a source of danger in its own right. At least one study of psychological distress and toxic contamination demonstrates that perceived threat to physical health is important in predicting demoralization (Markowitz and Gutterman 1986). And demoralization is associated with feelings of helplessness and low self-esteem (Laufer, Brett, and Gallops 1984). Once ensnared in threat, the stress response syndrome produced can lead to both physical and psychological pathology.

Blame

Finally, it is humans that are ultimately responsible for the contamination of the biosphere. Through willful or negligent acts, or perhaps through the normal use of an inadequate technology, a contaminate such as lead or radioactivity is leaked into the environment. No one is expected to prevent a cyclone, but technology is generally viewed as being under our control.

In the areas of accidents and damages, blame is most likely to occur when two conditions are met. The accident or event is perceived as having been preventable; and the people responsible are perceived as avoiding their moral responsibility for either safe operation or subsequent damages. Hazardous waste contamination satisfies these conditions.

The term "preventable" carries two specific meanings in the case of waste management. The first meaning refers to the belief that technology should be available for the proper disposal of waste. A failure in the operation of that technology is thus the result of some type of human error. The second, and perhaps more volatile meaning, refers to the belief that waste should not be disposed of in a particular locality in the first place. This second meaning raises painful questions of social justice and environmental equity that are not easily resolved in public hearings, boards of inquiry and the other machinery of siting initiatives.

The second condition of blame is more important for our pending analysis of the three cases. The victims of off-site releases of toxic contamination are almost uniformly disappointed, frustrated and angered by their perceptions that responsible parties will not admit their culpability, nor act swiftly and efficiently to abate the hazard, clean up the site and compensate the victims.

Blame is a powerful emotion because it is rooted in moral evaluation. People are holding other people accountable for their misery. It occurs in

hazardous waste emergencies because people do not believe that corporations or governments acted properly in their initial decision to site a facility in their region, in the subsequent management of that facility, and finally in assuming responsibility for the dangers of off-site releases.

It is not difficult to see the relationship between blame and trust. You can disagree with someone and still trust that person. However, to conclude that someone is morally accountable for your misfortune precludes trust. But the problem with blame is comparatively deeper in those cases where people originally assumed they could trust certain people or groups. For example, most people adversely affected by hazardous waste are ordinary Americans who believe in "the system." It is thus particularly painful to learn that government is unable or unwilling to help with the horrors of contamination and that the local industry or government project responsible for the damages is denying, or at best begrudgingly admitting, liability.

Implications

It is important to note that these three features of toxic contamination are not now amenable to standard hazardous materials management techniques. In other words, regardless of how well prepared and rehearsed a company or government is in emergency response to off-site releases, the duration of the event is likely to be measured in years, not days; there is presently no fool-proof means of identifying the amount of most releases, their paths of contamination, or their short and long-term health effects; and regardless of the best emergency response plans, the victims of toxic contamination are going to be pointing fingers and assigning blame. The fact that these variables operate independently of hazard management procedures highlights the unusual and perhaps unresolvable dilemmas created when toxics are unwittingly released into the environment.

Part 2:

Community Profiles

The second part of this report examines the efforts of three communities to adapt to biospheric contamination. "Community 1" and "Community 2" are pseudonyms; court proceedings require that we do not reveal the real names of these communities. Information on other contaminated communities is introduced, when appropriate, to offer a comparison or expand on an observation.

Community 1

Situated in the western United States, this rural subdivision of 180 families was located approximately four miles from a city center. Housing lots vary in size from 1/2 to 1 acre. Surrounding approximately 1/2 of the perimeter of the subdivision are over twenty small to medium-sized industries. Chemical processing, petroleum storage, trucking and cement making are among the services these industries provide. Benzene, ethylbenzene, toluene and xylene are among the chemicals that have migrated off site and have contaminated the wells and soils of this subdivision. In 1988 the EPA recommended that Community 1 be placed on the National Priority List of Superfund Sites.

Two years later, in August 1990, the EPA officially recognized Community 1 as among the nation's most polluted communities. Over 3/4 of the subdivision's residents have already moved out at their own expense. A law suit against the polluting industries is now underway.

Community 2

A neighborhood of approximately eighty families, Community 2 was located a few miles from a small ranching village in the western United States. Less than a mile from the neighborhood, miners worked day and night to strip

coal from its seams in the earth's crust. Over 100,000 gallons of water were required every few hours to dampen the coal and reduce the heat generated by the huge shovels. To acquire the water, the coal company used a significant portion of the underground water surrounding its operation. When it reduced the water table, the carbon and methane gases released from the mining were free to travel through the now dry swale beds. These gases started appearing in basements, driveways, and cracks in the streets and sidewalks. Fires started spontaneously in people's driveways. Kitchen tables rocked and glassware broke as methane pockets exploded under people's houses. In 1985 the Department of the Interior ordered an investigation of the coal mining operation. In 1986 families were ordered to evacuate the subdivision; subsequently, a law suit was brought against the company.

Centralia

In 1962 an underground mine fire was discovered in Centralia, Pennsylvania. When the initial fire-fighting efforts failed, the blaze ignited an outcropping of coal. From there it spread underground into the abandoned mine shafts that honeycomb the ground under and around Centralia. State and federal governments spent over \$5 million over the following two decades without halting the fire's underground march.

Despite the failure to contain or extinguish it, the underground monster did little visible damage for years. But in 1969 carbon monoxide gas drove three Centralia families from their homes. In 1976 carbon monoxide in a concentration twenty times the lethal dose for a human being was found pouring from a borehole twenty-seven feet from the doorstep of another Centralia home. In 1979 a service station was ordered closed because of rising gasoline temperatures in its underground storage tanks. The following year the federal government purchased seven borough properties

considered to be unsafe; other followed. More and more residents complained of physical illness that they attributed to the fire.

Then, on Valentine's Day, 1981, a twelve-year-old boy fell into a cave-in caused by the mine fire and escaped death only by grasping onto an exposed tree root. Several Centralians responded to this near-tragedy by forming a community action group to push for an adequate governmental response. But instead of rushing to join the new group, most Centralia residents became hostile toward its members. Government efforts to control the fire continued to fail. Public meetings, scheduled more frequently, became occasions for residents to express bitter hostility against the government and against each other. This small-town community became the scene of telephone threats, tire slashings, and a fire bombing. No fewer than seven grassroots community organizations sprang up among the one thousand inhabitants, each group offering a different perspective and proposals, and each prepared to fight for its views.

In July of 1983 a resolution of one sort was achieved when a government-sponsored engineering study judged the fire to be even worse than anyone had thought. It concluded that if left to burn itself out, the fire would make all of Centralia uninhabitable, but continued efforts to control or extinguish the blaze would also make life in Centralia intolerable. The solution: Centralia must go. In October of 1983 the U.S. Congress authorized the sum of \$42 million for purchase of Centralians' property. The vast majority of Centralians accepted the government's offer to buy their property.

Although the details of each of these cases differs, they are similar in several respects. In each case, essential elements of the local biosphere were contaminated, the water was no longer safe to drink, the air was not

safe to breath. In each case the source of contaminants was produced by human technology. Moreover, in each case, the contaminants would not subside or abate on their own. Technical intervention was necessary to stop the flow or clean-up the contamination. And in all three cases, technical intervention proved unable to reduce the levels of pollution and people were forced to relocate. Finally, with few exceptions, the populations of each of these communities were working-class and blue collar with high school or less education. Whatever financial equity these people enjoyed was tied up in their houses.

Part 3:

Toxics, Adaptation and Social Change

In developing our sociological perspective on toxic contamination in Part 1, we alluded to the particular problem this type of crisis presents for people and their communities. The actual or potential pollution of the many communities contaminated by gases, chemicals and radiation, demands that people, groups and social organizations adapt to the threat of pollution.

In Part 3 we will focus on how technological degradation of local biospheres frequently results in individual and social change. We will present evidence from the three case studies and supplementary work on this topic to support the idea that in adapting to the threats created by environmental contamination, people and their groups experience a high level of individual and collective stress. Moreover, through this process, people frequently are forced to change their definition of themselves and the rules by which their social groups function.

Biospheric Contamination and the Self

When confronted by a crisis, individuals can adapt either by reducing the threat in defense of the self, or by revising the self to be more consistent with the expectations of the threat. Most people would rather reduce the threat while maintaining the integrity of the self. We can see how this works if we examine what usually happens in cases of natural disaster. When a natural disaster occurs, the rules and expectations of how to respond are built into a disaster subculture which helps people to anticipate the experience of impact and recover from its devastation. Most people living in "tornado alley" know when the tornado season begins, know what to expect from their local emergency news service, and are aware of what side of their houses to be on and what rooms to be in during the brunt of the storm. Even in the unfortunate event of human loss, most survivors know how to grieve and are helped by others who specialize in this type of life adjustment. The presence of a viable disaster subculture, combined with an aversive agent whose effects are readily visible, help to explain why natural disasters do not usually cause measurable levels of emotional illness in victims, unless a particular victim is predisposed to psychiatric problems prior to impact (Mileti, Drabek, and Haas 1975).

On the other hand, biospheric contamination is experienced without the benefit of a disaster subculture. Society does not have a prescribed or routine response to this type of crisis. This should not surprise us. While we expect a tornado to threaten life and property, those of us living in twentieth-century America do not expect our tap water to be dangerous.

However, this attitude is changing. Worries over our ability to maintain the purity of our bodies are increasing in the face of the ever-widening web of environmental pollution. That these issues are finding

their way into all aspects of popular culture, and that they can effect our self-concepts, is illustrated by the story a young mother told of her six-year-old daughter confronting her in tears after watching a Saturday morning cartoon. The cartoon included a hero who fights toxic pollution and who was lamenting the fact that pollution is everywhere --- in our atmosphere, in our water, and even in our own bodies. The girl was very upset: "How can pollution be inside me? Am I being poisoned? Will I die?"

Purity of the body and the freedom to exercise control over it are values with deep roots in Western society (Erikson 1991, Vidich 1980). With the exception of intentional ingestion, the cultural meaning of the word "poison" violates both of these values. To "be poisoned," that is, not to poison one's self, expresses the loss of control over one's body. An agency outside the person willfully or negligently exposed his or her body to a foreign, impure substance. Toxins "slink in without warning, do no immediate damage so far as one can tell, and then begin their deadly work from within---the very embodiment...of stealth and perfidy....Poison has always represented the epitome of evil and treachery...." (Erikson 1991:20). People who begin to perceive themselves and their families as poisoned are experiencing a profound life change event.

For many who experience contamination, since they cannot alter the situation, adaptation must take place at the level of the self. Janoff-Bulman and Frieze argue that exposure to toxins is likely to result in changing several of the basic assumptions the individual has about the world, including a positive belief in the self (Janoff-Bulman and Frieze 1983, see also Gibbs 1986). Davidson and Baum found that many people living near Three Mile Island blamed themselves for the difficulties they experienced in responding to the nuclear accident (Davidson and Baum 1991).

Ironically, Davidson and Baum also found that those who experienced self-blame following TMI had lower levels of stress than those who blamed others. They suggest the reason for this is that one's ability to maintain control over oneself is greater than to control others or the situation. The relationship between loss of control and psychological distress is well documented; in fact, at the end of their book on Social Causes of Psychological Distress, Mirowsky and Ross conclude: "Of all the things that might explain the social patterns of distress, one stands out as central: the sense of control over one's life" (Mirowsky and Ross 1989:167).

There are many aspects of technological hazards that, by their nature, make them difficult to control. A number of those aspects are discussed later in this report. In fact, no one individual living near a hazard can have much control over it. Moving away is the only sure way to maintain safety, and the sacrifices involved with that alternative are usually monumental.

In separate studies of Community 1 and Community 2 we looked in more depth at the relationship between biospheric contamination, loss of trust and control, and changes in self-conception and psychological distress. These studies gathered aggregate data on measures of anomie, powerlessness, social isolation, and coping resources in the two contaminated neighborhoods and a non-contaminated control group. We used four scales which measured different aspects of alienation, coping and self-conception. In the case of every scale, we found that residents of the contaminated communities had significantly higher scale scores than did respondents in the control group. Significant differences remained even when controlling for factors such as education, income and age (Couch and Kroll-Smith 1991).

Most of the items in the alienation and coping scales asked respondents to agree or disagree with a statement. Many of the items in those scales measured disillusionment with, or lack of trust in, government or other large institutions. For example: "This world is run by the few people in power, and there is not much the little guy can do about it;" "Persons like myself have little chance of protecting our personal interests when they conflict with those of strong pressure groups;" "It is only wishful thinking to believe that one can really influence what happens in society at large;" "There's little use writing to public officials because often they aren't really interested in the problems of the average man."

Other items tap into a more general lack of trust ("These days a person doesn't really know who he can count on"; "Sometimes I have the feeling that other people are using me"); or pessimism about the future ("It's hardly fair to bring children into the world with the way things look for the future"; "I worry about the future facing today's children"); or a lack of personal control over one's life ("I often feel helpless in dealing with the problems of life"; "I have little control over the things that happen to me"). Finally, there are the items which suggest the loss of self-worth that can accompany technological hazards: "I certainly feel useless at times"; "At times I think I am no good at all"; "I wish I could have more respect for myself"; "All in all, I am inclined to think of myself as a failure."

That contamination and the social response to it have negative impacts on psychological well-being is supported by data gathered independently in one of these same communities by a psychologist. Among his findings are elevated levels of anxiety, depression, guilt, intrusive imagery, demoralization, and fear of losing control. The levels on some of his

measures are higher for residents in the contaminated community than those found in studies of emergency psychiatric service patients, general psychiatric patients, and alcoholics (Kroll-Smith, Wilson, and Couch 1989). There is additional support to be found in the literature. Several researchers have pointed to the apparently greater emotional toll of prolonged stress among victims of technological hazards (Gibbs 1986, Schorr, Goldsteen, and Cortes 1982, Vynar 1988). Davidson and Baum report that people living within a short distance of the Three Mile Island nuclear plant have experienced chronic stress for at least six years (Davidson and Baum 1991). Weisaeth found his respondents expressing intensified concern for their safety and well-being over a year after the accident at the Chernobyl nuclear power station (Weisaeth 1991). Amidst the ongoing controversy over the extent of human damage caused by the Chernobyl accident, one scientist who has found little medical pathology in studying Byelorussians "said the one real medical effect was the stress caused by the accident" (Brooke 1991:18).

In a study unusual because it documented stress responses to both natural and technological crises in the same community, Smith and her colleagues compared the emotional well-being of people who had experienced both floods and dioxin contamination of property at Times Beach with those exposed only to dioxin and those exposed only to floods in other area. People exposed to dioxin contamination reported higher levels of psychosocial trauma than people exposed only to the flooding. One year later, "Flood only victims were twice as likely to report full recovery than were those exposed to dioxin with or without accompanying flooding" (Smith et al. 1986:60).

It is very important to recognize that it is not only the direct effects of the hazard that cause these negative consequences, but the social response to the hazard or its threat. These are sometimes termed "secondary impacts" (Hartsough 1985). Secondary impacts include the experience of social isolation and stigma. Edelstein, for example, argues that the very words "pollution" and "contamination" are markers used by non-victims to signify danger, to mark people and places to be ritually avoided (Edelstein 1991). Levine reports that many parents who moved from the Love Canal discovered a fear among their new neighbors that the Love Canal children would contaminate their children (Kroll-Smith, Couch, and Levine in press, see also Kunreuther and Slovic 1988). Centralia's little league team disbanded when neighboring teams refused to play on the Centralia field for fear of contamination. Contrast this with living in a town periodically hit by hurricanes or flash floods. Indeed there is frequently a heroic label applied to survivors. The "I survived. . ." tee shirt market expresses this tendency. On the other hand cadmium or lead pollution of soil or drinking water creates no heroes.

Other secondary impacts happen if, as usually happens in cases of contamination, you turn to others for help. If a corporation is causing the problem, perhaps it can be persuaded to remedy it. If that does not work, or if no active corporation is present (as in the Centralia case), the government can be approached for redress. And throughout it all, one's neighbors can be solicited for support.

Rather than reestablishing one's sense of control, appealing to others to help remedy technological hazards usually reinforces one's helplessness. For reasons discussed below, neither large organizations nor one's neighbors are likely to provide adequate support. The available evidence strongly

suggests that counting on others to help remedy the situation generally ends in mistrust, alienation and stress.

The disgust expressed by many who counted on their neighbors for help is evident in the words of a Centralia resident:

"Centralia is like someone you know who is slowly dying of cancer; I mean every time you turn around there is another part of the town that's infected. If we would just get together we could fight this cancer. But people around here are more concerned with themselves than with their neighbors. Rumors, hostileness, prejudice, backbiting...this town's more sick than the fire."

Another Centralian is more personal in discussing the effects of community conflict:

"The fire has affected me terribly. Not because of fear of the fire itself, but (because of) the threat of the community being torn apart....We're scared really of what's going to happen to us. It's a great, great emotional trauma on us."

That this type of community conflict can affect a person's view of self and others is poignantly expressed by another resident:

"Centralia went from a community that was almost placid...to a community that's in constant turmoil. It's divided neighborhoods. It's created groups that work against each other. It's made me cynical in lots of ways. It's made me doubt the intentions of people....I'm sick to death of it."

Yet another Centralian intends to pass his new-found cynicism on to the next generation:

"People hold grudges in this town. They don't forget. And I'll tell you, I no longer respect people unconditionally...conditional respect,

that's what the fire taught me. That is what it has taught me as a parent and I will pass it on to my children."

Centralians not only learned not to trust their neighbors; they also learned not to trust their government. Their experience with the government's response to the fire turned many of them from highly patriotic citizens into untrusting cynics. In fact, one of the few areas of agreement in the town was the almost universal belief that the federal and state governments were doing a poor job in attempting to solve the problem. In a survey we conducted in 1982 of 354 adult Centralians, 94 percent rated the job done by the state government as only fair or poor, and 95 percent ranked the federal government's response in those categories.

In in-depth interviews with Centralians, many expressed their disillusionment with their government; for example,

"My family lives every day with poisonous gases; I'm very scared, everybody is....Some people in (the government) try to tell us it's okay here, it's safe. We know it's not safe here....I don't trust the government anymore."

It is important to realize that losing trust in the ability of government to protect its citizens from the effects of technological hazards is not unique to Centralia. Loss of trust was readily evident in our study of Community 1 and Community 2. In fact, most studies of responses to contamination refer to this loss of trust (for example, see Edelstein 1988:118-137). This statement, which could easily have been made by a Centralian, was actually made by a resident of Love Canal:

"I can see their point as far as not trusting the government....I think at one time people felt, well, if the government says something, it's God's

law, where it's not that way anymore....Well, as far as the government, they're going to give you what they want." (Fowlkes and Miller 1982:88)

The depth of mistrust is illustrated by the fact that many in Centralia not only blamed the government for an inadequate or incompetent response, but thought that the government was actively involved in a plot against them. Throughout our interviews and observation of the most severely affected groups in Centralia we became aware that many of the people who believed they were at most risk from the underground fire also believed that a conspiracy of massive proportions was hatched by the federal and/or state government to rob them of their property and clear the coal beneath the town. Some went so far as to argue that there was no fire at all, only gases intentionally pumped into the mines to try to force Centralians to abandon their homes. Others thought that rats were being trucked into town in order to make life in Centralia intolerable.

These are extreme examples, but the belief in the existence of some sort of conspiracy was widespread. In our 1982 survey, 36 percent of the respondents thought that there was a conspiracy to keep the fire burning, and 35 percent thought that some people had something to gain by the fire's continuing menace.

More secondary impacts accrue from prolonged litigation to recoup financial losses, and protracted and painful relocations. Overall, in a stress study conducted as part of our Centralia study, respondents expressed more stress concerning the social response of the community and the government than about direct health threats of the fire.

In conclusion, there is sufficient empirical evidence to suggest a relationship between the contamination of essential environmental resources and changes in the organization of personal qualities each of us attributes

to ourselves. Unable to alter the environmental hazards, and frequently unable to move from the source of the threat, some people are experiencing profound stress while viewing themselves as less effectual, less able to master difficulties, and less worthy of other people's respect and attention. Although we expect that most persons who perceive themselves as victims of toxic contamination exhibit some of the characteristics we have identified, people do not respond uniformly to these changes in self-definition. Some victims also respond by becoming politically active (see Stone and Levine 1985, Couch and Kroll-Smith 1991). Although comparatively few people adapt by becoming citizen activists, their influence on the course of events and the structure of the local community is often profound.

Risk Appraisals and Uncertainty

The best that any of us can do in situations of potential danger is to identify the source of the threat, how specifically it is likely to harm us, what kinds of damage it is likely to cause, and what we can do to avoid it. Two assumptions are taken for granted in this ideal scenario. The first assumption is that there is an objective world of concrete facts that will reveal itself to systematic inquiry; the second assumption is that a rational, calculating person, an engineer, if you will, is sorting and assessing these facts. The image is of an objective world to be known and a rational knower pursuing the facts.

The world most of us live in, however, rarely if ever conforms to this ideal. Most of the time, most of the facts are not known, or if they are, they are not communicated in a manner that makes them intelligible to ordinary people. And sometimes, as we all know, ordinary people will act contrary to the facts.

Consider the case of hazardous waste contamination. Several studies have documented the difficulty scientists, physicians and citizens experience in identifying the presence of toxins in the biosphere. The physical manifestations of this type of hazard make it practically impossible to objectively determine the pathways toxins are likely to follow, their direct and indirect potential for harm, and techniques that are likely to work for controlling or abating their discharge (Fowlkes and Miller 1982, Kroll-Smith and Couch 1991, Levine 1982).

Note, however, that although people are not likely to know with any certainty just how much toxicity is present, how dangerous it is, and so forth, they most likely will act as if they do know. In other words, where objective "facts" are not available, people are likely to construct subjective "facts" that define the scope and degree of danger and prescribe an appropriate course of conduct. This means, of course, that without concrete evidence of threat, people are more likely to over- or underestimate the amount of risk posed by the hazard. Indeed, when presented with contrary bits of official information and ambiguous signs that the local environment is changing, it is not unlikely that residents will come to differing conclusions about what the "real" danger is and how to cope with it. Let us look at the type of problems people face when they must figure out the scope and degree of danger posed by a toxic hazard. To do this, we will examine aspects of the case of the Centralia mine fire in some detail.

Mine Gases and Ambiguous Evidence

In spite of the fact that the mine fire irrevocably changed the history of Centralia, only a handful of people have ever seen the underground blaze. Although it is burning two to three hundred feet beneath the earth's crust,

the fire did surface in the spring of 1981 and again in the spring of 1983. However, in both cases, the Pennsylvania Department of Environmental Resources backfilled the source of the blaze with fly ash. Moreover, the "breakouts" occurred along mountainous terrain that would be difficult to traverse. Finally, both breakouts occurred outside the official town limits. Thus, although the fire did surface at least twice, few people actually saw it. That a mine fire exists, very few will argue. That there was a mine fire under the Borough of Centralia remained a point of contentious debate.

A middle-aged man living in the area which the government designated as the "impact zone" remarked, "Some people refuse to believe that a fire exists in town even though it broke to the surface at one point and spews carbon monoxide everywhere....They refuse to even acknowledge the odor." On the other hand, in the words of a thirty-six-year-old woman living on what came to be called the "cold side" of town (in reality only a little more than a half mile from her neighbor in the impact zone): "I don't believe the mine fire is in Centralia itself. I think the people just want to move. Maybe the fumes are in the houses, I don't know; that's what their yelling about, but the fire is going the other way." Was the fire moving the other way, away from the town? One engineering report commissioned by the local government said no, it was moving underneath the town and would be a greater danger in the ensuing months. Another engineering report commissioned by a local citizens' group said yes, the fire was burning a path out of the borough and would be less of a danger in the months to come.

Like radiation, mine gases are invisible. But some mine gases, unlike radiation, do have an odor. On days when the wind was blowing from the south, a mixture of carbon dioxide and sulphur dioxide seeped from cracks

and crevices in the earth's surface and spread over three or four blocks of Centralia before dissipating. For residents living in the path of the gases, there was clearly something in the air. An elderly woman living in the path of the gases found the sulphur smell "sickening."

In addition to the acrid odor, people living in the impact zone (also known as the "hot side" of town) experienced burning eyes, lassitude and respiratory troubles. For these residents, the gases and their side effects were unequivocal evidence that a serious hazard existed. For residents on the cold side of town, however, gases were not in the air. Unless they traveled through the hot side on a day when CO₂ and SO₂ were detectable by the senses, they had to depend on their neighbors' accounts for evidence. It was possible, of course, for residents on the cold side of town, having no personal experience of the fumes, to discredit or diminish the claims of their neighbors that hazardous gases were present.

A more insidious gaseous product of the mine fire was virtually undetectable by the Centralians themselves. Unlike CO₂ and SO₂, which can be registered by sight, taste, smell, and physical reactions, the deadly carbon monoxide is detectable only by gas monitors. Colorless, odorless, tasteless, and non-irritating, CO is formed whenever a carbon-based fuel is incompletely burned. Considered by the Pennsylvania Department of Health to be the most dangerous side effect of the underground mine fire, CO combines with hemoglobin in the blood. Acute poisoning ends in death by respiratory failure.

In the early 1980s, the Bureau of Mines funded a project to monitor air quality in homes to assure that the safety of residents was not jeopardized by the seepage of CO. The Pennsylvania Department of Environmental Resources (DER) was appointed to administer the program. DER

representatives knocked on doors and asked residents if they wanted gas monitors placed in their homes, an inspector to check their homes regularly for gases, or both. Only nine families outside the impact zone requested a routine check of their homes for gases. Not one family outside the impact zone requested a monitor. However, 72 of the 106 families living in the impact zone (69%) requested the devices. Expressed in this self-selection process was the variable conclusions residents were drawing regarding the "real" dangers associated with the fire.

Beyond the differing appraisals of risk posed by the mine gases, Centralians also reached contrasting assessments of the threat of subsidence, as miners call cave-ins. Subsidence occurs when heat from a mine fire burns rock substrata, so weakening the support for the ground's surface that it literally caves in, leaving a hole anywhere from a foot to several yards in diameter. Subsidence may also be the result of mining an area more than twice. During a third mining, the underground pillars supporting the mine shaft are "robbed," leaving only a few feet of topsoil as a ceiling over a sizable cavern. The thin layer of soil is likely to give way under the weight of vehicular traffic, heavy rainfall, or even pedestrians. Most of the pillars under Centralia have been robbed.

Twelve cave-ins have been reported in Centralia since 1980. Although most of Centralia was susceptible to subsidence, all twelve occurred on the hot side of town. In specific areas understood to be at high risk, red signs warned, "Posted -- Keep Out -- Danger." An area about a half block square was thought to be so hazardous that it was enclosed with an eight-foot-high chain link fence.

Were the twelve subsidences on the hot side of town related to the fire? Centralians could not agree. Some reasoned that the disproportionate number

of cave-ins on the hot side was simply the result of having robbed a greater number of pillars from that area. If most third mining had occurred in that area, they reasoned, then subsidences were more likely. Other Centralians, however, particularly those living in the impact zone, were convinced the twelve cave-ins were tied directly to the mine fire, and that anyone who thought otherwise couldn't see what was really going on. Who was right? Government scientists disagreed. The DER changed the official interpretation of the source of the subsidences on two separate occasions. The federal Department of the Interior consistently denied that subsidence in Centralia was related to the mine fire, although the agency paid for the eight-foot-high fence mentioned above. Why would we expect ordinary people to interpret the source of risk with any more clarity and assuredness than the technical agency experts themselves?

The physical properties of mine fire gases and subsidences are difficult, if not impossible, to measure, predict and, as we will see below, control. Because Centralians could not determine once and for all if and when they were being exposed, they were forced to reach their own conclusions regarding the scope and degree of dangers posed by the mine fire. It is reasonable to conclude that in all the complex and contradictory encounters Centralians had with the mine fire, no single observation or experience of the crisis could stand as definitive; every appraisal of danger had both its adherents and its discreditors.

The different meanings that people assigned to the fire, and the emotive freight these differences carried, depended on the residents' perceptions of the risks posed by the subsurface conflagration. Many families in Centralia perceived the poisonous gases and the threat of subsidence as hazardous agents with a high degree of physical risk. One woman kept an "emergency

suitcase containing valuables and necessities under the bed and a pet carrier nearby in the event of a disaster." Other families saw the risks posed by the fire as having a low probability of endangering their health or well-being. In the words of a young man living next to the impact zone: "The fire and gases may reach this far. I don't know. Right now I'm in the clear." Still other families conducted their lives as if the fire was at most an annoyance, hardly a risk.

In summary, a product of long-term, invisible hazardous waste contamination is likely to be multiple, contrasting perceptions of danger. These perceptions of individuals become transformed into shared beliefs about the scope and degree of danger. These beliefs make it very likely that mutual opposition and community discord will emerge in toxic hazard crises. We will have occasion to discuss the emergence of destructive community conflict in a later section. Now, let us briefly consider the social process by which these beliefs are formed.

Threat Beliefs and Uncertainty

People facing the threat of chemical contamination or asbestos poisoning live in a chronic state of uncertainty. The greater the degree of uncertainty, the greater is the need to construct a symbolic interpretation of the scope and seriousness of the threat. "In situations...involving exposure to invisible contaminants. . .one finds that invisible health threats are met by the development of nonempirical belief systems about the nature of the threats" (Vyner 1988:21, see also Kroll-Smith and Couch 1987). Several studies suggest that these threat beliefs "may be more important in determining chronic stress and mental health effects than is the actual threat or danger posed" (Vyner 1988:45, see also Baum 1987, Baum, Singer, and Baum 1981, Fowlkes and Miller 1982, Kroll-Smith and Couch 1990). Thus a

key question in the study of the social sources of trauma concerns the meaning of beliefs in victims' emotional and behavioral response to threat or loss.

In an earlier article we called symbolic constructions of danger "threat belief systems," and distinguished them from risk perceptions (Kroll-Smith and Couch 1987, Kroll-Smith, Couch, and Levine in press). Beliefs, we suggest, more profoundly influence the believer than perceptions influence the perceiver. To perceive is to become aware of something directly through the senses; to believe, on the other hand is to commit with conviction to a publicly ratified view of some aspect of the world. To perceive that you have a respiratory problem is one thing; to believe it is caused by environmental contamination is another. Beliefs are internalized; they are located deeper in the psyche than perceptions and are far less easily modified.

The tenacity of beliefs is explained in part by the fact that they are social phenomena. While perceptions issue from sensory stimuli, beliefs are constructed in conversation among people who agree that the world or a portion of it is sacred, safe, dangerous, worthy of trust or distrust, and so on. Collective agreement strengthens the hold beliefs have on believers. Perceptions are more private matters, easier to revise; to violate a belief, however, is to risk censure and disapproval. Thus, embedded in beliefs is a moral claim on believers. They are required to behave in ways consistent with their commonly held beliefs.

The development of threat belief systems is a common occurrence in cases of environmental contamination. The first and most important grassroots group to emerge at Love Canal organized on the basis of a shared belief system regarding the amount and kind of danger it was facing and what its

members were entitled to as taxpaying citizens (Levine 1982:167-177). Similarly, Love Canal residents talked about chemical migration and risk using "the conditional language of belief..." (Fowlkes and Miller 1982:47). Similarly, people residing near the Three Mile Island nuclear facility developed coherent beliefs about safety and trust in government after the TMI accident (Vyner 1988). Several families in a trailer park contaminated with asbestos "developed new linguistic/emotional definitions of the situation" and "a new basis from which to view and respond to their environment" (Cuthbertson 1987:61).

There is a thematic continuity in these examples and in the three cases we studied. By examining our work and the studies of a number of other scholars (Cuthbertson 1987, Fowlkes and Miller 1982, Vyner 1988), we identified four themes common to the threat beliefs of contaminated communities:

- 1) The certainty that the environment, or a portion of it, is now dangerous and to be avoided.
- 2) The certainty that the bodies of believers and the bodies of their children are being poisoned.
- 3) The conclusion that victims can expect little empathy or assistance from neighbors or government.
- 4) The conclusion that escape or relocation is the only reasonable way to avoid further damage.

Beliefs confer certainty on an uncertain reality. They reduce the hazard that accompanies the acute experience of uncertainty. Technical experts may disagree over the presence of PCBs or dioxin in people's backyards, but believers are certain the chemicals are there. Certainty is also extended to the ambiguous events and incidents coincident with technological hazards. For

believers, the meanings of a power surge in a gas monitor, a neighbor diagnosed with cancer, or an agency official who cites evidence that the risks are not as severe as first indicated, does not reside in the events themselves but in the logic of the belief system. Believers can stop asking questions about the scope and degree of danger. Certain of the "true" extent of the danger they require little supporting information to confirm their threat beliefs and an extraordinary amount of contrary evidence to disconfirm them. A heavy cigarette smoker in Centralia scoffed at the idea that his two-pack-a-day habit might be the source of a chronic, productive cough. "I've been smoking all my life," he reasoned, "but it's only been since this mine fire that I started to cough."

The certainty with which believers believe in the reality of loss and threat appears to be independent of the statistical frequency of the losses or threats themselves. Interviews with Centralia residents who constructed a threat belief system discovered that not every believer could recount personal experiences to confirm the reality of the threat of poisonous gases and subsidences, and the personal encounters some people did have with the fire varied in number and intensity. While personal experiences were not available to all believers, two sources of accredited public information were: the worst case situations of seven families who experienced persistently high gas readings in their homes, and the three crisis events that occurred in the vicinity of the fire. These atypical cases were frequently talked about as if they were the typical experiences --- as if the most extreme was also the most representative. Claims of damage and loss were based on the relatively few catastrophic events and clearly dangerous situations in the history of the blaze, not the long and tedious chronology of events that might have encouraged a less dreadful apprehension of the situation.

There is, of course, a sound ecological basis for this apprehension. Extreme cases may be statistically unrepresentative of people's experiences at the moment, but there is no way of providing unqualified assurances that the next day or the day after that new victims will not be discovered or that low-probability events will not occur. Nuclear accidents at TMI and Chernobyl provide graphic examples of the latter; the "downwinders" are apparently an example of the former (Ball 1986).

Complementing this ecological basis is a social process that results in the intensification of threat beliefs. It stems from victims' experiences of social isolation following toxic exposure. Believers in a threat belief system quickly find that they are no longer welcome among nonbelievers. Placed outside the boundaries of their support groups and local communities, believers are likely to see themselves as a separate group and begin to rely on one another for support (Stone and Levine 1985). With a high amount of intra-group activity among believers and a low amount of inter-group exchanges, few believers will have a chance to survey the range of interpretations and responses others hold about the crisis. Nor are they encouraged to seek new information relevant to further evaluations of alternatives. Avoiding and being avoided by non-believers, social isolation works to intensify the fears of believers.

In summary, threat beliefs are intensely held claims about danger and loss of communal support which may come to demand almost all the attention of the believers. The behavior of believers is characterized by extreme alertness to any sign of possible danger; a strong motivation to avoid people who disagree with the beliefs; extreme concern with any detail related to the problem; a tendency to reduce the complexity of the world into the simplified idea that everything is threatening and few options exist for reducing the danger; and a

readiness to identify others who are able but unwilling to assist in overcoming the crisis as derelict in their moral duties. It is reasonable to assume that the steady state of vigilance required by threat beliefs might cause enough chronic apprehension to produce anxiety in its own right (Boehnlein 1987, Kroll-Smith and Couch 1990, Vyner 1988). Chronic preoccupation with danger, accompanied by the idea that there is little anyone can or will do about it, is a source of traumatic stress in people's lives arguably as significant as the physical danger of the hazard itself. In the belief that their health and safety are at risk, that their home and community are no longer safe places in which to live, believers are likely to feel that they no longer have a stake in the preservation of the community. For those who believe that danger is imminent, the preservation of the community is subordinate to seeking a safer environment.

Toxic Contamination and Community Conflict

Throughout this discussion we have alluded to the intra-community conflict that is likely to emerge in the event people discover the presence of toxins in their environment. In all three cases we examined and in the reports of other toxic hazard crises, we discovered hostility, anger and resentment among the victims. Reason would suggest that people should indeed be angry with those parties whom they believe are responsible for the contamination. But the anger we observed extended far beyond the anticipated hostility towards people and institutions held responsible for the threat of exposure.

A fire bomb was tossed through a window in Centralia, destroying a motor cycle repair shop. A citizen activist in Centralia received death threats by an anonymous caller until he had his phone disconnected. A resident of Community 2 awoke one morning to find scrawled on his living room window the

words, "Take Your Money And Run, Asshole." A man living in Community 1 was arrested for minor assault on a neighbor. These are not unusual events in towns experiencing toxic contamination. We know that natural disasters tend to heal divisions among victims, at least temporarily. However, we also now know that the victims of hazardous waste are likely to blame one another for their misery. In two of the three cases we examined, the intra-community conflict became personally and socially destructive. Centralia, in particular, was irrevocably changed by social conflict as neighbors, friends, and even relatives vehemently disagreed with one another over the "real" dangers of the fire and what should be done about them.

The sources of this destructive conflict are several. One of the most important sources is the extreme uncertainty caused by toxic contamination that mitigates against the effective functioning of local organizations designed to operate in non-crisis situations. In other words, community residents are probably not able to rely on traditional community organizations to help them organize their responses to contamination and coordinate activities to reduce the threat and re-establish a sense of order and routine.

The marked lack of effectiveness among such traditional community groups as emergency response services, local government or the Chamber of Commerce, is not difficult to explain. If we think of chronic threat as a challenge to the stability of any social structure, we can conceive of two logically adaptive responses to it: anticipation and resilience. Implied in the idea of anticipation is to foresee in advance the consequences of a potential source of danger and have ready an effective emergency response. However, local community organizations can reduce threat by anticipating it only when it is possible to know with a high degree of certainty what to expect and

how to prevent it. This is not the case with toxic contamination. In these cases, communities must rely on organizational resilience or innovation to bounce back from the insult of contamination.

Community social structures are generally better suited to anticipation than resilience. Thus, faced with the dangers of environmental contaminants, but without the benefit of an anticipatory organizational response, local community organizations are apt to be unable to respond to the problem in a timely and effective manner.

For example, the residents of Community 2 were ordered by the local sheriff to abandon their houses one day because of dangerous gases. The next day the order was rescinded; the day after it was reimposed. In a particularly troublesome incident, the local real estate board in Community 2 issued a formal statement that its members could not represent homeowners who wanted to sell until the properties were deemed safe. A day after the announcement, several Realtors reneged on their promise to the board and solicited business from Community 2 homeowners.

Perhaps the best example of the limitations of local social organization faced with the adaptive demands of toxic contaminants is the case of Centralia. The kindest observation we can make regarding the role of the local borough council in the mine fire crisis is that it remained non-responsive. The borough is governed by a system that strictly limits the mayor's authority and gives the bulk of what executive power there is to the council. Composed of citizens who volunteer their time and effort, the Borough Council's functions are clearly custodial during normal times. Untrained volunteer leadership may be sufficient for taking care of the everyday business of a small municipality. But when confronted with a crisis that jeopardized the community's health and safety, indeed its very

existence, this form of local government could not be expected to respond effectively to the myriad demands. There was no evidence from the minutes of its meetings that the council exercised any leadership role in the mine fire crisis; given the history of the borough and the custodial nature of the council, this would have been expecting too much. And yet the absence of forceful leadership had serious consequences.

To the extent that routine social arrangements do not give people access to effective roles consistent with their particular appraisals of danger, traditional structures become subordinate to innovative (some would say radical) citizens' activities. Whether they are called "local protest groups" (Clarke 1991) or "social movement organizations" (Cable and Walsh 1991), citizens organize because they experience the communication, leadership and planning functions of the routine community structure as inadequate to the adaptive demands of environmental contamination.

It is reasonable to assume that the emergence of citizens' groups in a town or neighborhood is likely to create new roles, opinions and public occasions, and thus rearrange the social context of those settings. An account of neighborhood responses to water contamination describes "the creation of a 'spatial network', a community group corresponding to the boundaries of contamination" (Edelstein and Wandersman 1987:72). This transformation of the local political organization of a community signals the emergence of an alternative leadership. Suggested in Cable and Walsh's account of the Yellow Creek citizen's fight against city hall (Cable and Walsh 1991) is the idea that emergent groups frequently result in the disassociation of emergent leadership from routine authority. In cases of environmental contamination emergent leadership can be expected to compete with, if not displace, traditional or formal authority. In both Community 2

and Centralia, for example, housewives organized active and effective grassroots groups that challenged local and regional political authorities. They made effective use of the local media, petitioned neighbors to voice their complaints, disrupted public meetings, and consistently called attention to the inability of local government to respond effectively to the contamination. In one case, the animosity between these citizens' groups and local officials became so intense that a fight broke out between several Borough Councilmen and citizen activists.

Intra-community conflict was not confined to battles between citizens' groups and local government; there was also marked hostility between citizens' groups themselves. It is rarely the case that only one group emerges in response to environmental contamination. The variable and largely invisible impact of toxic poisoning insures that different areas and neighborhoods are likely experiencing very divergent levels of stress and social disruption.

Consider the Centralia case:

"Burning eyes, the taste of sulfur, and an acrid odor accompanied by headaches, lassitude, and respiratory troubles were unequivocal evidence for residents on the 'hot side,'...that the gases caused by the fire were circulating in the borough. For residents on the north end ('cold') side of town, however, gas was not 'in the air'" (Kroll-Smith and Couch 1990:44-45).

For some residents the threat of contamination is remote or simply nonexistent. For others, however, contamination is not a remote possibility but an immediate reality. For believers it is no longer a matter of paying attention to warning cues, to signals of danger, for they are already in the impact stage. "In a water pollution case, a woman recalls listening to a

"sixteen-year-old girl tell. . .of her fears that the creek's contaminants would affect her ability to have children. 'I was standing at the door, crying with her, and I thought then, "Lord Jesus, this can't go on!"' (Cable and Walsh 1991). For other residents, however, the problem is not as immediate, perhaps not as severe, and calls for a less volatile and drastic response. A resident of Love Canal recalls spending "a lot of time down in the creek (purportedly contaminated) and I never got any skin rash. . .We've had so much wildlife. . .schools of fish, rabbits" (Fowlkes and Miller 1982:48). Biospheric contamination creates a crisis requiring a choice as to which of several competing experiences of the same world, each of which tacitly claims to have faithfully reflected that world, will be credentialed as the version of the world.

Thus a segment of a neighborhood or a community is now experiencing its environment as the source of disease, adverse generational effects and human loss; their homes are viewed as dangerous and certain areas in their neighborhoods are redefined as life threatening and to be avoided. Groups emerging around a threat belief system talk about the possibility of "suffering," "fear," and "death." With a firm belief in their status as victims of contamination, believers are likely to use the emotionally charged vocabulary of impact to place moral demands on neighbors, friends and others to accept their claims that adverse effects are now occurring and immediate action is necessary. People who define the problem as at worst a warning or perhaps as no problem at all, are likely to begin viewing believers and their emergent groups as threats to property values and valued life-styles, perhaps as threats to the very continuance of the neighborhood or town itself (Cuthbertson and Nigg 1987, Fowlkes and Miller 1982, Kroll-Smith and Couch 1990). Those who do not find in the environmental cues

warrant for extreme concern, are likely to see themselves as victims of a fictive or at best exaggerated crisis.

These variable interpretations of the problem create the conditions for multiple emergent groups. The Centralia mine fire resulted in the formation of seven citizens' groups in a town of fewer than a thousand people (Kroll-Smith and Couch 1990). Three distinct grassroots groups emerged at the Love Canal, each organized around a different perception of the amount and kind of danger by the chemicals (Levine 1982). Similarly, seven local protest groups emerged in the wake of the accident at Three Mile Island (Walsh 1981). Illustrated in Centralia, Middletown and the neighborhoods of the Love Canal is an idea somewhat counter to the romantic notion of traditional sociology that smallness of scale is more effective in political action, joint decision making and communal response to crises. In each of these cases smallness of scale did not prevent the emergence of competing interest groups and rancorous community conflict.

Consider the observation on intramural conflict culled from several studies of human-induced hazards that resulted in contamination of environmental resources. In their study of Love Canal, Fowlkes and Miller found that:

"For the most part. . . families that believe that chemical migration was of limited seriousness do not so much marshal a body of evidence in support of their proposition as they discredit any and all claims that migration (was) widespread. They discredit those claims primarily by categorically discrediting the people who make them" (Fowlkes and Miller 1982:98).

Or consider Kasperson and Pijawka's research on asbestos contamination in Globe, Arizona. They found "that the non-victimized community (developed) sharp resentment against the disaster victims" (Kasperson and Pijawka 1985:16).

Cuthbertson and Nigg agree, arguing that "conflictive, rather than consensual, adaptation develops following a technological disaster" (Cuthbertson and Nigg 1987:468).

Of course, conflict can facilitate the stable growth of society (Coser 1956). For example, in the latter stages of a natural disaster, conflict facilitates the restructuring of society by helping to realign group interests and to decide how power and resources will be distributed in the reconstitution of the community. This type of conflict takes place within a consensual framework, one that is supported by community norms and by the work of the therapeutic groups that emerge during the disaster.

But the type of conflict we find accompanying toxic contamination is very different. It can be expected to disrupt, or perhaps destroy, the traditional patterns of interpersonal relationships and shared understandings that serve to anchor personal life in a social context. This form of disruption or destruction is more insidious and difficult to respond to than the destruction of a town's material culture. It is one thing to rebuild a house; it is quite another to heal the pain and anger that people experience when neighbors become enemies and no one can trust others.

In summary, we suggest that human-made hazards that alter the relationship between communities and biospheres are likely to generate severe social conflict based on contested accounts of both the problem and solution. This conflict is markedly different from the collaborative strategies typical of human responses to natural disasters and is likely to result in the loss of

important community resources, including a basic social consensus, mutual support, and trust.

The Problem of Controllability

So far in this report, we have attempted to demonstrate how toxic hazards result in high levels of psychological stress and social conflict, usually in greater amounts than what accompanies natural calamities in developed countries. Natural disasters are frequently experienced as emotional shocks, but only rarely do they result in long-term social or psychological impairment. The individual and collective trauma of toxic hazards, however, frequently lasts for years. Moreover, instead of being ameliorated by the social processes set in motion by the biophysical events, the social and human problems are typically exacerbated by the group responses. One reason for this is the nature of the issues with which groups are expected to deal in toxic hazard situations.

One of these issues is the problem of controllability. Human activity --- willful, negligent, or otherwise --- is responsible for creating the hazard, and human intervention into the environment is required to abate, extinguish or control it. The often extreme difficulties in detecting and measuring toxic contamination, and in developing and implementing mitigation plans that stop its advance, creates the problem of controllability. And this problem, in turn, is a principle source of psychological and social stress.

Because of the nature of toxic hazards, the official response is less concerned with community relief and rehabilitation, and more intent on mitigating or controlling the hazardous conditions. Since advanced and expensive technological methods are needed to accomplish this, there is an unusually great reliance on state and federal governmental agencies to provide assistance. In Centralia, governments spent over \$5 million between 1962 and

1981 trying to control the fire, but to no avail. The eventual relocation of the community cost the federal government \$42 million. Were the fire to be dug out completely in 1983, the best estimate of the cost was over \$650 million.

Moreover, because the paramount issue is controllability, there is the tendency for the government to define toxic hazards as engineering puzzles rather than human (or social) problems, and to assign to technical agencies the lead role in managing the problem. These agencies are staffed by engineers and other specialists who are used to tackling technological, not human, problems. Because these experts are likely to focus on definitions of situations that call for the skills and authority they possess, the personal, social and economic dimensions of the crisis are likely to be underestimated.

This underestimation of the human toll is reflected in the examples of Centralia, Community 1 and Community 2, which were never officially declared disaster sites. Nor were residents officially responded to as if they were victims. While the community may have been at a loss to collectively define its crisis, there was a consensus among state and federal officials that this was an engineering riddle, not a disaster, and was to be managed by technical, rather than social service, agencies. In Centralia, the federal agency with primary responsibility was initially the Bureau of Mines, and then the Office of Surface Mining; for the state, it was the Department of Environmental Resources. The Pennsylvania Department of Health was pointedly kept out of Centralia until the decision to relocate the community was made; it then did a health study which provided findings to justify the decision to relocate. Ironically, even with the dominance of technical agencies, a final technical solution to the contamination has eluded the specialists and assured that official information regarding the presence, extent and severity of the

hazards was sufficiently vague or contradictory to legitimate (or at least not refute) the competing definitions of the crisis among residents.

Mainly, then, it is state and federal technical agencies which assume responsibility for controlling the hazard. There are three characteristics of these agencies which exacerbate the controllability problem and help to produce the generally ineffective responses which accompany contamination.

First, they are usually remote from the affected community. This is true in terms of geography, culture and power. Spatially distant, with norms, values and world views divergent from those of victim communities, and with relatively enormous (but not unlimited) power, government agencies are unlikely to be sensitive to the needs and desires of the affected communities. They are also liable to be perceived by community residents as uncaring, insensitive, and untrustworthy, thereby generating conflict between themselves and the communities they are mandated to assist.

This point is brought home time and again throughout the Centralia story. And time and again, it is lost on government officials, who cannot explain or accept that their actions are the source of much anger and dissatisfaction. Take, for example, two documents written only a few weeks apart. The first, a memo written by a federal official, reads in part: After 18 years the residents of Centralia are disgusted, frustrated, confused, angry, and exceedingly emotional. Recognizing the volatile nature of this situation, OSM (Office of Surface Mining) has sought to be totally candid with the community. We have made no commitments we couldn't keep and we have met all the commitments we have made; thus our credibility has been established with the people and the elected officials." Evidence to the contrary exists in a letter to the OSM from a state DER official: "Dozens of letters and phone calls to this office seeking technical data and interpretation of the

monitoring programs have evidenced both a lack of communication between the Office of Surface Mining, U.S. Bureau of Mines and the residents, and questionable credibility of the data that is published. Consequently, OSM's credibility is rapidly declining in the area" (quoted in Kroll-Smith and Couch 1990:39-40).

The agencies responsible for controlling technological hazards and disasters are also bureaucratic. While a bureaucracy is governed by written rules, there are few laws and precedents to help agencies deal with toxic contamination. Therefore, the agencies are called upon to innovate, something bureaucracies are not well suited to do. In following procedures designed for use in other types of situations, these agencies are even more prone than usual to be stifled by red tape and internal disagreements.

The Centralia example provides an excellent case in point. Control efforts were often stifled by the lack of mechanisms for providing quick and adequate funding. For example, an early end to the problem was thwarted in 1963 when the state could not find \$160,000 to employ methods with a high probability of extinguishing the fire. \$36,000 was found for lesser efforts, which failed totally. By 1965 estimated costs for permanently containing the fire had grown to \$2.2 million. It took three years to put together a plan to fund the project and to complete its first phase; by then, estimated costs had grown to \$4.5 million. The plan was replaced by a \$500,000 alternative, which also failed. Many other examples could be cited; for example, in 1971, the Bureau of Mines thought it located the actual source of the fire. It offered to dig it out if half of the \$50,000 cost could be found; it could not.

Finally, governmental power is decentralized, with a multitude of agencies at different governmental levels holding legislative responsibility in different policy areas. This decentralization greatly lessens governmental

ability to implement policies effectively. In addition, the policies themselves are frequently unclear and conflicting concerning environmental issues. Given diffused power and authority, and adding to this the considerable expense involved in ameliorating a toxic contamination crisis and aiding the affected population, agencies can be expected to differ among themselves concerning where responsibilities should lie.

Moreover, confronted with a technological problem containing many competing potential solutions, none of them certain, all of them expensive and with a hostile community, the agency response is liable to favor short-term problem management and containment, rather than long-term problem solution. Indeed, a primary agency goal seems to be to minimize political damage to the agency itself and to keep the outlay of public expenditures to a minimum.

All this is not lost on residents of contaminated communities, for whom the government has little credibility and deserves little trust. In the words of one Centralian, "You have experts --- and you put in quotes when I say 'experts' --- that work for the government...they won't tell you what the truth is." His wife added, "This is why people become disinterested. Why should we listen to this story? We heard three others and they were all different. What's going to make the fourth one any better or any truer?"

These characteristics of the responding agencies, along with the fact that their focus is on attempting to control the fire through technical means, led to much hostility and lack of trust of the government by Centralia residents. The Centralia study and work on Love Canal (Kroll-Smith and Couch 1990, Levine 1982) speak of a protracted, seemingly endless period of time between the discovery of the hazard and the realization that its worst consequences are past. Unlike most natural disasters, there is no brief moment of terror, to be followed by an easily defined sequence of inventory,

rescue, remedy, and recovery. Also unlike tornados and hurricanes, government is expected to protect the victims by controlling the environmental hazard itself, something that is extremely difficult, if not impossible, to do.

Given the lack of technical control and the loss of trust in government, toxic hazards tend to trap at least some of the population in extended periods of apprehension and dread. For many Centralians and residents of Community 1, Community 2 and Love Canal, relief from fear came only when they were permanently removed from their homes and towns, a process that took several years.

Before communities are relocated, however, many lose the ability to adequately carry out their social functions. In other words, because of the toxic hazard and its secondary impacts, a town may cease to be a fully functioning social community before it dies as a geographic community. We will conclude this report by briefly considering some ways in which toxic hazards are social disasters.

Toxic Hazards, Social Disasters

In the lexicon of disaster researchers, toxic contamination, underground mine fires and radiation leakages are more often referred to as hazards than disasters. As described throughout this report, such aversive agents usually lack the suddenness of onset and the clearly visible damage that accompany what are generally called disasters. They are ambiguous in scope and impact, and therefore open to multiple interpretations. If the physical characteristics of the disaster agent form the basis of defining that agent as a hazard or a disaster, the hazard designation provides a better fit. There is at least a potential for danger; there is some risk; but there may be little agreement over whether there is enough danger or risk to fear that a physical disaster will ever result.

However, from our perspective, toxic hazards often result in social disasters. The process by which this occurs is described in this report, as are many of the consequences for individuals and the groups to which they belong. But we need to look also at what happens to the community as a whole; it is here that the full extent of the social disaster can be appreciated. We will conclude this report with a brief examination of the effects of toxic hazards at the community level.

Throughout the years, there have been numerous definitions of "community." For our purposes, we use Warren's classic definition of community as "a combination of social units and systems which perform the major social functions having locality-relevance" (Warren 1963). Warren goes on to define those functions as:

1. Production/distribution/consumption. This constitutes the economic dimension of community.
2. Socialization --- the passing on of culture and skills.
3. Social control, or the way in which social order is maintained.
4. Social participation, which is the participation of a community's population in the social life of the community.
5. Mutual support, or how community members help one another.

Of course, not all communities perform all five functions to the same degree or in the same way. As Kreps and Wenger point out, the degree to which a community performs the various functions influences the issues which will produce conflict and who the conflicting people and groups are likely to be (Kreps and Wenger 1973). For example, with regard to toxic contamination, the conflict will differ if an active corporation within the community is the cause of contamination, compared with a situation in which no corporate offender is present. In the former type of situation, blame and

responsibility may be shared between a corporation and government agencies; in the latter, government bears the full brunt.

Regardless of variations, however, the process described in this report generally has a deleterious impact on the ability of a community to fulfill its functions. The structures which normally carry out community tasks are overwhelmed by problems associated with the hazard. Emergent groups come into existence but are neither designed nor usually capable of dealing with community-wide functions. The result is a diminution of the quality of community life in each of the areas which Warren outlines.

1. Toxic hazards can seriously affect the economic functioning of a community. Production activities may be curtailed, as in Centralia, where the underground fire caused the permanent closing of all remaining deep mine operations in the area. Lost jobs, declining property values and increased demands for various services can put tremendous economic strains on communities. In many cases, concern over the safety of consumable products over which the community has some responsibility (e.g., water) exacerbates a community's difficulties.

2. Socialization of culture and skills may be disrupted or altered in various ways. Concern over the safety of schools, for example in Centralia and in Love Canal, disrupted the educating of students and eventually resulted in closure of the schools. The content of socialization may also change --- instead of learning that one's community is a source of pride and social support and that one's home is a safe haven, the community comes to be seen as dysfunctional, a source of enmity and conflict, and one's home as the source of poisoning, not safety. Values concerning people may also change substantially, as is illustrated by the quotation at the beginning of this report.

3. As a community's socialization abilities are disrupted, so are its abilities to control the behavior of its members. Economic difficulties may impede the performance of formal control agents, as, for instance, police in a community may be laid off. More critically, however, is the breakdown of civility between neighbors and one-time friends, resulting in the breaking of various community norms that would have been unthinkable before the hazard situation. In Centralia, these ranged from protest marches, to name-calling and fist fights at public meetings, to telephone threats, tire slashings and a fire bombing, all over issues related to the mine fire.

4. Social participation in communities effected by technological hazards is greatly altered. Participation in traditional community-wide activities and in on-going voluntary associations may decrease, while social participation in hazard-related activities increases. Emergent groups and public meetings command a tremendous amount of time and energy. But given the difficulties of controllability (discussed above), little may be accomplished except to increase frustration and feelings of powerlessness. The intense conflict which characterizes the activities of community groups aids in the destruction of the community's social bonds.

5. Related to this are changes in the nature of mutual support. Community conflict resulting from technological hazards creates enemies where there used to be friends, splitting neighbors and even family members into different hostile camps. Voluntary associations such as churches and fraternal associations, usually relied upon to provide support to members, become split over hazard-related issues. Emergent groups provide an important new source of mutual support for their members, filling part of the void. However, much of the loyalty to an emergent group is based on its differences with other groups, creating an "in-group/out-group" or "we/them" atmosphere in

which community-wide support networks are diminished and are replaced with networks of conflict.

In summary, toxic contamination sets in motion a social process that inhibits the performance of community-wide functions and rips apart the bonds of social support and civility that usually accompany community membership. The myriad of serious demands placed on communities confronting toxic contamination situations overwhelm institutionalized structures (such as local government), creating severe problems within affected communities. The end result is a disaster at the level of the social community, and a disaster for a community is inevitably a disaster for at least most of its members.

Conclusion and Implications

By considering the destructive impacts which are visited on communities which host toxic hazards, we have come full circle in this report in that the loss of a community's ability to function affects its member groups' and individuals' ability to function. People experience stress-related psychological difficulties and problems in self-conception as they try to cope with the fears of a poisoned environment, the stigma associated with contamination, and breakdown in their daily routines. Groups emerge in response to the perceived threats of the hazard, but fight among themselves, often blaming each other for the problems confronting themselves and their communities. Instead of providing a swift, efficient, compassionate response to the problems of an affected community, government response tends to be technically focused, distant, bureaucratic, decentralized, and ineffectual. The usual structures and routines which govern community life are overwhelmed by efforts to control the hazard and deal with its problems, resulting in a breakdown of the social fabric of the community as a whole.

This report highlights several of the important areas of social disruption and personal trauma that are likely to follow the recognition or fear that the local environment is contaminated. It is critical to realize that these problems are not due only to actual contamination, but are caused or exacerbated by the social response to the technological hazard or disaster. In a very real sense, people are victimized twice: once by the toxic agents themselves and once again by the severe disruptions to their community life and emotional well-being. If you contaminate or pollute the natural environment, you contaminate the emotional and social well-being of the people that inhabit that environment.

Our findings have direct relevance for the Yucca Mountain situation. Should the proposed nuclear waste project become a reality, and should a radiation leak take place at the site, we would expect a process such as that described in this report to take place. Such an event would have potentially disastrous consequences for local residents and communities, as well as for the credibility of the Department of Energy and the nuclear energy program.

But the implications of our research go further still. Our case studies, and those done by other researchers, discover that the process described above is liable to take place regardless of the actual level of contamination or of physical damage caused by the contamination. All that is needed is the fear of potential contamination, and a lack of trust in the ability of the responsible institutions to protect the public from harm. That fear is a natural companion to the presence of radiation, and, as illustrated by our case studies, regardless of the best intentions, the nature of governmental response tends to produce mistrust in communities which host technological hazards. Moreover, in the cases we studied, rather than diminishing over time, that mistrust has increased the longer contact between

the government and the communities is maintained. Without the development both of clearly adequate mechanisms to provide for the long-term physical safety of local residents, and of methods for establishing and maintaining trust between residents and government officials, the establishment of a high level nuclear waste repository at Yucca Mountain would be likely to have very deleterious effects on neighboring residents and their communities.

REFERENCES

- Ball, Howard. 1986. Justice Downwind: America's Atomic Testing Program in the 1950s. New York: Oxford University Press.
- Baum, Andrew. 1987. "Toxins, Technology and Natural Disasters." In Cataclysms, Crises and Catastrophes. Edited by G. Van den Bos and B. Bryant. 5-54. Washington: American Psychological Association.
- Baum, Andrew, Raymond Fleming, and Laura M. Davidson. 1983. "Natural Disaster and Technological Catastrophe." Environment and Behavior 15 : 333-354.
- Baum, Andrew, Jerome Singer, and Carlene Baum. 1981. "Stress and the Environment." Journal of Social Issues 37 : 4-35.
- Boehnlein, James K. 1987. "Culture and Society in Posttraumatic Stress Disorder: Implications for Psychotherapy." American Journal of Psychotherapy 41 : 519-530.
- Bolin, Robert. 1985. "Disaster Characteristics and Psychosocial Impacts." In Disasters and Mental Health. Edited by B. J. Sowder. 3-28. Washington, DC: U.S. Department of Health and Human Services, National Institute of Mental Health.
- Brooke, James. 1991. "Chernobyl Said to Affect Health of Thousands in a Soviet Region." New York Times November 3 : 1, 18.
- Cable, Sherry, and Edward Walsh. 1991. "The Emergence of Environmental Protest: Yellow Creek and TMI Compared." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. 113-132. New York: Peter Lang.
- Clarke, Lee. 1991. "The Political Ecology of Local Protest Groups." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. 83-112. New York: Peter Lang.
- Coser, Lewis. 1956. The Functions of Social Conflict. New York: Free Press.

Couch, Stephen R., and J. Stephen Kroll-Smith. 1985. "The Chronic Technical Disaster: Toward a Social Scientific Perspective." Social Science Quarterly 66 (3) : 564-575.

Couch, Stephen R., and Steve Kroll-Smith. 1991. "Alienation and Technological Hazards." Cincinnati: Presented at the Annual Meetings of the American Sociological Association.

Cuthbertson, Beverly H. 1987. "Emotion and Technological Disaster: An Integrative Analysis." Dissertation, Arizona State University.

Cuthbertson, Beverly H., and Joanne M. Nigg. 1987. "Technological Disaster and the Nontherapeutic Community: A Question of True Victimization." Environment and Behavior 19 : 462-483.

Davidson, Laura M., and Andrew Baum. 1991. "Victimization and Self-Blame Following a Technological Disaster." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. New York: Peter Lang.

Edelstein, Michael R. 1988. Contaminated Communities. Boulder, CO: Westview Press.

Edelstein, Michael R. 1991. "Ecological Threats and Spoiled Identities: Radon Gas and Environmental Stigma." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. 205-226. New York: Peter Lang.

Edelstein, Michael R., and Abraham Wandersman. 1987. "Community Dynamics in Coping with Toxic Contaminants." In Neighborhood and Community Environments. Edited by I. Altman and A. Wandersman. 69-112. New York: Plenum.

Erikson, Kai. 1991. "A New Species of Trouble." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. 11-30. New York: Peter Lang.

Fowlkes, Martha R., and Patricia Y. Miller. 1982. Love Canal: The Social Construction of Disaster. Federal Emergency Management Agency.

Fritz, Charles. 1961. "Disasters." In Contemporary Social Problems. Edited by R. K. Merton and R. A. Nisbet. 651-694. New York: Harcourt.

Gibbs, Margaret. 1986. "Psychopathological Consequences of Exposure to Toxins in the Water Supply." In Exposure to Hazardous Substances. Edited by A. H. Lebovits, A. Baum and J. E. Singer. 47-70. Hillsdale, NJ: Lawrence Erlbaum Associates.

Hartsough, Don M. 1985. "Measurement of Psychological Effects of Disaster." In Perspectives on Disaster Recovery. Edited by J. Laube and S. Murphy. 22-61. Norwalk, CT: Appleton-Century-Crofts.

Janoff-Bulman, Ronnie. 1985. "The Aftermath of Victimization: Rebuilding Shattered Assumptions." In Trauma and Its Wake. Edited by C. R. Figley. New York: Brunner-Mazel.

Janoff-Bulman, Ronnie, and I.H. Frieze. 1983. "A Theoretical Perspective for Understanding Reactions to Victimization." Journal of Social Issues 39 : 1-17.

Kasperson, Roger E., and K. David Pijawka. 1985. "Societal Response to Hazards and Major Hazard Events: Comparing Natural and Technological Hazards." Public Administration Review 45 : 7-18.

Kreps, Gary A., and Dennis E. Wenger. 1973. "Toward a Theory of Community Conflict: Factors Influencing the Initiation and Scope of Conflict." Sociological Quarterly 14 : 158-174.

Kroll-Smith, J. Stephen, and Stephen R. Couch. 1987. "The Chronic Technical Disaster, Small Town Conflict and the Social Construction of Threat Beliefs." In The Small City and Regional Community. Edited by R. P. Wolensky and E. J. Miller. 262-269. Stevens Point, WI: Foundation Press.

Kroll-Smith, J. Stephen, and Stephen Robert Couch. 1990. The Real Disaster Is Above Ground: A Mine Fire and Social Conflict. Lexington: University Press of Kentucky.

Kroll-Smith, J. Stephen, and Stephen R. Couch. 1991. "What Is a Disaster? An Ecological-Symbolic Approach to Resolving the Definitional Debate." International Journal of Mass Emergencies and Disasters 9 (3) : 355-366.

Kroll-Smith, J. Stephen, Stephen R. Couch, and Adeline G. Levine. in press. "Technological Hazards and Disasters." In Handbook on Environmental Sociology. Edited by R. A. Dunlap and W. Michelson. Westport, CT: Greenwood.

Kroll-Smith, J. Stephen, John P. Wilson, and Stephen R. Couch. 1989. "Psychosocial Impacts of Exposure to Industrial Pollution: The Disaster at Brookhurst." Jackson, WY: Report prepared for Spence, Moriarity and Schuster.

Kunreuther, Howard, and Paul Slovic. 1988. "Potential Impacts of the Yucca Mountain Repository on Convention Planning and Tourism in Las Vegas and the State of Nevada." San Francisco: Presented at the Annual Meetings of the American Association for the Advancement of Science.

Lang, Kurt, and Gladys Engel Lang. 1964. "Collective Responses to the Threat of Disaster." In The Threat of Impending Disaster. Edited by G. H. Grosser, H. Wechsler and M. Greenblatt. 58-75. Cambridge, MA: MIT Press.

Laufer, R., E. Brett, and M. Gallops. 1984. "Post-Traumatic Stress Disorder Reconsidered: PTSD Among Vietnam Veterans." In Post Traumatic Stress Disorder. Edited by B. Van der Kolk. Washington: American Psychiatric Press.

Levine, Adeline G. 1982. Love Canal: Science, Politics and People. Lexington, MA: Lexington Books.

Markowitz, Jeffrey S., and Elaine M. Gutterman. 1986. "Predictors of Psychological Stress in the Community Following Two Toxic Chemical Incidents." In Advances in Environmental Psychology. Edited by A. H. Lebovits, A. Baum and J. E. Singer. 89-107. Hillsdale, NJ: Lawrence Erlbaum Associates.

Mileti, Dennis S., Thomas E. Drabek, and J. Eugene Haas. 1975. Human Systems in Extreme Environments: A Sociological Perspective. Boulder, CO: Institute of Behavioral Science, University of Colorado.

Mirowsky, John, and Catherine E. Ross. 1989. Social Causes of Psychological Distress. New York: Aldine de Gruyter.

Schorr, John K., Raymond Goldsteen, and Cynthia H. Cortes. 1982. "The Long-Term Impact of a Man-Made Disaster: A Sociological Examination of a Small Town in the Aftermath of the Three Mile Island Nuclear Reactor Accident." Mexico City: Presented at the Tenth World Congress of Sociology.

Smith, Elizabeth, Carol S. North, and Paul C. Price. 1986. "Responses to Technological Accidents." In Mental Health Response to Mass Emergencies. Edited by M. Lystad. 52-95. New York: Brunner/Mazel.

Stone, Russell A., and Adeline G. Levine. 1985. "Reactions to Collective Stress: Correlates of Active Citizen Participation at Love Canal." Prevention in Human Services 4 : 153-177.

Vidich, A.J. 1980. "The Theodicy of Man-made Hazards." ARC Newsletter : 3.

Vyner, Henry. 1988. Invisible Trauma. Lexington, MA: Lexington Books.

Walsh, Edward. 1981. "Resource Mobilization and Citizen Protest in Communities around Three Mile Island." Social Problems 29 : 1-21.

Warren, Roland. 1963. The Community in America. Chicago: Rand McNally.

Weisaeth, Lars. 1991. "Psychosocial Reactions in Norway to Nuclear Fallout from the Chernobyl Disaster." In Communities At Risk. Edited by S. R. Couch and J. S. Kroll-Smith. New York: Peter Lang.

**MITIGATING ENVIRONMENTAL STIGMA AND LOSS OF TRUST
IN THE SITING OF HAZARDOUS FACILITIES**

BY

MICHAEL R. EDELSTEIN

MITIGATING ENVIRONMENTAL STIGMA AND LOSS OF TRUST IN THE SITING OF HAZARDOUS FACILITIES

Michael R. Edelstein, Ph.D.¹

INTRODUCTION

Contaminated communities may be defined around the perceived boundaries or "risk shadows" of a discovered contamination or proposed hazardous facility (Edelstein, 1989a; Stoffle, et. al., 1991). In either case, the events surrounding contamination (or the imposed threat of contamination through hazardous facility siting), rather than contamination per se, cause the predominant stresses in contaminated communities. These events take their meaning in light of the "eco-historical context" of the community. This context is useful for understanding both the extent to which the facility serves as a cause for environmental stigma and the atmosphere of trust or distrust that surrounds the facility plan and lifecycle. Such an understanding can be used to explain outcomes of stigma and distrust or to project into the future scenarios related to these effects.

In this paper, the constructs of trust and environmental stigma are analyzed and the potential for their mitigation is assessed. Three case studies are briefly reviewed for their potential relevance to theory affecting hazardous waste siting. The first case study, involving the potential psychosocial impacts of the proposed sixth CECOS hazardous waste site in Niagara Falls, New York, illustrates how environmental stigma and distrust are embedded in a community's eco-historical context. An important issue in this case study was the prospect for mitigating such impacts. Further understanding of the problems involved in mitigating environmental stigma and distrust are explored through two additional case studies, involving so-called "sanitary landfill" facilities in the states of New York and Washington. Before examining the cases, we will introduce the key constructs of our analysis.

THE ECO-HISTORICAL CONTEXT

Community history shapes the perception of ongoing events in a very particularistic manner, much as childhood history influences the individual. Such history involves the individuals and social groups and institutions of the community, as well as the changing and stable characteristics of the local environment. Varied landscapes may express different eco-

historical relationships, giving rise to a social tolerance for change that threatens the "image" of community (Edelstein, 1988a and b). Because the image of the community is vulnerable to environmental stigma, defense of the community identity is frequently encountered in hazardous facility siting. Furthermore we can look to the eco-historical context for roots of trust and distrust in the facility.

ENVIRONMENTAL STIGMA

Stigma is a process of changing in a negative way or discrediting the perception of a victim "marked" by some observable characteristic such as a noticeable deviance, a flaw or limitation, a sign of being spoiled or some other undesirable characteristic (Jones et. al., 1984, p. 6; Goffman, 1963). Paralleling social stigma, the author has described a process of attribution and perception termed "environmental stigma." Environmental stigma involves the discrediting of settings, places, objects, nonhuman lifeforms and surroundings, as well as individuals, families and communities associated with these environments (Edelstein, 1991, 1989b, 1988a, 1987, 1984).

ELEMENTS OF ENVIRONMENTAL STIGMA

The five key elements of environmental stigma are the image or identity threatened, a potentially stigmatizing occurrence, the visibility of the stigma, the evaluation of the stigma and the response to the stigma.

Identity and Stigma

Environmental stigma requires as a prerequisite that there exists some identity---a construction of meaning attaching person to environment---that is subsequently devalued after a stigmatizing occurrence, discovery or announcement. Examples of potentially affected place identities are the special meanings and qualities of a particular setting, the residential expectations held by homeowners in a particular neighborhood and the image of a community, as shared by its members and/or projected by its boosters. With environmental stigma, the threat is not only to an individual's self concept or to a group's identity, but rather persons and groups are additionally devalued as a secondary outcome of a changed view of place.

Because places reflect identity (Heider, 1963), information about environments may influence judgments about people associated with the environments (see Ichheiser, 1949, Goffman, 1959). In this sense, environmental stigma may smear one's identity merely by association, or what Goffman (1963) termed a "courtesy stigma" (see Edelstein, 1987). In the context of the Nevada high level nuclear waste repository, the potential for

adverse courtesy stigma impacts has been demonstrated by several recent studies (Easterling and Kunreuther, 1990a; Slovic, et al., 1990a,b,c).

A Potentially Stigmatizing Occurrence

Environmental stigma assumes that some devaluing characteristic pertains to objects or the setting, serving as the basis for stigma. This characteristic may be an inherent property of the environment, but often there is a potentially stigmatizing occurrence---some change that, if recognized, will be demeaning. In cases of toxic contamination, for example, the release of an organic chemical into the groundwater is only potentially stigmatizing. The stigma awaits the discovery and announcement of the contamination.

Unlike past contamination, waiting to be discovered, environmental stigma can also accompany the expectation of future contamination (see Edelstein, 1988a). Such anticipatory fears are closely related to stigma because the belief that potential contamination is an inherent property of a facility means that stigma is likely to precede any actual contamination or discovery of contamination. This point was made by the author, for example, in his initial analysis of psychosocial impacts to be expected from the proposed high level nuclear waste site in Richton, Mississippi.

The region becomes marked due to the potential for, rather than the actuality of, contamination. Because contamination often is not discovered at the time of occurrence, this stigma may be very similar to the stigma which would accompany an identified leak of radioactive materials. Rather than being innocent until proven guilty, the facility is marked because it will, in the perceptions of the public, undoubtedly be guilty sometime in the future (Edelstein, 1985, p.7).

Visibility and Stigma

Because the presence of environmental contaminants frequently is imperceptible to human sensory systems, there is frequently a lag time between their release to the environment and their discovery (see also Vyner, 1987; Edelstein, 1988a). For stigma to accompany such invisible phenomena, something must make them visible to affected victims, concerned government agents and to the general public. On one hand, visibility is created through direct manifestations of contamination, such as dead animals, sightings of leachate, physical health symptoms including identified cancer clusters, buildings abandoned due to contamination, fences surrounding hazardous sites, warning signs, stacked barrels, etc. Perhaps even more essential to visibility are communications about the contamination that give it personal

meaning, including media coverage, community meetings, letters from officials and the voiced concerns passed along through social contacts. Such information not only makes the contamination visible but it also makes it more likely that it will be seen.

Bounding of the contamination to create a cognitive map of the affected areas is often a primary step in "marking" a contamination case, and may even be requisite for environmental stigma. As boundaries are created around an area identified as contaminated, the area encapsulated is marked for stigma. Immediately adjacent areas may also be stigmatized because they are located at the margins of risk.

Evaluating the Mark's Significance

The observer of a mark relies on several criteria for evaluating the stigma (Jones et. al., 1984; Edelstein, 1984). The more disruptive and unaesthetic the condition, the more it is stigmatizing.

If a mark cannot be concealed, then it is all the more likely to cause stigma. The revealing of a concealed stigma may have negative effects upon trust. When the damaging attribute was formerly concealed and appearances were normal, stigma may be further complicated by a sense of deceit and danger expressed by those who learn that they had been previously fooled into thinking that their environment was safe (see Jones et. al., 1984). Such effects are particularly instructive for Department of Energy and other U.S. nuclear projects, where recent disclosures of environmental and health problems contradict previous promises of safety. Such contradictions obviously affect the perceptions of those in the affected areas, but they are also not lost on outsiders who rely on such reports in determining how much to trust agency promises if the agency ever approaches their own community (see Easterling and Kunreuther, 1990b).

Ironically, special concerns arise when a concealed stigma is exposed. The visibility of an invisible contaminant contravenes the notion of "cleaning up" the environment. Once invisibly contaminated, it is impossible for a site to be visibly cleaned. Thus, the stigma from contamination lingers. As the author noted in describing the unwillingness of former customers to continue to using a brand of bottled homogenized milk after disclosures of PCB contamination,

the characteristics of (this brand of) milk that caused people to be pleased with it previously were now overshadowed by this one new factor. Effectively, the milk now tasted differently, even if in fact there was no measurable change in its actual taste (Edelstein, 1984, p.20).

The prognosis or course of the mark also influences the stigma. In chemical or radioactive pollution cases, it is frequent for "clean up" to be pushed far into the future. It may take years to restore basic services such as potable tapwater. Health effects to exposed people are rarely clear; yet dreaded diseases such as cancer may be in the offing. And, because the actual outcomes are so clouded in uncertainty, the beliefs of various actors in an invisible contaminant incident about the impacts of the incident become very important (see Edelstein, 1988a; Vyner, 1987; Jones et. al., 1984; Fowlkes and Miller, 1982). With high level nuclear wastes, problems of prognosis are pushed beyond the limit of imagination.

Risk is closely associated with stigma. The message of environmental stigma is that there is some lurking threat or danger associated with the stigmatized environment; therefore, stigma is closely related to fear (Edelstein, 1988a; Jones et. al., 1984). The author argues, for example, that anticipatory fears bring into the present apprehensions regarding future occurrences. In the wake of disclosures about toxic contamination, victims may fear latent disease, genetic effects, and so forth. Anticipatory fears also occur with regard to proposed projects that promise an unwanted effect sometime in the future. It is important to stress that potentially hazardous facilities--particularly waste disposal sites that are places for the disposal of that which no one else wants anywhere else--are not only inherently stigmatized because of the risks that they entail, but they are inherently stigmatizing for these same reasons (see Edelstein, 1988a).

The origin of the contamination may also influence the stigma. Possibly the most significant psychological factor in most toxic contamination cases is the fact that the harm is not naturally occurring (see Edelstein, 1988; Couch and Kroll-Smith, 1985; Baum et. al., 1983). Instead, humans are directly responsible--either by neglect, greed or illegal activity. As a result, victims not only experience uncertainty about the health implications of their exposure, but they also feel victimized by the perpetrators. Their tragedy is not truly "accidental". Rather than focusing energies on coping with the actual disruptions of the incident, victims must additionally grapple with the psychological burden of blaming--blaming the polluter, blaming government for inadequate prevention and inadequate helping response, blaming others for not being supportive and self blame for lack of foresight.

Response to the Stigma

Responses to contamination may, themselves, be stigmatizing. Environmental stigma may affect perceptions of the desirability, safety or attractiveness of settings that in turn affect people. For example, a major outcome of toxic exposure or hazardous waste

siting appears to be a loss of property values, demand for homes in the affected area, and ability to acquire a mortgage for stigmatized homes (Edelstein, 1988a; also Baker, 1988). Morrell and Magorian (1982), in discussing the economic impacts of a hazardous facility, suggest that serious environmental problems will cause property to plummet in value. However, they suggest that in the absence of such releases, the tax benefits of the facility may actually lower property values. In contrast, Rosenman, Fort and Budd (undated) argue that hazardous facilities create an atmosphere of uncertainty that itself destabilizes property prices. Beyond impacts on property value and real estate demand, devaluing of food products produced in the area and lessened tourism are similar effects.

Often, stigma is directly related to fear of environmental hazards and their health consequences. At other times, stigma emerges as an independent area of impact; even when there is little actual fear of harm, per se, there may be great concern over potential stigma itself (see Edelstein 1991). Fear of stigma may itself operate to influence response to siting a hazardous waste facility. Morrell and Magorian (1982) cite the case of Bob's Home Service in Missouri. Nearby residents were afraid to oppose the facility for fear that adverse publicity would diminish their property values. In the author's own work on the impacts of the proposed high level nuclear waste facility at Hanford, Washington, a similar fear of stigma was found to be the source of major social pressure against anti-Hanford activism.

ENVIRONMENTAL STIGMA AND HAZARDOUS WASTE SITING

As has already been established, environmental stigma is a major factor in opposition to hazardous waste facilities. Environmental stigma results from the devaluing of place that results from its being "marked" as a potential or actual hazardous waste site.

The Siting Process

Because disclosure is the essence of stigma, the siting process itself becomes an important contributor to environmental stigma. No longer do waste sites appear quietly, with little fan fare. Even where the finished site will have a low profile or be essentially out-of-sight, the review process helps to ensure that the facility will not be out-of-mind. How does this occur?

First, the siting process publicizes the issue. The goal of public participation makes it necessary to alert the public to the proposal. Media selectively amplifies the issue further. Public meetings make the project tangible. Community and environmental organizations and municipal officials may also contribute to what is known about the proposal. As a result, risk

factors associated with the facility are recognized, often in the context of uncertainty. The public recognizes the absolute risk associated with the proposal, while experts and regulators often concern themselves with the relative risk. As a partial result, there are frequently differences regarding the question of acceptable risk.

The essential point is that the siting process sends a message to the public that the facility is undesirable and unwanted.

Insult and Outrage

In hazardous waste facility siting, a government agency generally acts for the broader public (outsiders who are spared the facility in their communities) by deciding on some local interests to be sacrificed for the larger good. Thus, to be chosen in such a siting review is to be designated as a "loser." Justifications for the siting posit that this place and those residing therein deserve to be chosen. Environmental stigma, thus, involves actual insult as well as potential injury. Frequently, victims of the process view it as unfair and react against perceived inequity and injustice. Ironically, local opposition to the siting may increase this stigma effect by helping to make visible that the siting selection has spoiled or threatens to spoil the community. Opponents are usually labeled as anti-social "NIMBY's", and thus blamed for causing the very social problems that made the siting necessary to begin with. Opposition also adds to stigma because it signals that residents concur that the facility is stigmatizing. However, the option of not opposing the facility is, ironically, also stigmatizing. Acceptance of that which others reject is to take on a lower social status and a recognition of weakness. In sum, siting selection impugns the character of the selected community no matter what their response.

Finally, whether a siting effort is successful or not, once stigmatized, a site may acquire "perpetual jeopardy" because it has acquired an identity as suitable for other hazardous projects. Stigmatized settings and communities may find themselves attracting multiple undesirable projects because their status as tainted makes them vulnerable---they are after all, already spoiled (see Edelstein, 1985).

DISTRUST

Our discussion of environmental stigma has already subsumed much of what might be said about distrust, since distrust is a direct cause and consequence of stigma. A stigmatized environment is a distrusted environment. While distrust may be parceled out to individuals, stigma involves a class bias. In this sense,

stigma is a categorical distrust. Like stigma, trust is generally seen as a social condition, involving the relationships between people. Although distrust of the environment is an important issue, for our purposes, we will view distrust as a dynamic situational attribute. Despite its situationality, it is the nature of distrust that experience biases the next encounter. Thus, as trust and distrust grow and sometimes invert over the course of a relationship, situational attributes become reified as dispositions. We can, therefore, speak of how distrusting a person tends to be or how much a person deserves to be trusted.

Distrust involves feelings of unacceptable vulnerability within a relationship. One becomes vulnerable in several ways: by disclosing information about oneself, by placing one's safety in the hands of another, by physical proximity to another. While such vulnerability is important to the development of a trusting relationship, with distrust, one seeks to limit vulnerability by not disclosing, not placing one's safety in the other's hands, not getting close, and so forth.

Distrust is continually found with contamination events (Edelstein, 1988a; Finsterbusch, 1987; Goldsteen and Schorr, 1991). As a human-caused phenomenon, contamination from hazardous materials inherently forces victims to seek an explanation for what has occurred. As they ponder why the disaster was made to or allowed to happen, they question whether government, industry or others had the ability to cause or prevent the exposure and whether they attempted or intended to do so. These questions make issues of trust and distrust central to the experience of a contamination event.

Likewise, as efforts to cope with the contamination event are made over time, the victims' trust in their social and institutional support systems is tested again and again. The person beset with a toxic threat "reads" the social environment and assigns various expectations to different actors. Failure to meet expectations of help and support leads to disappointment and can erase prior assumptions of trust and create distrust.

The siting of potentially hazardous facilities also raises inherent questions of trust because there is frequently outrage over the choice of the community as a site. After all, it is hard to trust someone's rationale for selecting you to have your life disrupted and to be put at risk. Since selection is, in itself, a form of stigmatization, those behind the siting are seen as not only stigmatizing the community, but seeing the community as stigmatized.

DISTRUST AND THE GULF BETWEEN INSIDERS AND OUTSIDERS

With contamination, distrust must also be understood as a

mutually unsupportive relationship between insiders and outsiders. Invariably, contamination is understood by those who share the experience and ill-understood by others. This lack of understanding makes it easy for those outside the situation to violate trust simply because they don't know how to respond to contamination victims, and they tend to disconfirm and reject victims' perceptions and experience. Their normal mindset is so different than the new contaminated mindset held by victims that relationships are disrupted because of the difference in perspectives, because there isn't an understanding of why the victims have changed from their prior normal mindset and because victims tend to be needy in a new and baffling way. Even intimate outsiders often misjudge the situation so as to blame the victims, a stigma response that causes distrust. They may also stigmatize the victims, seeing them as devalued or tainted by their exposure. They may also discount, rationalize or deny outright the exposure itself or the ramifications of the exposure and the exposure event. The separate realities of the exposed and outsiders invites a gulf of distrust between victims and their former social support systems. Residents of contaminated communities become distrusting, in part, because the stigma causes them to become disassociated from the assumptions of the larger community, leading them to become more critical and cynical and, as a result, less trusting.

GOVERNMENT AS A TARGET FOR DISTRUST

Government is frequently the target of distrust because it was involved in causing the contamination and/or it failed to prevent it (Edelstein, 1988a; also, Edelstein, 1986/87). Once caused, government is frequently the messenger disclosing the exposure and counseling "victims" on how they need respond. This guidance role is likely to continue over time. Government is judged according to how well it manages this response to the contamination. Several criteria for evaluation are likely.

Informational Trust/Distrust.

Depending upon the situation, there may be a high dependence upon government for information that clarifies uncertainty and explains what is not understood. Untruths and detectable distortions, contradictions and disconfirmations, unclarity, inappropriate and inauthentic communications all are perceived as invalid and invite distrust.

Provision of Support and Help

There may also be a high dependence upon government for support and assistance---both emotional and functional. Failure to provide the support that is expected, deserved and often promised invites distrust.

Disabling or Enabling

Finally, government is either expected to act on behalf of the victim or to return sufficient control and empowerment to enable them to act on their own behalf. On the unfamiliar contaminated turf, it is easy for people to become disabled as they give themselves over to those with expertise. The state of dependency is stressful in its own right, but when it is perceived that the caretaker is incompetent or unmotivated, then such disability is all the more alarming. Furthermore, when people are denied a voice on issues that they feel they can speak to, or are denied control because information is not shared, then their disability is no longer seen as due to the contamination but rather due to the closed governmental process. The imposition of this disability, rather like an innocent person being handcuffed, results in an outrage that is not incited by true dependence (see also Edelstein, 1986/87).

Inherent Stress in the Situation

Just as citizens are caught in a literal double bind--wherein every reason they might make is wrong--by the circumstances of a contamination event, so are officials often caught in their own bind, whereby nothing they do is sufficient. The chances of tripping up are enhanced by the large number of unknowns inherent in such events. In this ambiguous environment, officials are expected to define the situation from the onset, to explain risks and circumstances and to develop strategies. To know the answers to citizens' questions. Neither the minimization nor exaggeration of issues engenders trust in the situation. And even if the officials have a good tolerance for the ambiguity, citizens may not. A great deal of patience and skilled communication is required if distrust is to be avoided.

Regulatory Binds

There are also situational factors that can erode trust of government. Different agencies and levels of government may disagree over the correct course of action in a given situation. Controversy and conflict may occur between citizen oversight groups or independent experts and government policy makers. Constraints exist in the type of help that government can offer, but such boundaries around the regulatory environment are often invisible and ill-understood by the public. Government officials are almost always outsiders to the situation and, therefore, are usually not sufficiently sympathetic to the psychosocial and hazard concerns.

Shared Values and Beliefs

Dispositional differences also exist between government

agencies and the public. For example, agencies tend to be technocratic, treating problems in the language of science and engineering, but poorly versed in the language of people. Accordingly, agencies hold a different paradigm of risk than do citizens and interpret the acceptability of situations differently.

Blaming of Victims

When victims are blamed for causing their own misfortune, the act of blaming is itself a form of distrust. Naturally, victims tend to distrust, in return, those who blame them. The process of blaming and victimization itself upsets the victims' belief in a just world (Lerner, 1980; Ryan, 1971). The loss of the presumption that one is treated as one deserves to be involves a general loss of social trust as well as distrust of the specific sources of blame.

A subtle form of blaming the victim occurs when government fails to act on available evidence, and the burden of proof is shifted to the victim. Shifts of responsibility also occur when government is blocked from taking action by a lack of jurisdiction, resources or personnel. The course of such shifting of responsibility tends to view the victims' plight as a private problem, not deserving or demanding government action.

COMPETENCE AND FIDUCIARY RESPONSIBILITY

Goldsteen and Schorr (1991) cite evidence on the community impacts of the Three Mile Island accident to support the importance of government fulfilling two further aspects of a trust relationship with the public. First, government is expected to have the technical competence and expertise to make correct decisions. Second, government is expected to have a fiduciary responsibility---it has the moral obligation to act on the public's behalf.

Both of these factors influence the tendency to blame government for contamination problems. Even when government is not blamed for causing the contamination, it is frequently blamed both for inadequate prevention and inadequate response (Edelstein, 1988a). Trusting government becomes even harder when government itself sponsors the hazardous project. The belief that government will not fulfill the duties assigned to it has been found to be the major contribution to expressions of concern about controversial technologies and a major factor requiring efforts at mitigation. Such "recreancy" not only adds a burden of distrust, but it suggests that distrust is itself a cause of stigma (Freudenburg, 1991).

DISTRUST AND BROKEN PROMISES

The issue of broken promises is a central reason for distrust (see Easterling and Kunreuther, 1990b; Goldstein and Schorr, 1991). In many ways, contamination involves the breaking of promises and the violation of expectations. Industry operates on an implicit---and sometimes explicit---promise that its activities will not harm the public. Government promises to enforce environmental laws and regulations. It is expected that, when in need, government will come to the rescue. Such promises are often formalized in permits that set forth the conditions for operating a facility. In accepting the permit conditions, the applicant promises to follow them. In issuing the permit, government promises to protect the environment and public by enforcing the permit rather than trusting the applicant. The public is to trust the operator/regulator relationship to establish a level of safe operation for the facility. When such promises are broken, it is difficult to reestablish faith. Promises associated with the safety of the site over time (e.g., "it will be safe," "it won't leak," "it will be carefully monitored," etc.) require believability that has as its requisite trust of those making the promises. Such promises may be rejected if they are seen as implausible or unrealistic, if they are contradicted by beliefs or information, or if the character of those making the promises has been impuned (itself a stigma). Once a facility is sited, its performance represents an ongoing test of such promises.

MITIGATION

The concept of mitigation was given formal meaning in environmental matters by the National Environmental Policy Act of 1969. As elaborated in Section 1508.20 of its implementing regulations issued by the Council of Environmental Quality (1986), mitigation refers to steps taken with regard to a proposed project toward:

- (a) Avoiding the adverse impact altogether by not taking a certain action or parts of an action.
- (b) Minimizing impacts by limiting the degree of magnitude of the action and its implementation.
- (c) Rectifying the impact by repairing, rehabilitating or restoring the affected environment.
- (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
- (e) Compensating for the impact by replacing or providing substitute resources or environments (p.30).

As part of NEPA's policy to "use all practicable means...to restore and enhance the quality of the human environment and

avoid or minimize any possible adverse effects..." (1500.10(f), p.3), the regulations require that environmental impact statements done for projects having potentially significant adverse environmental effects must discuss mitigations during reviews of alternatives to and environmental consequences of the project [1502.14 and 1502.16(h)]. Finally, in its record of decision, the lead agency for the project is required to

state whether all practicable means to avoid or minimize environmental harm from the alternatives selected have been adopted, and, if not, why not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation. [1505.2(c); p.20]

The lead agency is to monitor and enforce required mitigations and report to interested agencies and the public upon request [1502.3].

Wlodarczyk (1990) stresses an alternative "planning" approach to mitigation developed in Ontario. Under this approach, mitigation serves the fourfold functions of planning (examination of adequate alternatives), enhancement (changes to enhance benefits), prevention (changes to the design of the facility, the site layout or facility operations to prevent problems) and reaction (contingency plans in case of problems). He stresses that compensation is not a form of mitigation. Rather, the two have an inverse relationship whereby only effects not preventable by mitigation should be compensated for.

While NEPA does not have jurisdiction over many projects involving potential environmental hazards, the concept of mitigation has diffused throughout project review activities in the United States and is used widely. However, rather than the critical and accountable approach foreseen by Congress and the CEQ, an optimistic bias exists with regard to mitigation, whereby it is assumed that adverse impacts can be erased or reduced through technological or operational changes to the project. As a "bureaucratic fix", mitigations thus serve as a means for rationalizing the issuance of permits for projects that would otherwise need to be rejected. Yet, the authenticity of mitigations depends upon the effectiveness of monitoring and enforcement activities. If these are weak, mitigations may exist only on paper.

Bogard (1990) further develops this principal problem with the concept of mitigation in his analysis of the Bhopal disaster. He notes that, in practice, the presence of a mitigation is assumed to remove a hazard. However, in reality, a mitigation is merely a restatement of the hazard. By definition, should the mitigation not occur, the hazard will return.

...hazard" and "mitigation" are, in the final analysis, interchangeable terms, and ... the same "objective" condition (event/object/action/location/time) can be fully described and analyzed under either (or both) labels, depending upon whose perspective one chooses to adopt. Simply stated, at their level of possible description, all hazards are mitigations, and all mitigations are hazards. All hazards carry the potential to be redefined as mitigations and all mitigations---actions to reduce the potentially disruptive consequences of hazards---are themselves capable of being redefined as hazards (pp.49-51).

Hazardous facility siting is accomplished, accordingly, by the systematic restatement of hazards as mitigations. For example, landfill leachate---a hazard---becomes a leachate collection system---a mitigation. Thus, sanitized, such hazards become acceptable.

Given the lack of systematic monitoring studies on psychosocial impact issues, the effectiveness of mitigations is assumptive in any case. But what are the effects of mitigation in such instances? Where distrust and environmental stigma are documented, can it be concluded at this time that known approaches to mitigation will, in fact, diminish or remove adverse impacts? The following three case studies do not definitively answer this question. But they may help to constructively muddy the waters.

CASE STUDIES

In this section, several case studies are reviewed. Each case involved documented distrust and environmental stigma. Two of the cases specifically involve attempts to mitigate these issues.

CASE 1: THE APPLICATION OF CECOS FOR A PERMIT TO EXPAND ITS NIAGARA FALLS, NEW YORK HAZARDOUS-WASTE DISPOSAL FACILITY

The CECOS case study is interesting in light of the Yucca Mountain context because it involves a projective study of effects from a planned hazardous waste site where the actual impacts of an existing site could be evaluated as a basis for analysis. Because the neighborhoods in question had long term experience with hazardous waste dumping and because issues of trust and stigma were well established, the study is able to examine the question, "What is the importance of community history?" This question is of particular interest because the high level nuclear waste site's extraordinary life projections suggest that---even were it established in an area with no

relevant history--that the history created from the onset of initial site selection and characterization will have lasting effects upon future perceptions of the facility. In this context, the CECOS case is useful for considering whether trust and stigma problems can be mitigated over time.

Background

The CECOS waste disposal complex is located on the eastern boundary of the City of Niagara Falls, New York, lying largely in the Town of Niagara. To the west is a large industrial belt. Also bounding the site are commercial strips, major roads and highways, and several residential areas, housing thousands of people. Nearing completion of its fifth hazardous waste landfill in 1985, CECOS, a division of Browning Ferris, Inc., applied to the New York State Department of Environmental Conservation (DEC) for permission to build a sixth facility at the site, to be called the Secure Chemical Residue Facility (SCRF #6). The SCRF#6 proposal, unlike applications for the previous waste disposal sites at the CECOS complex, was met with virtually unanimous opposition from local governments and citizen groups.

Prior to the start of permit hearings before an administrative law judge (ALJ), the New York State legislature mandated in 1987 that hazardous waste sites also be approved by a special siting board consisting of three local citizens from the candidate site area and representatives of five state departmental commissioners. Through an interim decision of this siting board, citizen intervenors were successful in establishing as an issue for adjudication the psychological impacts of SCRF #6. The author was retained to prepare testimony on this issue in behalf of the citizen intervenors. In September 1988, three separate but convergent studies were conducted in order to estimate psychological impacts of the SCRF #6 project.

First, a review of CECOS media coverage was made utilizing a file of several hundred newspaper articles about CECOS from 1985 to 1988 by two independent area newspapers. Additionally, project documents, census data and government files were reviewed. This documentary evidence served as the basis for a chronology of events, a source of confirmatory information and a means for assessing the degree that media may have affected public perceptions of CECOS and the SCRF #6 application.

Second, six focused group interviews were conducted with a total of 30 community members in order to obtain an in-depth understanding of the ways that the existing CECOS operations were affecting area residents and to explore any concerns that they had regarding the SCRF #6 application. The interviews were held at the 66th Street School, located within view of the CECOS site. Five of the interviews involved a sample of residents from nearby

the CECOS site, recruited mostly through random phone calls. A sixth group involved key informants, leaders or active members of the intervening citizens groups. The sample involved a cross section of the community in terms of activism and concern, employment, income, location, age and sex. Dr. J. Stephen Kroll-Smith, then of Penn State University, assisted the author in conducting these interviews.

Third, a survey research firm was retained to conduct telephone interviews using a 35-item survey instrument drafted by the author. The survey utilized a 10 percent sample of 280 respondents randomly drawn from reverse telephone directories listing 2,800 residents in three target neighborhoods. These neighborhoods were the large, single-family blue collar LaSalle area south of CECOS, a trailer park called Sabre Park tucked into the southeast edge of the CECOS site, and a middle-class, single family home section on Third Avenue, located to the east of CECOS. These neighborhoods were downwind and proximate to CECOS and were the source of frequent past community complaints about the existing CECOS facilities. Demographically, the survey results suggest the following profile for the area. More than 80% of the residents in the target area were homeowners. Only about 40% had children under 18 years of age living with the family. Only about half the residents reported household income over \$25,000. Just under 20% recorded at least one family member working for a company that generates or disposes of hazardous waste. Nearly a quarter of the respondents had formerly lived in the Love Canal neighborhood, a quarter of whom reported moving because of the Love Canal incident.

Findings and Discussion

Table 1 summarizes overall findings from the survey. Relevant portions of these findings will be combined with results from the interviews and media review in order to consider four aspects of the CECOS case that are particularly germane to this analysis: the eco-historical context, trust, environmental stigma and potential for mitigating psychological impacts. But first, an overview of the findings may be in order.

The survey confirmed documentary and interview findings that suggested that a virtual consensus had formed in the Niagara Falls area opposing SCRF#6. Residents were aware and knowledgeable about CECOS. However, rather than lessening apprehensions, knowledge of CECOS appeared to amplify concerns about the complex. Residents reported direct effects from the facility--such as odors--that disrupted their lifestyle. They also reported concerns about potential long term health and environmental effects related to the facility. The facility was seen as a negative detractant from the community. It was also a major source of personal stress.

SUMMARY OF SURVEY FINDINGS REGARDING THE SCRF#6 EXPANSION

Community Response to the CECOS Expansion:

---90% of the respondents were aware of CECOS and could correctly identify the function of the site, namely hazardous and toxic waste disposal;

---88% of the respondents opposed SCRF6 and only 6% favored it;

---93% of the respondents indicated their relatively greater concern about CECOS in comparison to other concerns in their lives, 63% claiming to be very concerned about CECOS.

Perceived Past Impacts from CECOS:

---12% of the respondents indicated that they or members of their family had already been affected by the hazardous waste operations at CECOS; another 13% were unsure. The primary direct impacts reported involved odors. Factors such as blowing dust, traffic impacts and noise were also noted. Several respondents also mentioned worry and health-related effects from the facility. It was notable that only one impact mentioned was positive---the employment of one of the respondents at CECOS;

---15% of the respondents believed that CECOS had already affected their own and their families' health and 31% were unsure;

---more than half the respondents agreed that their neighborhood has been "adversely affected due to the presence of CECOS", while less than one third disagreed;

---similarly, more than half the respondents agreed that the CECOS facility "has been a source of stress for myself and my family", while slightly more than one third disagreed.

Perceived Future Impacts from CECOS:

---70% of the respondents believe that they or their family could be harmed by the CECOS facility. Only 16% believe that they could not be harmed. The principal modes of harm mentioned involved water contamination, air pollution, soil pollution, health effects and chemical accidents and explosions;

---73% of the respondents indicated that the CECOS facility represented "a threat to my well being"---against 13% who disagreed;

---only 15% agreed that the likelihood of an accident occurring at CECOS was extremely slight---against 65% who disagreed;

---only 19% of the respondents agreed that the likelihood of an accident occurring during transport of wastes to CECOS was extremely slight---against 82% who disagreed;

---86% agreed that there was a high potential for ground or surface water contamination due to CECOS; 7% disagreed;

Table 1. Page 2:

Perceived Future Impacts from CECOS, continued:

---84% of the respondents agreed that if CECOS were expanded, people would face a greater risk of becoming sick... against only 11%;

---only 20% agreed that because CECOS was an existing facility, an expansion would have minimal additional effect... against 75% who disagreed.

Perception of Potential Benefits from the Facility:

---Only about 30% of the respondents agreed that "Niagara Falls is able to perform a valuable service to other communities by making available a safe site for hazardous waste disposal," while 60% disagreed;

---only 27% of the respondents felt that the local economy is helped by having the CECOS facility and 61% disagreed;

---only 10% of the sample indicated that it helps the image of Niagara Falls to have an important service industry like CECOS in the area, while 86% disagreed;

---only 12% of the respondents indicated that they thought the proposed expansion of CECOS would bring better community services, while 74% disagreed;

---only 27% of the respondents indicated that they thought that the proposed expansion of CECOS would generate new tax dollars for the community, against 54% who disagreed.

Facility Good Will---Trust and Equity:

---84% of the respondents agreed that the Niagara Falls area had already done its share for waste disposal, as compared to 10% who disagreed;

---only 26% agreed and 58% disagreed with the statement that "I am confident that modern technology can be used to build a secure landfill expansion at CECOS";

---only 19% agreed that "CECOS is a corporation that can be trusted to run a safe facility", against 63% who disagreed;

---only 11% indicated that public complaints about the CECOS operation had been investigated promptly, against 53% who disagreed and 35% who were unsure;

---only 17% of the sample agreed that government could be trusted to closely monitor and safeguard the CECOS facility; 71% disagreed.

TABLE 1: Summary of findings from random telephone survey of three neighborhoods downwind and proximate to the CECOS waste complex in Niagara Falls. From Edelstein, 1988b, based upon Goldhaber Research Associates, 1988. Note that a plus or minus 6% error was associated with the sampling for this survey.

Residents tended to see CECOS as already portending future harm, an outcome that the expansion would make more likely. Such harm might occur through groundwater contamination or other environmental media. Facility or transportation accidents were perceived as likely causes of such contamination. The fact that the existing facility was already there did not remove the perceived effects of the expansion. Rather, the expansion was viewed as expanding the potential for future problems. Residents had not given up on the community as a place to build a desired home life; instead, they seemed ready to fight for their community.

The Eco-Historical Context

The assessment of the SCRF#6 application revealed that residents perceived the application in light of the eco-historical context of the community. Most notably, the perception of residents of Niagara Falls was affected by the history of this community over the prior decade or so in coping with major toxic exposure incidents. The fact that possibly no other community in the United States had confronted contamination as so ambient a condition left a deep and significant psychological impact.

People living in communities without known toxic threats will live in a "normal belief system" whereby they do not recognize that exposures can happen at all or at least to them, personally. In Niagara Falls, the opposite was true. There was evident a "toxic belief system" whereby residents believed their landscape to be contaminated. Once such a toxic belief system exists, it is merely a matter of extension for there to be an expectation that any new hazardous facilities represent a threat of additional harm. Residents may have little control over exposures which are already discovered or are still incubating, but they have the possibility of control when they oppose the addition of still another hazard. In the case of CECOS, the additional hazard was not just any hazard, but rather a site intended to receive the most hazardous of chemical wastes. The wastes would be placed in a facility of a type that residents have "learned" will eventually leak. It was known that there is a geological fault beneath the site. Furthermore, there were few if any offsetting virtues to the site. The wastes would come not just from the local industries that put bread on many residents' tables, but from all over, continuing an historic inequity in waste responsibility. The company running the project (Browning-Ferris, Inc.) had just moved its headquarters out of town and had a known record of violations and bad conduct. Little if any benefit was to be realized in return for the risks associated with a CECOS expansion.

The eco-historical context can be further illuminated by contrasting three different and conflicting landscapes that the author identified in Niagara Falls---the industrial landscape.

the natural/tourist landscape, and the residential landscape--- with a fourth emergent landscape---contamination.

The Industrial Landscape. Given its historic position as a center for hydropower, Niagara Falls developed a strong industrial base in the 19th Century that served as the foundation for a major concentration of chemical industries. As one travels the eastern part of the City of Niagara Falls, an industrial landscape dominates much of the area from the river northward, representing almost an industrial enclave between downtown and the CECOS/Lasalle area. This industry continues to be a keystone of the local economy and a major source for employment, as confirmed by the 1980 census.

As a contextual factor, this industrial landscape is important for several reasons. First, people in the area have a long history of living with the direct and indirect impacts of the chemical industry. Thus, the industrial landscape provides a set of baseline conditions to which people have adjusted, to varying degrees, over decades. Furthermore, if one took a strict adaptational view, one might predict that there would be little additional concern and disruption resulting from expansion of the industrial landscape. This acceptance was precisely what CECOS claimed when their promotional materials linked waste disposal to the local chemical industry. But the study results, summarized in Table 1, do not indicate that CECOS and SCRF#6 were accepted as part of the industrial landscape.

This rejection of CECOS as part of the industrial landscape is particularly evident in responses from the subpopulation that one might expect to be the most supportive of the expansion--- chemical workers. Instead, the majority of respondents to the telephone survey employed (or related to employees) in the chemical industry opposed CECOS and shared the various concerns expressed by the sample at large. An indepth interview with an employee of the local chemical industry helps to explain this lack of acceptance of CECOS as part of the industrial landscape. This respondent believed in technology, thought that CECOS was an important aid to the local chemical industry, and even trusted that both government and the company were responsibly protecting the site. At the same time, he recognized major potential problems with the site---the fact that leachate or wastewater would reach the river, the possibility of an accident at the site due to human error despite good technology---and what he saw as the real Achilles heel---transportation of wastes into the site. Thus, even in someone generally supportive of the chemical industry and the need for waste disposal, there was a recognition that the CECOS site introduced a significant potential risk for local people.

In conclusion, even to the extent that there was an acceptance and support of the industrial landscape by residents.

CECOS did not appear to benefit from inclusion in this landscape.

The Natural/Tourist Landscape. The second landscape in Niagara Falls involves the precipitous drop of the Niagara River to create one of the wonders of the world. This landscape serves as the basis for the second identity of the area and for its thriving tourism. The river and the falls dominate the local landscape, except in the starkly contrasting industrial zones.

The industrial center and tourist-spot identities of Niagara Falls are in natural contention. The social dynamics that support tourism and the chemical/industrial landscape also appear to compete. This "split" personality has been an evident past source of tension, affecting the course of local politics and contributing to community conflict. However, with the downturn of the industrial base of the area in the 1980's, Niagara Falls developed a renewed interest in restoring the natural landscape and removing stigma associated with industry and particularly with industrial pollution. A clear objective in this shift has been to support and restore the tourist base to the economy. A major convention center and other projects signal this interest.

Tourists represent a significant if transient local population. The 1985 Pannell, Kerr and Forster study of Niagara Falls, Canada cited 8.4 million travelers crossing the Niagara Falls border in 1983. Niagara Falls Boulevard in the area of CECOS offers a large number of motels and tourist facilities. It is inconceivable that tourists are not exposed to the same visual, noise, odor and additional impacts as residents, although the significance of such stimuli for a temporary population may differ. The diminishment of the quality of the tourist environment might potentially affect such factors as repeat visits, length of stay, patterns of activity and the reputation of the place.

Residents of the community frequently noted the disparity between the symbolism of the Falls and of the SCRF#6 proposal. There appeared to be nostalgia for the time when Niagara Falls was identified with the wonders of nature. Respondents spoke of a new kind of tourism---tourists who neglected visiting the falls so that they could spend their time observing Love Canal and CECOS, as well as other toxic sites. They were concerned about what kind of statement was being made about a community whose tourists seek out toxic sites rather than Niagara Falls. Such threats to community identity, in turn, affect the identity of residents. In this regard, the SCRF#6 decision appeared to take on a key significance for the viability of the natural landscape of Niagara Falls and those who identify with it. Approval of SCRF#6 took on the connotation that it would keep the community sunk in its current toxic quagmire. In contrast, disapproval of SCRF#6 would signal the chance for a return to an identity not dominated by the defeatism and contamination symbolized by Love

Canal.

The Residential Landscape. Aside from its industrial and natural features, Niagara Falls is a residential area. Major residential neighborhoods are evident to the east and south of the industrial zone. Many thousands of people live within a mile or two radius of the CECOS site. Given that CECOS was the highest point in the area---called "Mt. CECOS" by the locals---it was a visible point of intrusion into these residential areas.

This intrusion was evident for each of the three target neighborhoods. Sabre Park, a lower income but reasonably stable trailer park community, was located literally at the base of Mt. CECOS. Sabre Park residents were cognizant of the "mountain" rising nearby and reported problems with soot and odors attributed to the site. It may not be surprising that some residents blamed CECOS as the source of mercury contamination that, at the time of the author's visit, had plunged the small neighborhood into its own replay of Love Canal. Additionally, the disruption for residents caused by this contamination incident---even if unrelated in source to CECOS---was a good indication of what would happen in the future should additional contamination result from SCRF#6.

In contrast, Third Avenue, in the Town of Niagara, is a comparatively affluent suburban neighborhood just to the east of CECOS. Residents described Third Avenue as a quiet place with a country atmosphere and nice, friendly people. The avenue is an exceptionally long street of one-story ranch houses on carefully groomed narrow deep lots where the canopy of trees literally frames Mt. CECOS, viewed by residents as a "huge hill of chemical waste." The looming landfill was actively viewed by residents as a threat to their health and even to their unborn children.

Finally, the Lasalle section south of CECOS is a large and somewhat diverse neighborhood that is older and comparatively more urban. Lasalle was described by residents as a quiet, low crime neighborhood lacking in problems other than CECOS. The neighborhood was popular with young families seeking to avoid crime further downtown and unable to afford the expense of the suburbs. There were also many retired people, similarly lacking in other residential options, living in the neighborhood. As with Third Ave., kinship networks were widespread within the neighborhood.

All three neighborhoods were characterized by fairly low mobility, by affordable housing, by proximity to kin, and by apparent pride in the home. These communities were ripe for the condition that the author has documented as the "inversion of the home", where both the psychological and financial security of the home is simultaneously destroyed (Edelstein, 1988b). In such instances, as the author noted in his CECOS testimony, any or all

of four conditions may result:

(1) The first condition involves entrapment, where residents seek to leave their home because they believe it to be hazardous but are unable to do so because of their financial limitations.

(2) The second condition involves forced relocation due to contamination, in this case potentially due to CECOS or SCRF#6, with attendant uprooting and major life stress.

(3) In the third condition, residents become marginalized from living just beyond the boundary of an area demarcated as contaminated. Life on the boundary, as neighbors of Love Canal well knew, was in some ways even more stressful than life within the area designated as contaminated because of the uncertainty over boundary accuracy and because stigma stretched to the margins. While these homes were officially declared as "safe", their proximity to the region of pollution causes many residents to feel insecure---an illegitimate position given the official declarations of safety. In such cases of marginalization, home may be inverted, with little chance of official assistance.

(4) Finally, as Love Canal again illustrated, a fourth outcome involves those who disbelieve the toxic danger, but whose lives are disrupted because so many of their neighbors believe that there is a problem. Selective relocation may remake their community as a ghost town, for example.

Given their experience with Love Canal, these impacts were not abstract speculation for residents living around CECOS. In fact, the community had available a full-blown worst-case scenario for chronic exposure to chemical contamination.

The Fourth Landscape---Contamination. A fourth emergent landscape has become increasingly important in Niagara Falls. Beginning in the late 1970's with the Love Canal incident, the Niagara Falls area has been the site of a long list of discoveries of chronic toxic exposures. The most prominent of these discoveries besides Love Canal have been the S-dump and the Hyde Park dump. However, there are many many other in-place-toxic sites; the exact number may matter less than their pervasiveness. The cumulative impact of these toxic sites has been a sensitization of the overall population to the negative impacts of toxic exposure. This may well be the most sensitized population in the world---at least to chronic toxic exposure incidents.

It was evident that the community's toxic legacy was a major variable affecting the psychological impacts of SCRF6. In the interviews, for example, Love Canal was clearly used as the model by which people judged the implications of SCRF6 for themselves and their area. The problems associated with forced relocation

and forced inability to relocate had uncommon clarity here. In many cases, this clarity derived from direct experience or observation or from personal contacts. Many area residents had themselves moved from the Canal. Furthermore, all who lived in Niagara Falls at the time were probably affected in some secondary way by the events surrounding Love Canal. The controversy over habitability and resettlement of the canal that raged at the time of the research merely underscored one of the key lessons of Love Canal---that once a community is affected by toxic exposure, it may never be able to move out from under the fog of uncertainty and controversy that surrounds questions of safety. Residents knew what others went through, even if they did not themselves directly experience the incident.

Conclusions for the Ecuhistorical Context

The implications of this fourth landscape for the perception of CECOS and the SCRF#6 expansion are quite significant. CECOS was not viewed as part of the industrial landscape. Rather, it was seen as an extension of the "contaminated" landscape---more related to Love Canal in people's minds than to the chemical industry. CECOS was not imbued with an industrial image---which trades off pollution for prosperity. Little perceived benefit offset the pure harm identified with the waste site. Furthermore, if Love Canal represented the toxic past of the community, CECOS and SCRF6 represented the toxic future. Because residents believed that the CECOS site would someday leak despite its "state-of-the-art" technology, it was viewed as a toxic incident in incubation, to someday be "discovered" as yet another Love Canal-type incident that would totally disrupt people's lives. In this sense, opposition to SCRF6 was viewed as a way of capturing a point---far in the future---where the community might be absolved from dealing with a toxic incident that could have been stopped. If Love Canal and Bloody Run symbolized the ghosts of Niagara Falls' past---contaminations that were fait accompli, and, therefore, beyond prevention---SCRF#6 symbolized the threat to the community's future that might still be averted.

Environmental Stigma and Trust in the CECOS Case

The CECOS case highlights the importance of both environmental stigma and trust as psychological constructs useful to understanding perceptions of a proposed facility and its potential for long term impact.

Issues of Environmental Stigma

In the discussion of the contaminated landscape of Niagara Falls, we have already documented environmental stigma. The local environment had been degraded by contamination---transformed from the honeymoon capital of the world to the waste capital of the world. The stigma extended to the perceived quality of the

natural/tourist setting and residential neighborhoods. The facility was seen as detracting from the image of the Niagara Falls community and, by association, from the people living there. Stigma affected the residents in at least two ways--by impacting upon their own psycho/social worlds and by affecting the economic value of both their private homes and their community.

Psycho/social Impacts---There was ample evidence from the interviews and survey that the CECOS project was seen as further defiling Niagara Falls as a community, as well as the private lives of its residents. Perhaps most disturbing was the documentation that residents of Niagara Falls had come to distrust the safety of their own physical environment, believing that it had already been spoiled to a large degree by past waste disposal activities. The normal accouterments of stigma were evident---blaming of victims by outsiders and by the victims themselves, prejudice against contaminated people, and lowered self and community esteem. In perceiving that outsiders had defined their community as a "sacrifice zone," local residents were well aware that their health and quality of life had also been deemed as having sufficiently little value as to be worthy of preservation. To be selected to receive wastes that others do not deem safe or appropriate for their own communities carries a clear and obvious social meaning.

Economic Stigma---These shifts in perception had apparent effects for the economic livelihoods of residents as well. Residents of the surrounding neighborhoods were homeowners with few assets beyond their houses. Much as at Love Canal and other contaminated communities, the threat to home was financial as well as psychological. Stigma also affected the value of their properties and, by extension, residents' degree of mobility. For example, the announcement of mercury contamination at Sabre Park entrapped residents in two ways. They reported that the value of their trailers dropped, making it uneconomical to move. There were also reports that other trailer parks refused to allow Sabre Park residents to move their trailers there for fear that contamination would be brought along.

Confirmation of the perception of such economic stigma effects came from a study by Baker (1988) that included a Niagara County site in its analysis. He found that in the wake of the Love Canal incident, distance from a hazardous waste facility became an important factor in the price charged for residences.

Not only does stigma have economic impacts on the residential environment, but on the tourist environment as well. The 1985 Pannell, Kerr, Forster study of Niagara Falls, Ontario found that business operators overwhelmingly feared the siting of a hazardous waste disposal facility in that community because they believed that the waste site would diminish the future

development of tourism. The firm concluded that the atmosphere of uncertainty created by a waste disposal site would adversely affect investment in the tourism industry. More significant than direct impacts to tourism from such a facility would be the negative impact on the image of the city. This stigma was expected to decrease tourism outright or at least to decrease the duration of tourists' stay. However, the greatest concern of the Ontario business community identified by Pannell, Kerr, Forster was that adverse publicity about the site would cause tourists to confuse Niagara Falls, Ontario with its sister city across the bridge, clearly stigmatized by contamination. Exaggerated comparisons to Love Canal, they feared, would drown out the fear of the beautiful Niagara Falls. Tourism by Americans would drop because American tourists are particularly wary of toxic waste and Love Canal-type publicity, traveling to Canada because of its clean air and water. Similar outcomes had been previously seen by Northern Ontario tourism outfitters in the wake of mercury contamination in One river system that had led to a general decline in tourism in the entire northern area.

Two other points about stigma can be drawn from the CECOS case study. First, the application threatened to reinforce the persistence of the existing environmental stigma. Thus, from a psychological perspective, there is likely to be greater stigma resulting from a recurring or continuing source of contamination than there is from one which is being cleaned up. By analogy, a diseased person expected to recover bears considerably less risk of stigma than does one recognized as being terminally ill. Niagara Falls may be heavily stigmatized from its past actions in allowing unwise waste disposal; however, actions to "clean up" the community would involve movements to end such perceptions. The permitting of a facility to bring in still more hazardous waste would have the opposite effect, prolonging the basis for the stigma even further into the future.

Second, the fact that the community was seen as already contaminated invited proposals to contaminate it further. This was essentially CECOS' argument in attempting to justify their site as appropriate. In effect, once spoiled, a community is under "perpetual jeopardy" of being selected as a site for a stigmatized facility until they somehow establish a new sanitized identity. By extension, since stigma of place becomes stigma of the people associated with that place, the question posed by SCRF#6 involved whether Niagara Falls, its people and its environment, had any remaining worth. The permitting of the facility by a government agency would have confirmed the perception that in Niagara Falls there was little left to lose.

Finally, it should be observed that the extensive review of print reporting about CECOS and Niagara Falls indicated a remarkable public attention to contamination and waste-siting issues. It was striking, in fact, to see so much attention to

these issues in a relatively small geographic area. Media coverage clearly had played a major role in creating and prolonging negative images for this community.

Issues of Trust

History is clearly a key factor in a discussion of perceived trust of the CECOS facility. Residents of the CECOS area had engaged in a lengthy process of learning about facilities and situations that were viewed as similar or comparable to the SCRF#6 facility. This experience served as the basis for a profound distrust evident in the community. Significantly, this distrust can be seen as having several referents.

General Distrust for Polluting Industry. The community history involving Love Canal and other contaminated sites introduced, through direct or vicarious experience, a general distrust for hazardous waste generation and disposal. From the experience, people learned that local corporations did not always act wisely and well.

Specific Distrust for CECOS. There was also a long history to the CECOS site and operation, one that had established a widespread perception of distrust of the facility and company. A substantial number of people reported direct and suspected indirect impacts from the pre-existing CECOS facilities. They further reported unresponsiveness in addressing their complaints about these conditions. The media file contained numerous stories of leakage problems, permit violations and other instances involving CECOS that would add to public distrust. This distrust was also evident in the local word-of-mouth. The local lore included stories of abuse at the CECOS site, where, for example, it was said that faulty liners had been overlooked in the construction of previous CECOS hazardous waste facilities. Such stories---whether true or not---contributed to a lack of confidence that CECOS would deliver on its promises to run a safe facility.

There was a further doubt that CECOS could be totally open with local residents about conditions in its complex. At one group interview, a participant noted during a discussion of CECOS' open house programs that, were she to invite someone to her house, she would likely shut off certain rooms. In this she clearly stated her distrust that the seemingly friendly and neighborly gesture of an open house was meaningless because CECOS would never disclose to public view those activities or operations which it feared exposing.

Distrust of Hazardous Waste Technology. "State-of-the-art" technology was not viewed as protective in a community where problems created in the past repudiated prior states of the art. What to the engineer appears as an all-encompassing technological

advance appeared to the residents as just another false promise waiting to fail. People here had had "their fill" of land disposal approaches to hazardous wastes. In their view, it was a cheap and easy answer to waste problems, but not an environmentally sound approach.

Government was Not Viewed as Protective. The perception that government had failed in the past to protect the public was highly significant because the promise of future government regulation carried little weight in mitigating concern and distrust. Not only had government failed to prevent previous problems in the community, but government was distrusted for two additional reasons. First, particularly local government was seen as being complicit in having created local environmental disasters. And, second, once environmental disaster was identified, government had failed overall to mitigate the effects in a manner that satisfied the involved and observing citizenry.

Prior Siting Decisions were Corrupt. Recognizing that previous waste-disposal decisions had local government support and approval, Niagara Falls area residents spoke cynically of their community as one where where "money talks." They did not trust that an honest decision would be made regarding whether this was a good technology and the right place to employ it.

Society was being Unfair. The selection of a neighborhood with so troubled a toxic legacy for yet another waste site hardly suggested equity; the social system that would allow more wastes to come to Niagara Falls was distrusted as fundamentally unjust. Residents of the community saw themselves as being victimized by others who viewed their home as a literal "sacrifice zone."

Disablement and Enablement. The author has documented the loss of control experienced by residents of contaminated communities, arguing that not only the inability to avoid exposure in the first place, but the disabling governmental process of addressing environmental problems rob people of their formerly assumed sense of control over their lives. In the CECOS studies, it became apparent that Niagara Falls' toxic legacy had already robbed many people of a basic sense of control over environmental conditions in their community. Past expansions of CECOS and other facilities had illustrated that the wishes of residents were not heeded by local or state government officials, resulting in a sense of hopelessness and futility and a cynicism and depression. While activists continued to press against CECOS, most residents appeared to have a quiet opposition---detected by the telephone survey---that might pass for apathy. As one interviewee expressed her own sense of defeatism, "What can you do about it? Nothing! So you make dinner." This segment of the population represented a "silent majority" strongly backing, as it turned out, the visible actions of a relative few activists.

What was striking about the widespread opposition against SCRF#6 was that this application had emerged as a virtual watershed in the community. If this project could not be stopped, then the ability to reclaim the community was lost once and for all. On the other side of the coin, success might signal a new sense of control over the direction of the community. The extent of the opposition against CECOS, thus, represented an effort on the part of people effectively disabled in their control over community events to regain efficacy. Opposition against CECOS was, in this sense, enabling.

Claims that Trust Impacts Can be Mitigated

During the five day hearing on psychological impacts in November, 1988, mitigation of trust issues became a key issue of contention.

CECOS's experts acknowledged the opposition and concern over the SCRF#6 site. They argued that fears were induced by excessive media coverage and were irrational because, as a state-of-the-art facility, SCRF#6 would by definition be completely safe. What was needed, CECOS suggested, was not to deny or change the SCRF#6 project but rather to find a way to modify and control how the project was viewed in the community. The author termed CECOS' approach a "personalistic strategy" because it makes concerned residents the focus of change rather than the facility (Edelstein, 1990). In this regard, the rebuttal witness for CECOS, Robert Gatchel, suggested during his testimony that individual psychotherapy and behavior modification might be used to treat stress related to the facility. A second expert proposed to "manage" perceptions of risk through "community-based risk communication and public education activities and programs" (Covello, 1988, p. 29). These programs would include tours and open houses and the circulation of brochures, video presentations, and a newsletter. Such activities were seen as helping residents to cope by increasing their understanding and familiarity with the facility. Over time, such activities combined with community benefit projects would provide "a firm basis for community trust and acceptance" (Covello, 1988, p. 33) that would remove psychological stress due to CECOS. CECOS' experts were able to cite no proof that such mitigation programs worked, beyond pointing to a few instances of successful facility siting, most notably the Swan Hill site in Alberta, Canada.

In contrast, the author argued that psychosocial impacts such as those found near CECOS cannot be easily mitigated. This conclusion was based upon four factors. First, there is currently no evidence demonstrating that mitigation techniques work. Certainly, the overwhelming opposition to SCRF#6 did not indicate that CECOS' existing public relations program was

successful. Furthermore, the Swan Hill case used by Cavello as an example of successful mitigation was hardly applicable to the Cecos case. Second, trust is the foundation for any mitigation program. Yet, the specific historical, social and environmental context of Niagara Falls generally, and specifically with regard to CECOS, indicates that it is unlikely that trust in CECOS, in SCRF #6 or in the regulatory agencies can be easily established. Conclusions well-supported by the survey and interview data. Third, educational efforts of the type suggested by Cavello may even backfire, enhancing rather than diminishing community concerns (see Slovic, et. al., 1982). Finally, the telephone survey further revealed that residents did not accord much weight to so-called benefits from the facility, ranging from promised tax dollars, employment and other local economic boons, and improved community services, and the honor of serving the social benefit of hosting such a facility. Against the personalistic approach to mitigation suggested by the applicant's experts, the intervenors proposed an environmental perspective whereby the project, not the people, is modified (or denied) in light of potential adverse psychosocial impacts.

Conclusion

The CECOS case study demonstrates the extent which environmental stigma and distrust are tied to the eco-historical context of the a community, giving these impacts a depth that may well defy superficial and personalistic approaches to mitigation. With the siting of new facilities in "virgin" communities, there may be a perception that agencies and facility operators can begin with a clean slate---absent such eco-historical baggage. However, one must question this assumption. Are there truly virgin areas left in terms of contamination experience? Certainly, Nevada is a tainted state in terms of past nuclear projects. Second, even where one able to begin with a fresh slate, a new eco-historical context would begin with the first announcement of the proposed site, and evolve through permit considerations, construction and facility operation and post-operation.

The CECOS case begs the issue of whether mitigation can address the documented environmental stigma and distrust. Because the DEC denied the SCRF#6 permit, there will probably be no test of future mitigation at that site. We must look to other cases to examine this issue.

CASE TWO: MITIGATING PSYCHOSOCIAL (COMMUNITY) IMPACTS THROUGH LANDFILL PERMIT REQUIREMENTS*

This case study examines mitigations for psychosocial and community benefits that were built into the construction permit issued in 1989 by the New York State Department of Environmental

Conservation (DEC) for an expansion of the Orange County Sanitary Landfill. While the case is in-progress, and any evaluation of outcomes can only be preliminary, the permit provides an opportunity to examine some of the problems that can affect the success of psychosocial mitigatory measures. The presumption that such impacts will in fact be mitigated by a permit or operations plan (or any other statement of intention) must take into consideration operational process dynamics that affect the success of such mitigations.

Background

In 1974, Orange County, New York, established a sanitary landfill along the Wallkill River in the Town of Goshen to receive primarily solid waste. A 150-acre-facility has operated on the 300 acre site ever since under terms of a consent decree with Region 3 of the New York Department of Environmental Conservation¹. In 1983, at the suggestion of the author, then President of a local environmental organization called the Goshen Area Resources Association (GARA), a voluntary process was created called OCSLIP, the Orange County Sanitary Landfill Interested Parties. On a monthly basis for two years, representatives of the county, Region 3 and the community met to discuss concerns regarding the landfill. The author continued his participation as President of a new county-wide non-profit environmental organization called Orange Environment, Inc. (OE).

In 1984, fearing that the existing facility had only limited remaining life, Orange County began serious work on a proposal to expand the landfill onto the remainder of its property in order to provide another 25 years of waste disposal capacity. The continued use of the site became a matter of controversy within OCSLIP, however, because the property adjoins the Wallkill River and sits atop the Southern Wallkill Valley Aquifer, a principal aquifer. This criticism of the county's plan was aided when, around that time, the commissioner of the DEC issued a policy discouraging new landfill development atop principal or primary aquifers. Both the DEC and OCSLIP acted to force the county to conduct a study of alternative sites and waste disposal practices. The county study, completed in 1985, contended the existing landfill site was the only suitable landfill location in the county; all alternative technologies and approaches to waste disposal were similarly dismissed, including recycling and waste reduction. OE and GARA led the public opposition to the siting study.

Although OCSLIP was a totally voluntary undertaking for all

---

¹. The DEC primarily operates out of nine regional offices, each with its own Director and staff, supported by a central office in Albany, N.Y.

participants, the county, Region 3 and citizens all had participated actively up until this time. Meetings had been congenial and tended toward agreement or supportive disagreement. However, with the evident gap between the county's landfill plans and the feedback given by citizens and Region 3, the county ceased participating in OCSLIP during 1985 and the board fell into disuse. Switching to a conflictive mode in order to advance its landfill plan with Region 3, Orange County successfully sued the agency in order to force an adjudicatory hearing on its application to expand its landfill. OE became a party of interest to these hearings held on the application in 1987 and 1988, successfully intervening against permit approval primarily on the grounds that alternatives had not adequately been addressed. Both Region 3 and OE had also opposed the site based upon the aquifer, the hydrology and engineering issues. After 27 days of hearing, the DEC commissioner denied the county's permit application on July 30, 1988. Region 3 then proceeded to consider a proposal that a smaller interim landfill be permitted at the site in order to allow the county five years to develop an alternative waste disposal site. While OE called for hearings to reconvene on this proposal, Region 3 proceeded to issue a permit without hearings, including OE in negotiations over the permit language.

OE used its involvement in these negotiations as an opportunity to argue that permit provisions be written that would mitigate and compensate local residents and the community for various adverse impacts related to the operation of the facility. In order to demonstrate that such impacts were an issue, OE undertook a study of residents living in the vicinity of Orange County Landfill and the adjacent Al Turi Landfill, Inc. and presented its findings and recommendations to Region 3. By introducing this "new evidence," OE sought to trigger further review under New York State's Environmental Quality Review Act. As an alternative to further review, Region 3 wrote a series of special permit conditions based upon OE's proposals. These conditions were finalized after discussion with the county, which accepted the mitigating permit conditions as a requirement for obtaining the permit.

These efforts at mitigation represented a major experiment on the part of Region 3 to recognize community impact issues. As a result, the permit was a radical departure from previous state permits that essentially ignored such issues. The special permit conditions that directly reflected the community mitigation aspects of the Orange County Landfill Permit issued in 7/7/89 are listed below.

1. OCSLIP was recreated, this time as a landfill permit requirement, in order to "establish a continuing forum for communication between the Permittee and interested public." OCSLIP membership was to consist of seven interested citizens living

nearby the landfill. Selection of one member was to be made by the OE, GARA, the Wawayanda Homeowners Association, the Towns of Goshen and Wawayanda and Region 3 and the county executive. (Special Condition 42, p. 15).

2. A 24-hour complaint hotline was to be established (Special Condition 42).

3. A full time DEC monitor was placed at the site in order to assure permit compliance. (Special Conditions 28-32).

4. A public health survey was promised as a means of reassuring nearby residents by collecting and evaluating "public health data about persons living near the prior and current Orange County Sanitary Landfill." The draft survey was to be submitted by October 31, 1989 for OCSLIP and DEC review. "At a minimum, the survey shall provide each individual with data collected about them, and must make available to the public its analysis of trends found among the total population surveyed while protecting the confidentiality of the data." The study was to employ methods developed by the New York State Department of Health (Special Condition 43, pp. 15-16).

5. A well water analysis of nearby wells was promised in order to reassure nearby residents by identifying any water contamination in the area. This survey was to be included within the public health survey. (Special Permit Condition 43).

6. A visual impacts plan was mandated to be written by a landscape architect in order to "provide for mitigation of the visual impacts of the facility, during and after operation, to the maximum extent feasible." (Special Condition 6, p. 3) This plan was to be reviewed by the OCSLIP board prior to approval by the DEC.

7. Revised procedures for reducing odors, noise, dust and other direct landfill impacts were mandated to be issued within 60 days and reviewed by OCSLIP. These procedures were to move the landfill into a "preventative mode." In addition, use of selective back-up beepers was to be explored to reduce noise impacts. (Special Conditions 44 and 45).

8. A study of traffic impacts was required. (Special Condition 46).

9. A host community benefit fund was established. The source of the benefit was to be a tipping fee of not less than 50 cents per ton. This fund would provide OCSLIP with an operating budget of \$5,000 per year. It would also "further mitigate the social and other environmental impacts of the facility which cannot be further mitigated by the special conditions of the permit." One third of the money was to go to a host community benefit fund for

the Town of Wawayanda, adjacent to the landfill expansion, and two-thirds to such a fund in the actual host community of Goshen "to be used as the Towns see fit for public benefit projects." (Special Condition 47, p. 17).

10. An appraisal plan was created to identify property value losses for owners within 2,500 feet of the landfill expansion site. The basis of this permit condition was the recognition by Region 3 that "there exists a zone surrounding the landfill...where properties are expected to experience significant adverse environmental impacts (such as, without limitation, odors, noise, vectors, aesthetic impacts and litter) which may not be effectively mitigated by the other measures required pursuant to this permit." Using a list of property owners within this zone supplied by the county and a list of licensed appraisers provided by Region 3, OCSLIP would select two or more appraisers to perform, at the county's expense, two appraisals of each property within the zone (Special Condition 36, p. 13).

Assuming completion and closure of the existing landfill, the appraisals were to compare, the value of each property under two conditions: (1) that permits for the new landfill expansion were never issued and (2) that the landfill was permitted to operate, with resulting unmitigable environmental impacts. Property losses attributable to the landfill were then to be reported to the County Legislature in order for that body to determine whether and how much to compensate affected property owners. Disputes over compensation where the two appraisals varied by 15% or more were to be referred to a mediator of the American Institute of Real Estate Appraisers, selected by the DEC and paid for by the county.

11. Because of its party status in the prior hearing, OE was also a party to the negotiation of a new order on consent for permit violations at the landfill. With OE's urging, \$300,000 of its fines for permit violations were returned by the state for an environmental credit project through which new parkland was acquired by Orange County.

It should be noted that the community impacts portion of the permit represents only one section; other issues addressed were also important issues for OE. For example, the organization had successfully argued that waste reduction and recycling were an alternative approach of central importance to the county's waste strategy. The permit required the county to commence waste reduction efforts and to produce a solid waste management plan in compliance with new state regulations.

In sum, the construction permit issued by the regional DEC reflected a serious attempt on the region's part to recognize and mitigate psychosocial impacts of the interim landfill that they

were allowing to be built. But how successful was the implementation of these provisions over the next two-and-one-half years?

Evaluation of the Social and Community Impacts Mitigation as of December 1991

With the July 1989 issuance of the permit to construct the new interim landfill, the OCSLIP board was quickly constituted, holding its first meeting on August 10, 1989. The Board met virtually every month for the first two years. As an entity, the OCSLIP board has worked diligently to see that compliance with the permit was achieved. However, problems have been encountered with many of the psychosocial mitigation provisions.

Difficulties in Meeting the Mitigations Requirements

Only a few of the provisions of the 1989 permit to construct an expanded landfill were implemented quickly and efficiently. OCSLIP was reconstituted and began meeting almost immediately after the permit issuance. A traffic study was produced in a timely fashion. The purchase of park lands called for in the consent decree proceeded quickly. Despite these steps to meet the permit, virtually the entire rest of the package met with delays and frustration. Overall, the basic premise was unmet, namely that, because the county needed to get into its new landfill immediately, the community provisions of the permit would be executed with dispatch. After a relentless push to build the first phase of the landfill, the county changed strategies and sought to drag out use of the old landfill as long as possible while the permit conditions languished. Because OCSLIP served as a main forum for discussing, debating and deliberating steps to meet the permit, the board was caught up in these delays.

The Appraisal Program---Much of the first year of the board was taken up with the task of implementing the appraisal plan. This task proved to be arduous, with the major point of early frustration being the disinterest of appraisal firms recommended by the DEC in undertaking the project as it was set forth. The Board spent the bulk of its budget to hire an environmental law firm to search out and identify suitable appraisal firms. After this task was finally accomplished, there was a delay of nearly another year in the county's approval of the appraisal contracts. As of this writing, no results from this study had been received.

The Health Survey---Frustration was encountered in a second major area, as well---the health survey. The permit clearly made the county responsible for the survey, with OCSLIP responsible only for approving the study design before it was implemented. At Region 3's suggestion, the County enlisted the help of the New

York State Department of Health (DOH) in designing an instrument. However, when Region 3 and county officials met with the state health researchers, they found them less than enthusiastic about a survey for a population not known to have been exposed to any specified contaminants and where no identified disease clusters were evident. A DOH administrator complained that this was precisely the kind of study the DOH did not want to do. Furthermore, in requiring a health survey, the DEC was infringing on the DOH's turf. It was not surprising, therefore, that the DOH response was lackluster and slow. Their incomplete draft survey instrument was eventually turned over to the toxicologist on staff at the county's engineering consultant firm to be finalized. However, few improvements were evident by the time of her meeting with OCSLIP on January 3, 1991. Citizens and a county attorney argued over cost-saving measures proposed by the county. The county proposed sending only a mail survey; OCSLIP wanted a face-to-face in-home survey conducted by a neutral professional. A compromise was reached whereby a brief symptom checklist was to be sent by mail to residents, with face-to-face followup for those requesting it and for those not returning the survey. In order to not hold up the health survey further, OCSLIP provisionally approved the survey, but the approval did not mask dissatisfaction by many members.

Despite the compromise, further delays in implementing the survey were encountered. For many months, the county's consultant failed to provide draft revisions for OCSLIP members to review. The time period was further extended when this consultant took a maternity leave before the work was completed. Then, in late Spring, 1991, the health survey was turned over to the County Health Department for implementation. In a lengthy and tense meeting of OCSLIP at that time, an administrator of the health department made his agency's position clear. The survey had been dumped in the county health department's lap at the last minute, and they had no sense of ownership over it. They did not think that the questionnaire developed by the state DOH and the consultant was valid and so would not vouch for the validity of the findings. However, they would not attempt to improve the questionnaire because that task had not been given to them. Their assignment only involved collecting the data and issuing whatever findings were warranted---and they expected to have no useful findings. A crowd of community residents attending the meeting were disheartened by this blunt message that there was so little to expect from the long-awaited study. Subsequent attempts to convince the county to strengthen the study before implementation were not successful.

At the time of this report, the health survey awaits Region 3 approval. Despite its awareness of the problems with the study, the agency is unlikely to disapprove the survey for several reasons. First, to do so might anger the DOH, which drafted the survey. Second, because health research is not a

topic under the DEC's jurisdiction and, furthermore, they lack specific expertise in this area, the agency lacks a basis for making substantive review. Finally, the county holds the responsibility for conducting the survey, and the DEC does not wish to effectively take over this burden. As a result, an admittedly inadequate study is likely to be approved and undertaken.

Other Provisions---The well water survey, to be implemented with the health survey, was also delayed. A matter of controversy debated at OCSLIP was the scope of the testing and the costs. Not surprisingly, the county argued to limit both the scope and cost. The design of this survey had also not been finalized by the time of this report. Similarly, the County had also failed to implement provisions requiring visual mitigation. Other provisions to prevent adverse direct impacts have not been acted upon. The 24-hour hot line number, although designated, has not been disseminated to the public.

A DEC monitor was not appointed until about nine months after the permit. As a result, part of the first phase of the landfill was built without independent inspection. This failure contributed to difficulties that the county has had in proving the adequacy of the construction of its liner. The eventual arrival of the monitor has helped to address citizen concerns. In the meantime, an agreement by OCSLIP participants to coordinate landfill visits with the monitor addressed the county's desire to stop citizens from carrying out uninvited inspection tours of the landfill. Such visits kept the county on a continual defensive because violations were frequently found.

Host Community Benefits---The final provision of the mitigation plan involved the payment by the County of host community benefits. While these payments were not intended to commence until use of the new landfill began---an occurrence continually pushed further into the future---there were several items of controversy surrounding the plan. Neither of the Towns receiving benefits had participated in the hearings or negotiations that created the permit requirements. The host benefits were recommended by OE without the Towns' knowledge. However, once municipal officials smelled the money, their interest intensified. The host community of Goshen protested bitterly that it had to share the tipping fee with the neighboring Town of Wawayanda, where many of the social impacts of the new facility will occur. An even more serious problem involves the fact that the intent of the benefit fund was to allow the municipalities to further mitigate the adverse effects of the landfill upon nearby residents. However, the respective Towns merely budgeted the tipping fees as general revenues and have been unwilling to consider using the funding for targeted mitigations. For example, when asked about his openness to discussing how the money was to be spent, the supervisor of

Goshen told the author that if he didn't like the way the money was budgeted, he could sue the Town---there was nothing to talk about. In a letter to Region 3, Goshen further warned the agency that any effort to clarify the wording in the permit to restrict the use of the money would end up in court. OE, on its part, has repeatedly asked the Region 3 to place such restrictions for fear that any value as mitigations would be lost otherwise. However, the agency has been unwilling to change the existing permit language, reflecting a concern that it might overstep its statutory powers. At the time of writing, Goshen's Supervisor was publically blaming OE for holding up the opening of the new landfill and, therefore, Goshen's community benefit. Because Goshen began budgeting for this money in 1990, its delayed arrival had allegedly "caused" a budget crisis in the Town.

The Permit That Never Came

During the two-and-one half year period since the construction permit was issued, Orange County built phase 1 and part of phase 2 of the new landfill. Despite many operational problems, the county has continued to use the original landfill that, in 1984, it had said was running out of capacity; the county has periodically revised its dates for when the landfill would be filled, always buying more time for its continued use.

The DEC began to seriously work on a draft permit in late summer and early fall 1991. However, on a visit to the landfill in early fall, OE discovered that there was severe leakage in the new landfill's liner. A subsequent review of the DEC's files confirmed the problem and suggested improper construction, as well as the identification of an active spring at the site. About the same time, OE learned that the County had never applied to the U.S. Army Corps of Engineers for permits to fill the wetlands atop which the facility was located. This issue had been raised years earlier by OE to the state, who claimed no jurisdiction to protect "unregulated" wetlands. Realizing the Corps' jurisdiction, OE filed a notice of intent to sue the County under Section 404 of the Clean Water Act in October 1991.

The county anticipated receiving permission to commence using the new facility in tandem with closure of the old. At the onset of December, 1991, Region 3 announced that the old landfill would close at the end of the year but that no permit for the new facility was in sight, given major engineering problems at the facility and the possibility of an inadequate distance between groundwater and the liner, as suggested by data collected after the liner's construction. The County faced a major waste crisis, with no place to take its wastes. Then, a week later, the agency modified its prior decision. The old landfill would be allowed to continue operation through the end of January 1992, when the portions of the new landfill that passed testing would be allowed to receive wastes under a revised permit. The County, in turn,

would have to accept a proposed consent decree and fines related to violations at the old landfill.

Given the uncertainty over the site's eventual use, it is not possible to comment at this time on the extent to which a permit to operate the facility will continue the mitigatory program, nor whether such a permit will even be issued. The community mitigations program may never be fully implemented. However, a partial evaluation of its effectiveness to date can be offered.

Barriers to Correcting the Deficiencies

Given the county's rather incomplete compliance with the community-oriented permit conditions, it may be useful to discuss some of the institutional barriers blocking successful implementation of the mitigation program.

Taming of Citizen Power---While the OCSLIP format provides a good forum for the sharing of information and for communication about concerns, it has not served as a tool for forcing compliance with the permit. Both Region 3 and the county have carefully kept their formal role relationships outside of OCSLIP. In contrast, OE, accustomed to the insider role it previously enjoyed as an intervenor in the project, has been relegated to being just one of OCSLIP's members. Efforts by citizen groups to use OCSLIP as a place for exercising oversight for the landfill have been stymied because that is not a role accorded to the board by either the regulator or the applicant. The result is that the process has fallen short of citizen expectations as a mechanism for forcing permit compliance and for resolving concerns about the facility's operations.

A further implication of OCSLIP has been the focusing of concerned groups on the internal business of the Board. While meetings are open to the public and the press, by and large, there has been less effort to organize the general public or to build public awareness of key landfill issues. Such issues have often not been communicated, even by local OCSLIP representatives to their neighbors. Thus, while OCSLIP is in itself a model citizen participation effort, it has not played a public education and mobilization role. While meetings have been open to the public and press, they have often dealt with esoteric questions about the landfill and permit, rather than serving for the expression of more common community concerns. In a sense, participation in the board has made it harder for groups like OE to play such a role, either, as they previously did. A conventional "citizen participation plan" developed by Orange County has never been implemented. Thus, in opening doors for a small group of representatives of communities and groups to meet with officials, broader participation may even have been diminished.

Furthermore, OCSLIP has institutionalized functions such as the monitoring of the landfill. Previously, small groups of citizens waded the rivers to secretly inspect the facility. A current enforcement action against the County for violations at the landfill came initially from work done by OE members who found leachate flowing into the river and who calculated that the landfill had been illegally expanded in height. Now there are formal procedures for visitation and enforcement is largely in the hands of the on-site monitor. It is not clear whether there has been an overall lessening or increase of enforcement with the taming of citizen monitoring because the monitor's emphasis is on working to abate and avoid problems, rather than waiting until they occur to punish the county.

Problems of Participation---the OCSLIP Board. As a mitigation, the OCSLIP concept is strong in design. Unlike conventional regulatory processes for assuring "citizen participation," OCSLIP offers the capability for community members to be actively involved in assuring that their concerns are discussed and to pressure for resolution. The empowerment involved in OCSLIP comes from the fact that the board is chaired by a community member, the group sets its own agenda, and the group has direct involvement in reviewing, commenting and to a degree approving submissions necessary for the permit to be met. Furthermore, because of the design of its membership, OCSLIP brings together representatives of the key parties on a regular basis, creating a communicational linkage that would otherwise be absent.

Board meetings have generally drawn a quorum. The chair and secretary have functioned well. The Region 3 representative, the regulatory affairs officer responsible for the landfill application, has been diligent and responsive. Reporting of agency concerns and actions has generally been excellent. Unfortunately, the same cannot be said of the county's participation. Although the Assistant Commissioner of Public Works has acted as a host for OCSLIP, he is not on the board and refrains from participating unless explicitly asked a question. Instead, the county is represented by a county legislator who formerly lived nearby the landfill. This legislator has been a sporadic and uninterested participant and has done little to communicate issues back to the county executive or legislature for action. The ineffectiveness of the county's representation has placed a severe limit on OCSLIP's own effectiveness. The two local environmental organizations have also experienced difficulty in making meetings.

Another potential roadblock has been the fact that, although OCSLIP participants all represent different groups, most community members have not sought to articulate any special interests of the group appointing them. While this has made

possible a generally congenial atmosphere and an uncommon level of cooperation and consensus. Some issues might better be resolved were members to more carefully identify and represent their constituencies.

Regulatory Bind---In several respects, the regional staff of the DEC had thought that they were making important innovations by attempting the community impact mitigations included in the new Orange County landfill construction permit. While there were few if any precedents for their actions in previous state permits, the agency recognized that legitimate impacts existed. Under the New York State Environmental Quality Review Act, it was their responsibility as lead agency to make sure that these impacts were mitigated. However, their efforts were not received with enthusiasm elsewhere in their agency and have generally not been copied in New York State.

This issue can be clearly seen regarding the community benefit plan. While this plan was one of the major innovations of the permit, yet the central office of DEC was unenthusiastic about having Region 3 personnel play a leading role in proposing such a mitigation. The fact that the local towns had not become involved directly in the hearings and that the benefits had been suggested by a citizen intervenor made the agency squeamish about the Orange County permit. As a policy, the agency prefers that compensation plans emerge from negotiations directly between intervening host communities and permit applicants, with the DEC merely approving the plan.⁴ Furthermore, there has been little practice of community benefit plans in the wake of the Orange County permit. Thus, a major innovation set little if any precedent. And, given the lack of central-office enthusiasm for their permit provision, Region 3 officials are reluctant to interfere with the Town of Goshen's decision to use its community benefit money as general revenue, even though such use contradicts the reasoning behind setting up the fund to begin with.

While the health survey emerged as an effort to mitigate documented community health concern, this undertaking put the DEC into direct turf conflict with the state DOH, the agency where such studies are normally initiated. To make matters worse, the DOH indicated that they sought to discourage the type of study called for by the permit. Furthermore, as an agency, the DEC central office acted to limit the extent to which it would be drawn into this area. Thus, although Region 3 wants the survey done properly, there is a limit to which it can exert its interests in an area outside its jurisdiction and expertise. As a result, the agency is prepared to accept even minimal compliance with the health study requirement.

So long as the board serves primarily a communications function, Region 3 is very supportive of its participation in

OCSLIP. Officials lauded the process as helpful. While the OCSLIP process has had disappointments, it has proven to be the longest running continuing public participation effort that the agency is involved with. According to Ralph Manna, Director of Region 3 DEC, OCSLIP is a model response group. Manna was enthusiastic about the community impact provisions of the permit as well, commenting to the author, "We set high standards and we accomplished a lot."

Conclusion

The Case study of the Orange County Landfill expansion permit illustrates that, even where there is adequate foresight necessary to create a psychosocial mitigations plan, there may be institutional and process dynamic factors that erode the effectiveness of the mitigations. While it is too early to write off the eventual effectiveness of the plan, and portions have already been reasonably successful, the case study raises a serious issue. If mitigations for distrust are not fulfilled, then the consequence will be to increase the degree of distrust. Likewise, efforts to compensate for environmental stigma, if not followed through, may only serve to call attention to the stigma and even enhance it. Should many of the protective provisions of the Orange County landfill permit go unmet, the county will be seen as violating its promises. Broken promises, as noted above, compound psychosocial impacts. It is further a likely consequence that the county has itself been stigmatized for the way that it has refused to deal with people victimized by its various waste facilities. That stigma--or eco-historically embedded distrust--is likely to complicate the county's future efforts to site and build new waste facilities. Widespread publicity now depicts the expansion landfill as a failed facility. If the county cannot be trusted to complete its obligations here, it is all the more unlikely that it will be trusted in the future. Thus, precisely at the point that the County must begin siting a new landfill, its trustworthiness is at the lowest point. How does the County win confidence given this track record?

CASE STUDY 3: THE SEATTLE GOOD NEIGHBOR PROGRAM

The final case study illustrates the prolonged effects of a waste facility on the surrounding community. In particular, the case study examines a waste-facility's "after-life," its generation of impacts on the surrounding area after the point that it was closed to new wastes. In a sense, the case illustrates that, over time, a facility becomes one long meter event that consists of many smaller actions and events affecting the community. In the case study, we will particularly examine a novel effort to use a property value compensation program as a way to mitigate environmental stigma and distrust impacts caused by a landfill and to stabilize affected neighborhoods. The sample

of respondents available to the author gave a particularly good perspective on the failings of a seemingly successful program.

Background

The Kent-Midway landfill operated from 1965 through 1983 as a primary point of disposal for the City of Seattle's solid waste. The facility was opened initially to dispose of construction and demolition debris in a former gravel pit located just off Route 5 south of Seattle. While the site generated various direct impacts on surrounding residential communities through its first fifteen years of operation, a local belief that toxic materials were dumped there was not confirmed by EPA until 1980. Then, the next year, both migrating leachate and explosive methane gas were discovered off site. By 1982, various environmental agencies had become involved in addressing the effects of the facility. In 1983, after heavy rains created a "black lagoon" that caused gagging odors in the surrounding communities and further leachate problems were documented, the landfill was closed.

This began the "after-life" of the Midway Landfill, a period during which concern about Midway Landfill hardly diminished. In 1984, Midway was named a federal superfund site. Methane migration off site became a major focus of investigation, leading to the evacuation and closing of a nearby day care center and to the surprising discovery that the gas had even migrated beneath Route 5, the major Seattle/Tacoma highway. In 1985 and 1986, eleven families and two businesses were forced to evacuate due to dangerous levels of methane. Gas flares, extraction wells and methane probes were placed in the affected neighborhoods. Continuous gas monitoring became necessary in buildings in neighborhoods surrounding the landfill, although controversy over how to read test meters called some findings into question. Other areas of public controversy surrounded the safety of the local school; as well as issues of cleanup, the potential for groundwater contamination and the disposal of surface runoff from the landfill. Extensive media coverage of these developments at Midway helped forge one ongoing and continuous public event to which residents were exposed.

In addition to the more typical engineering responses to these landfill problems, the City of Seattle developed an active real estate value support program in 1986 called the "Good Neighbor Program" (GNP) intended to offset real estate downturn in the neighborhoods stigmatized by the landfill problems and now widely dubbed "methane meadows."

The Study

In mid-summer 1990, the author did lengthy focused interviews with the members of six families in their individual

homes. Additionally, three group interviews were conducted at the West Hills Community Baptist Church nearby the landfill. In all, 46 people were interviewed. Respondents were selected to reflect perceptions in the five principal residential neighborhoods surrounding the Midway Landfill. Finally, some 450 newspaper articles describing the landfill and other area waste sites were reviewed.

Findings

During its operation, the Kent-Midway landfill had caused direct impacts on nearby residents that included gas and odor problems and such health issues as respiratory problems and nose bleeds. But these effects did not attain the media attention created during the period when methane migration was discovered off site and some dozen families were forced to evacuate. Media coverage was so consistent during this period that one chain of regional newspapers created a special methane graphic that they used to accompany all articles dealing with the landfill. Newspaper articles detailed the tribulations these families had in being wrenched away from their homes and homelife, the disruption occasioned by their temporary settlement in motels, the fact that residents had to be accompanied by a fireman should they wish to stop at their house to pick up something, and the eventual permanent relocation of some families. There was great attention to the question of how safe it was to return to the area, with descriptions of insecure residents so attentive to their gas alarms that one reported, "I sleep with one ear open." (unknown, 1985). There was concern for health effects of the gas, particularly for children. Children in the neighborhood were reportedly worried that their houses might blow up or that their parents would be wiped out while they were away at school. At school, the methane threat became the source of stigma and taunting for children living in the affected areas. Families in affected neighborhoods were described by The Seattle Times (undated) as "living in a powder kegg" (p.B1). Residents interviewed talked of their fear that the colorless and odorless gas might enter their homes, making such innocuous actions as turning on an appliance into a life or death matter.

As the author has consistently found in such instances, impacts of contamination are harshly felt at the margins, where residents are not evacuated due to acute risk but are also not assured that they are safe. In the Midway case, methane meter readers made constant rounds as part of Seattle's monitoring effort, continually reminding residents of the problem and that they might at some point be forced to leave. Evident were such effects as the inversion of home, fears over adverse health effects, the breakup of social networks and neighborhoods as relocation began and family stress and guilt as residents debated the tradeoff risks of moving or staying.

Distrust of Seattle also sprang from many sources. The long history of the landfill facility itself gave rise to claims that the city had not heeded residents' complaints over the years. All time residents realized from what they had heard that toxic wastes were dumped there, a matter denied by the landfill before it was finally confirmed. The ongoing operation of the landfill was in itself an outrage for local residents, placing them in a situation they could do nothing about. This made them angry. Once the methane issue arose, residents were beset by an invisible threat---with the attendant fears of explosion, asphyxiation and evacuation---for which they were totally dependent upon the city for verification of safety. Many appear not to have believed assurances that the methane problem was gone. Furthermore, at various points, Seattle had promised full reclamation of the area, with sidewalks and a park with replanted trees. These promises became part of residential expectations for those who moved in thinking that the landfill was only a temporary intrusion in the neighborhood. When they were unmet, the failed promises became a further basis for distrust. One informant summed up how distrust contributed to feelings of insecurity in the situation.

The more I heard and read about, the more I became skeptical because I felt that there were no assurances at all of what they really know (how dangerous it is) and whether or not there was more they needed to take care of that was not being handled. I also wondered how much of their activity (drilling methane wells and the methane testing) was done just to appease the residents and how much more there needs to be done that they will not do.

Virtually every informant expressed feelings of distrust for Seattle and described their dealings with the city as a significant source of stress. In fact, it seemed that Seattle's response to the situation continually intensified stress and increased the distrust. This outcome is certainly evident if one examines the City's efforts to mitigate the environmental stigma associated with the landfill area in the wake of the detection of methane beyond the landfill property.

Seattle's Efforts to Mitigate Stigma Impacts

Seattle took several seemingly appropriate steps in responding to the landfill controversy beyond technical engineering efforts. For example, when concern that methane extraction wells placed in residential areas might vent benzene or other hazards into the neighborhood became the source of controversy and distrust, Seattle gave \$30,000 to a local community group to hire independent experts. Perhaps of greatest interest was the innovative effort by the city to address environmental stigma effects.

Environmental Stigma at Midway Landfill

Residents surrounding the Midway landfill found their neighborhoods to be defined by the contamination---particularly the methane escape---and by the attendant publicity. Perception of homes and residents in what came to be known as "methane meadows" was changed in devaluing and negative ways. This affected the ways that residents thought about their own neighborhoods. It also became a factor in the demographic shift in the area brought on by the city's policies, as described below. A taste for some of the aspects of this stigma can be gotten from a sampling of comments made by residents.

I was called by a realtor to see if I would list my house. But when I told him where I lived, they said that is the landfill area---we don't want to touch it.

The idea of living near a garbage dump---the word garbage is enough to make you ill.

If people ask me where I live, I say between Kent and Midway. They say "Is that near the landfill," and I go "oh no!" This happens often. There is a stigma for living in this locale.

Anybody you meet from this state knows.

My 5 year old grandson said he didn't want to go to grandma's house because the house "might blow up." It made me feel terrible.

The landfill is a stigma against us, isn't it!

People would make jokes about the smell, "has your house blown up yet?" "Oh you live over there!" "Oh, gosh, you live in that terrible neighborhood?" It certainly affected our feeling of pride in our neighborhood. When you get to the point that you won't say where you live.

When there was a meeting and people were upset about putting homeless people in those houses, my neighbor said that a lady told her "why are you so upset, your community is ruined anyway."

I didn't tell anybody I lived in Midway because people say they knew about Midway Landfill. Then I would say, "I live two blocks from it." They would say "Oh". That ends the conversation. Unfortunately, it took the landfill to put Midway into people's consciousness. There is still a stigma attached to Midway even though

GNP claimed to have maintained property values.

"Oh, you live by the landfill?"

This neighborhood had no problem because Midway Landfill was on the other side of I-5. It was not until we were considered to be a contaminated area that we developed a stigma. That resulted in houses not selling, vacant houses, people trying to leave the area. One person at work said the cost of garbage went up because I was so greedy. People say, "Why did you buy a house built on a dump?"

You would hear people talk about driving I-5. People would start to say, "you live at the landfill where the smell is at?"

Given the impact of the landfill on the social perception of the surrounding neighborhoods, it was not farfetched for an article lead in a Seattle newspaper to read: "For Sale: Beautiful Kent home. 3 bedrooms. Furnished with all appliances and supply of potentially lethal methane." (Seattle Times, 3/8/86, p.A8). Indeed, what realtors called a "state of suspended animation" settled over the area defined by the Department of Ecology for gas migration (Kent News Journal, 2/6/86). The Federal Way News reported one realtor's comment that "if you bought your house for \$100,000 near a landfill, you'd be lucky to get \$1,000 for it" (3/12/86).

These effects served to motivate Seattle's efforts to prop up property values and to stabilize the community.

The Good Neighbor Program

In late March 1986 the City announced a property stabilization effort called "The Good Neighbor Program." Under this program, the City offered to guarantee home prices at a level comparable to those expected had the landfill never existed or to comparable homes elsewhere in King County. Specifically, the City would pay the difference between the buyer's and the seller's prices. If a resident was unable to sell after 4 months, the city would buy the house. For those willing to stay, the city would subsidize home improvements. Community amenities would also be created to increase land values. The program was designed to persist until either ten homes in the gas-affected area sold for full market value without subsidy or two years after gas levels dropped consistently below 100 ppm. In fact, the program was closed to new enrollees in May 1988, two months after the tenth home was sold at full value. Through March 1988, a quarter of the nearly thousand homeowners in the designated area entered the program, with around 150 houses purchased by the city, two-thirds of which were then sold.

The program cost Seattle in the neighborhood of \$6 million (Seattle, 1986 and 1988).

The origins of the program were several. By February 1986 a settlement had been reached with evacuated and nearby residents on their claims for damages. Many other such claims were being received by the city. A meeting in early March provided a forum for hundreds of residents to complain about their difficulties in attracting buyers for their homes even though interest rates were low. Some residents complained that they were unable to refinance their homes because banks refused to talk to them. Realtors expressed concern over their obligations for disclosure and the need to build methane testing into realty contracts. There was much concern that the boundaries of the affected neighborhoods were ill-defined. Even in "gray areas," Fannie Mae loans were refused because of that agency's policy not to make loans in toxic/hazardous zones. Residents were deeply concerned that the city would settle only with evacuees and leave the rest stuck in the situation. Based upon suggestions made by an attorney working with a local community group to help families seeking to relocate, a proposal was developed that the city guarantee property values.

While a primary objective of the city in creating the program was to avert or settle law suits from people trapped in homes they wanted to leave, the program served many residents seeking a way to get out of the situation and regain control over their lives.

Failures of the Program

The primary goal of the Good Neighbor Program had been to encourage residents to stay in the affected neighborhoods. In this central mission, the program appears to have failed. While the program offered a way out for residents seeking to leave, it disappointed residents seeking to remain in their homes. Based upon the interviews, this failure appears to revolve around four issues: the introduction of an undesired demographic shift---with undesired changes in community norms; the marginalization of residents just outside the boundaries; terms that some residents found to be arbitrary, unfair and unacceptable; and the ending of the plan, closing off options for ambivalent residents. Each of these points is explored below.

Undesired Changes on the Neighborhood. As the author's informants described it, the original neighborhoods around the Midway Landfill underwent significant changes under the Good Neighbor Program. Residents described the pride that they and their neighbors had taken in their well-kept homes and the sense of belonging that they had felt for their very stable neighborhoods before the Midway Landfill problems. Residents had moved to the area because they saw it as desirable; they were

proud to live there. The sense of belonging and pride of ownership of home showed up in the well kept lawns and newly painted houses and in a general sense of well being in the neighborhood. These characteristics were changed by the Good Neighbor Program. Long-term neighbors were replaced by newcomers who---in moving into a stigmatized neighborhood where they could buy or rent cheaply---failed to show the same degree of commitment to the area as the prior neighbors showed. Their norms of behavior deviated significantly from what the oldtimers had come to expect and desire of their neighbors. The following paragraphs explain these changes in the informants' own words.

Linda Heights was a place where everybody agreed with the same things. Your children could play in the backyard. These things changed once houses sold in the area; there were rentals. Nothing personal against the new persons in the area but they are not interested in their houses; we have lost the effect of the community. They don't take care of their yards. I'm an outdoor person, it upset me.

In part this appears to be that a different class of people is now attracted into the neighborhood. They have different attitudes, less consideration and cooth. Lower socioeconomic class. They trespass on yards, park before others houses, block your driveway.

This was an attractive neighborhood. People were the solid citizen type, friendly but not nosey. There was community spirit. We would look out for one another. You would notice if somebody was not up and around that day. They would help out if something happened. We were trusting to one another, which isn't here now.

Our friends moved. We lost people that we were close to. As people came in with rentals, they didn't care about being a part of the community. They broke down the core community. The houses weren't kept up.

No the GNP didn't stabilize the neighborhood. Houses sold below fair market value. A lot moved out and rented. They moved somewhere else and didn't care what happened to the rest of us. We stuck it out thinking that Seattle would do something fair for all of us. They didn't do a thing for us. We fixed the house up for our retirement. We put money into it. I worry if something happens to one of us that we won't be able to get out what it is worth. It bothers me.

The sudden turn over in residences in the neighborhood changed the nature of the neighborhood. A poorer class of people---it sounds snobbish but true---the

neighborhood deteriorated. People did not take care of their home or yard. They did not control their kids. I feel that it has gone down hill. At one point I was out for a walk on 30th and 13 houses were listed for sale in 2 blocks. That is a lot of property to turnover at one time, and that is only one area not counting others.

When people started moving out, everything went downhill. It looked like hell. The prices of the houses dropped. People came and went. People moving rented. We saw a different pattern. When we moved into our home, it appealed to normal average people. When the price dropped, I hate to say it, but it looked like a lower class of person came in here. Everything went downhill. Certain homes on our street deteriorated. We noticed immediately. I was embarrassed. People considered this to be a neighborhood that had lower standards because the prices were down and no one lived here. It was really embarrassing. There are people with debris around their yard and their lawns not maintained. They don't paint. Nothing is maintained on the outside of their home. They weren't as friendly either. There were a lot of renters. We didn't know if they would be here a long time. There is less trust because there are so many new people. You lived with people, trusted and knew them; they had the same patterns you had and all of a sudden there are different people.

The close ties of the old neighborhood were destroyed. As the neighborhoods came to be seen as increasingly less desirable, some residents who had fought to remain in their homes now sought to cut their losses and move out. In other cases, they feared that property values were so low that they would be unable to leave if they sought to. In this way, the GNP appears to actually have motivated the attempted departure of the very residents originally most committed to staying. The neighborhoods were depreciated, not stabilized.

Marginalization of People Just Outside the Program's Boundaries. The seemingly arbitrary boundaries of the program excluded some residents from participating who wanted to leave their homes. As these residents realized that they were effectively trapped because of the boundaries, this became a major source for tension. Again, we cite the residents' own words.

One side of our street was in and one was out. It did nothing but antagonize the neighbors and myself. How could they draw that. It was fiction. It was like Seattle said "tough, you're outside. No problem."

Everybody on this side of 244 was arbitrarily excluded from the GNP. Our land values were affected just as much as anyone else's, but we were excluded. The city did more bad than good with the GNP. A couple of houses away they gave people the opportunity to get out. We didn't have that chance. All they gave us was a pamphlet; they didn't do a damn thing for us. We felt abandoned, left to our own devices.

Criticism of the Deal. Some residents reported dissatisfaction with the process of selling their homes to the GNP. The sale was governed by a series of appraisals that some found to undervalue houses, particularly against the cost of replacement housing in the area. A variety of rules that were seen as arbitrary governed the condition the house needed to be in for the sale to go through. Again, we can glimpse these problems through the words of respondents.

I was eligible for GNP but never explored participation. We had the opportunity to sell. We had to start the process by listing our house. We didn't think we were able to handle it. We had a market evaluation done, but we didn't do an appraisal because we didn't think that was an option because the market evaluation showed lower than other comparable houses in other areas. We felt we would lose money. We weren't in a position to do so. So we never listed. The way it worked was a house was listed for "fair market value" for Midway. If the house didn't sell for that, the city would make up the difference between what the seller was able to get and fair market value. But if I took money from this house, I would not be able to buy a comparable house because Midway housing values were so low. Also, I was retired. I was not in a position to take on a new mortgage when this one was almost paid for. And, finally, I was located here, and I did not want to move. The GNP actually decreased property values because houses sold for under market value. Even though the city made up the difference to the seller, the market price for the property listed as what it sold for---it devalued properties.

They had two appraisals---one theirs, one yours. In theory it sounds good. If you wanted, they'd do a third. But then you found out that you didn't really get yours. They hadn't accepted your appraisal if they didn't like the increase. It wasn't fair. And certain appraisers were blacklisted. They didn't tell you in advance, but you had to have new carpet and the walls had to be white before they would appraise it. Their appraisal was \$140,000. Our appraisal was \$138,000. The city did a third and \$144,000 was the average. Then

they lowered it because we hadn't got new carpeting, repainted and other things they expected to be new, like landscaping. If it wasn't painted off-white, they would deduct from the appraisal the cost of repainting, and they would deduct it again at closing. The appraiser arrived angry that he could not find the house. He spent 20 minutes. We asked him about the view, and he said that the view would not affect the value.

The GNP didn't stabilize the community. If anything it deteriorated the community. It broke it up. And the spirit and the belongeness of the community went down. I can't help but think that the city offered you less than what it was worth so that they wouldn't get stuck with the loss.

Respondents claimed that many people who left under the GNP program didn't feel they got a good deal for their homes. Not only were they not paid what their house was worth financially, but they received no consideration for the emotional and other values attached to the home. As in other instances where property purchase occurred, the valuing procedures were often felt to be devaluing by residents heavily invested financially and psychologically in their homes (see, for example, Reko, 1984).

The Ending of the Program. The most ambivalent residents put off making up their minds whether to leave. In some cases, they were waiting to see if the property stabilization would succeed. In others, other life factors influenced a delay in departure. In any case, some of these procrastinating residents suddenly found themselves racing the clock to participate in the program at a time when it was already too late. This became a further source of frustration, as these residents described it.

Near the end of the GNP program, they wanted to terminate it so they set strict deadlines. There was no time to find a comparable replacement home with as good a commuting situation. We would have lost \$25,000 or more if we had moved because of the high value of comparable homes.

We had just gotten a second mortgage before the GNP in Spring 1986. We were locked in. Initially, there was a big backlog. It looked like they wouldn't sell until 1987. We decided to wait until 1989 for our daughter to graduate and use the GNP if we needed it and the market hadn't improved. We thought the program would remain open.

By the end of the program, some residents reported that Seattle employees were not helpful in making sure that they could

set up the appointments with appraisers needed to participate in the GNP. Residents, on their part, were angry that, even though the program had not ended, it was effectively too late to participate.

Conclusion

In sum, then, the sample of residents interviewed by the author---although skewed in that they were residents who had not had their needs met by Seattle---indicate that the GNP program failed for them in a variety of instructive ways. It should be noted that the reports of this sample do not rule out the possibility that the program successfully served another sector of the population. But for the residents involved in the lawsuit, the GNP had served as a further source of stress. Rather than alleviating the burden placed on residents, as presumably it was intended to, it served instead to increase their anger and alienation. These comments by informants are instructive of the effect the program had on their sense of trust in the City.

People are really angry at the city for having done what they called a GNP in essence when they were covering their own asses. People really feel that they've been taken by the city. I certainly feel that way. This is a source of much of our stress. The stress results from the way that the city handled this and from future health doubts.

I don't see it. It alleviated Seattle's problems. They bought the house and got rid of the problem; people would get out of the area. They didn't help with anybody's problems except Seattle's. They didn't know how to help people in this situation, but they caused more problems for people. You could see it deteriorate. They closed the office at the church where you could ask for a settlement. If you called and asked for a (methane) monitor, they said they weren't doing that anymore. We were on a list for landfill information; it dwindled down. You called Seattle to ask these people something. They just work for a living; they wouldn't give an answer.

Seattle, having recognized the effects of environmental stigma, created a program to address its financial implications. Yet, the success of the Good Neighbor Program in assisting many residents to leave created even greater community impacts for those who stayed behind willingly or because they were unable to participate. Rather than community stability, the program induced a major transformation of the neighborhoods surrounding the landfill. Furthermore, even in acting to restore property values damaged by their facility, Seattle became increasingly distrusted as their program proceeded. The Seattle case study illustrates

some of the challenges involved in attempts to mitigate for environmental stigma and to restore trust.

Specifically, the Seattle Good Neighbor Program shows that efforts to mitigate stigma may even broaden or intensify adverse community impacts, at least in the relative near term. Unlike Love Canal, where entire neighborhoods were ordered out or offered resettlement, in the Midway case, an attempt was made to get people to stay. Yet, in the Midway neighborhoods, a significant depopulation of original residents and resettlement with new residents occurred. The case study raises the question of whether the original tainted community must be destroyed in order to be saved. Once contaminated, it can only thereafter be home to those who were outsiders to the original events and who have a normal rather than contaminated belief system.

CONCLUSIONS---SITUATIONAL AND DISPOSITIONAL IMPACTS

Neither distrust nor environmental stigma are unidirectional variables. Both are complex dynamic states. Because mitigation, by definition, is merely the absence of the threat, there is an inherent problem in the concept of mitigating for distrust and stigma. The absence of distrust does not constitute a state of trust. Similarly, the absence of stigmatizing factors does not constitute a condition of positive community or self image.

Paralleling the model used by social psychologists to think about people (Heider, 1958), it may be useful to reflect on the utility of the distinction between dispositional and situational characteristics of an environmental contamination. Dispositional characteristics belong to the contamination, whereas situational characteristics belong to the context into which the contamination has occurred or is placed, over time.

The author concluded some time ago that "waste"---in this case nuclear waste---is inherently stigmatizing. As a human-caused condition, it is absent good features. In contrast, its bad features are legend (and, unfortunately, reality). Because stigma is an inherent characteristic of nuclear waste, it makes little sense to pretend that the stigma is a situational characteristic. Furthermore, it appears that mitigation only works for situational characteristics. This is not to suggest that some of the impacts of stigma cannot be eased or erased by targeted programs---such as property-value compensation. But in most cases, mitigation---by definition---misses the mark because the basis of the stigma is not addressed. For example, community benefit packages, while important perhaps for the sake of short term compensation and fairness, do not necessarily address stigma issues. They may be a benefit that offsets a negative, in a crude quantification, but only in a fictional cost-benefit sense. Short of hiding the contaminants or of culturally-reprogramming their meaning, the inherent stigma of nuclear wastes is a fixed

dispositional property that cannot be reduced through mitigation unless the contaminants themselves are removed.

Does this mean that mitigation should not be attempted for stigma? Not necessarily. As noted, some symptoms of stigma are mitigable---such as property value issues. These mitigations do not reduce the stigma---which is inherent---but they compensate individuals for the adverse effects of the stigma.

But is distrust also a dispositional characteristic of contamination? Generally, distrust can be thought of as a dynamic situational characteristic. In theory, then, distrust should be accessible to mitigation. However, the effect of the eco-historical context on distrust---its reification as a disposition---is not easily reversible because the very essence of trust---the willingness to assume good intentions---may be absent.

Ironically, the siting of new stigmatized facilities does not escape this problem because the intention (siting the facility) is a sufficient basis for distrust even without historical foundation. It is from the relationship of trust and environmental stigma, in fact, that we see that there is an inherent dispositional basis for distrust in this situation. Specifically, by definition, a trusted relationship cannot develop if the understood intent of the relationship involves harm. Because the end result of siting is to leave the community with a stigmatized facility, for those who perceive the stigma at least, it is an oxymoron to speak of trust.

BIBLIOGRAPHY:

American Psychological Association, Briefs of Amicus Curiae, U. S. Supreme Court, October Term, 1982.

Baker, Brian. "Perception of Hazardous Waste Disposal Facilities & Residential Real Property Values." Impact Assessment Bulletin, 6,1,1988, 47-54.

Barton, Alan. Communities in Disaster. Garden City: N.Y.: Doubleday, 1969.

Baum, Andrew, Raymond Flemming and Jerome Singer. "Coping with Victimization by Technological Disaster." Journal of Social Issues, 1983, 39, 117-138.

Bogard, William. The Bhopal Tragedy: Language, Logic, and Politics in the Production of Hazard. Boulder, Co.: Westview Press, 1989.

Congress (U.S.), (The) National Environmental Policy Act of 1969.

L. 91-190, 42 United States Congress 4321-4347.

Council On Environmental Quality. "Regulations For Implementing the Procedural Provisions of the National Environmental Policy Act." Reprint 40 CFR Parts 1500-1508, as of July 1, 1986.

Couch, Stephen and J. Stephen Kroll-Smith. "The Chronic Technical Disaster: Toward a Social Scientific Perspective." Social Science Quarterly, 1985, 66, 564-575.

Covello, Vincent. "Testimony of Dr. Vincent T. Covello on the Psychological Impacts of SCRF 6," prefiled testimony for Rivkin, Radler, Dunne & Bayh and Sive, Paget & Riesel, P.C. in the matter of the application of CECOS International, Inc. for the proposed Secure Chemical Residue Facility #6, application #90-85-0551, October, 1988.

Easterling, Douglas and Howard Kunreuther. "The Vulnerability of the Convention Industry to the Siting of a High Level Nuclear Waste Repository." Unpublished paper of the Wharton Risk and Decision Process Center, University of Pennsylvania, September, 1990(a).

-----, "Siting Strategies to Install Trust and Legitimacy: The Case of Radioactive Waste Repositories." Paper presented at the symposium on Hazardous Materials/Wastes: Social Aspects of Facility Planning and Management, Toronto, Ontario, Canada, October 2, 1990(b).

Edelstein, Michael R. "Ecological Threats and Spoiled Identities: Radon Gas and Environmental Stigma," in Stephen Couch and J. Stephen Kroll-Smith (Eds.), Communities at Risk: Community Responses to Technological Hazards. Worster: Peter Lang, forthcoming 1991.

-----, "Psychosocial Impacts on Trial: The Case of Hazardous Waste Disposal," in Dennis Peck (Ed.), Psychosocial Effects of Hazardous Toxic Disposal on Communities. Springfield, Ill.: Charles Thomas, 1989.

-----, "Stigma and Hazardous Waste Siting." Paper presented at Washington State University's conference on Hazardous Waste, '89 "Strategies for Site Cleanup," Spokane, Washington, September 18, 1989.

-----, Contaminated Communities: The Social and Psychological Impacts of Residential Toxic Exposure. Boulder, Co: Westview Press, 1988.

-----, "Intervenor Concerned Citizens Organizations Prefiled Testimony of Psychological Impact Issues," report for Milbank, Tweed, Hadley and McCloy in the matter of the

application of CECOS International, Inc. for the proposed Secure Chemical Residue Facility #6, application #90-85-0551, October, 1988.

-----, "Toward a Theory of Environmental Stigma," pp. 12-25 in Joan Harvey and Don Henning (eds.), Public Environmental Stigma, Ottawa, Ca.: Environmental Design Research Association, 1987.

-----, "Disabling Communities: The Impact of Regulatory Proceedings." Journal of Environmental Systems, 16(2):87-110, 1986/87.

-----, "Psychosocial Impacts on the Community." Report for the socioeconomic study of the proposed Richton High Level Nuclear Waste Repository, 1985.

-----, "Stigmatizing Aspects of Toxic Pollution." Unpublished report prepared for the Law firm of Martin and Snyder, 1984.

Federal Way News. "Low Interest Doesn't Help Homeowners." 3/12/86.

Finsterbusch, Kurt. "Typical Scenarios in Twenty-four Toxic Waste Contamination Episodes." Paper presented at the meeting of the International Association for Impact Assessment, Barbados, June 1987.

Fowlkes, Martha and Patricia Miller. "Love Canal: The Social Construction of Disaster." Report to the Federal Emergency Management Agency, 1982.

Freudenburg, William. "Risk and Recreancy: Weber, The Division of Labor, and the Rationality of Risk Perception." Paper to be presented at the American Sociological Assoc., Cincinnati, Oh., Aug. 24, 1991.

Goffman, Erving. Presentations of Self in Everyday Life. Englewood Cliffs, N.J.: Prentice-Hall, 1959.

-----, Stigma: Notes on the Management of Spoiled Identities. Englewood Cliffs, N.J.: Prentice-Hall, 1963.

Goldstein, Raymond and John Schorr. Demanding Democracy After Three Mile Island. Gainesville: University of Florida Press, 1991.

Heider, Fritz. The Psychology of Interpersonal Relations. N.Y.: John Wiley and Sons, 1958.

Ichheiser, Gustav. "Misunderstandings in Human Relations," Supplement to The American Journal of Sociology, September 1949.

LV, pp. 6-7.

Jones, Edward, Amerigo Farina, Albert Hastorf, Hazel Markus, Dale Miller and Robert Scott. Social Stigma: The Psychology of Marked Relationships. N.Y.: W.H. Freeman, 1984.

Jorling, Thomas. Interim Decision in the Application of the Development Authority of the North Country for Permits to Construct and Operate a Solid Waste Management Facility in the Town of Rodman, Jefferson County, N.Y., July 24, 1990.

Kahneman, Daniel, Paul Slovic and Amos Tversky. Judgment under Uncertainty: Heuristics and Biases. N.Y.: Cambridge University Press, 1982.

Kent News Journal, "Realtors Know of Midway's Sales Impact." 2/6/86.

Lerner, Melvin. The Belief in a Just World: A Fundamental Delusion. N.Y.: Plenum Press, 1980.

McQuaid-Cook, Jennifer and Simpson, Kenneth. "Siting a Fully Integrated Waste Management Facility in Alberta." Hazardous Waste Management. 36(9):1031-6, September 1986.

Murrell, D. and C. Magorian. siting Hazardous Waste Facilities: Local Opposition and the Myth of Preemption. Cambridge, Ma.: Ballinger, 1982.

Pannell, Kerr, Forster. "Tourism Impact Study: Proposed OWMC Hazardous Waste Treatment Facilities." February 1985.

Petterson, J.S. "Perception vs. Reality of Radiological Impacts: The Colania Model." Nuclear News, 1988, 31, 14, 84-90.

Reko, H. Karl. "Not an Act of God: The Story of Times Beach." Unpublished report, 1984.

Rosenman, Robert and Rodney Fort, "Perceptions, Fear and Economic Loss: Issues in the Siting of a High Level Nuclear Waste Repository." Undated and uncited reprint.

Ryan, W. Blaming the Victim. N.Y.: Pantheon, 1971.

Seattle, Engineering Department News Release, "Good Neighbor Program Home Sales." December 22, 1986.

-----, "Seattle-Kent Good Neighbor Program to End." March 29, 1988.

Seattle Times, "Buried Garbage is an Explosive Threat." Date Unknown, p. B1.

-----, "Residents Ask for Landfill Relief." 3/3/86,
P. A8.

Slovic, Paul, Baruch Fischhoff and Sarah Lichtenstein,
"Psychological Aspects of Risk Perception" pp. 11-42 in Sills,
David, Wolf, C.P., and Shelanski, Vivian (Eds.), Accident at
Three Mile Island. Boulder, Co: Westview Press, 1982.

Slovic, Paul, Mark Layman, Nancy Kraus, James Flynn, James
Chalmers and Gail Gesell. "Perceived Risk, Stigma, and Potential
Economic Impacts of a High-Level Nuclear Waste Repository in
Nevada." Unpublished paper, Decision Research, 1201 Oak St.,
Eugene Oregon, August, 1990(a).

Slovic, Paul, Mark Layman and James Flynn. "What Comes to Mind
When You Hear the Words 'Nuclear Waste Repository'? A Study of
10,000 Images." Unpublished paper prepared for the Nevada Agency
for Nuclear Projects, Yucca Mountain Socioeconomic Project, Phase
IV-B, Tasks 8.5 and 8.6, November 1990(b).

-----, "Images of Place and
Vacation Preferences: Implications of the 1989 Surveys for
Assessing the Economic Impacts of a Nuclear Waste Repository in
Nevada." Unpublished paper prepared for the Nevada Agency for
Nuclear Projects, Yucca Mountain Socioeconomic Project, Phase IV-
B, Tasks 8.5 and 8.6, November 1990(c).

Stoffle, Richard, Michael Traugott, John Stone, Paula McIntyre,
Florence Jensen and Carla Davidson. "Risk Perception Mapping:
Using Ethnography to Define the Locally Affected Population for a
Low-level Radioactive Waste Storage Facility in Michigan." Draft
manuscript of the Institute for Social Research and School of
Natural Resources, February 6, 1991 (clear for final)

Unknown, "Methane Gas: Family is 'Angry and Scared', 1985.

Vyner, Henry. Invisible Trauma: The Psychosocial Effects of
Invisible Environmental Contaminants. Boston: Lexington Press,
1988.

Wlodarczyk, Thomasz. "Mitigation and Waste Management Facility
Siting," Impact Assessment Bulletin, 8,3, 1990, 45-61.

1. The author wishes to thank Judith Ferry, Esq., Region 3 Attorney for the New York State Department of Environmental Conservation, Scott Thornton, Chairperson of OCSLIP, and Dr. Deborah Kleese, Empire State College, for their helpful comments on drafts of this document.

2. The CECOS case study is based upon work funded by the law firm of Milbank, Tweed, Hadley & McCloy as part of their pro-bono representation of the Concerned Citizens interveners in the permit hearings on the proposed sixth hazardous waste disposal area at the CECOS property in Niagara Falls, New York. The author appeared as an expert witness on psychological impacts on behalf of Concerned Citizens. The assistance of Brent Olesen, Esq., Stephen Kroll-Smith, Ph.D., Gerald Goldhaber, Ph.D. and the Ecumenical Task Force of the Niagara Frontier is gratefully acknowledged.

3. Regarding the inappropriateness of the Swan Hill case study, several points can be made. The Alberta siting case cited in support of the CECOS strategy was hardly applicable. There has been no evaluation of psychosocial impacts from the Alberta facility. Furthermore, major differences between the Swan Hill and SCRF #6 cases limit the validity of generalizations. Specifically, the Swan Hill facility was a new facility located in a low visibility area 10 km from a community lacking any history in dealing with hazardous wastes. It was a government project with a late and limited role for the private operator. The community controlled the siting process from the onset; the effort involved an invitational process driven by incentives and voluntary participation and the final decision was dependent upon majority support in a plebiscite in the host community (McQuaid-Cook and Simpson, 1986).

4. The case study of the Orange County Landfill Permit reflects the author's ongoing activism regarding the site since 1980. From 1980 to 1983, the author was president of a local environmental group called The Goshen Area Resources Association. From 1983 through the present, he has been president of a county-scale non-profit environmental organization, Orange Environment, Inc. In both capacities, he has generally been the most high profile citizen involved with the facility. To assist in developing the case study, a review was made of extensive records of meeting minutes, correspondence and other records. A lengthy interview was held with Ralph Manna, Region 3 Director of the DEC on July 24, 1991. Briefer discussion were also held with other DEC personnel and with Mr. Scott Thornton, chair of OCSLIP.

5. While the Region opposed the permit outright, OE sought to limit any permit to a limited site and a short period of operation, if safely achievable. OE's position reflected its effort to balance concern over the public's need for a waste

disposal facility with the poor siting and questionable design of the proposed facility. A result of these varied positions was that the Region played the role during the hearings of being the "opposition," while OE attempted to find some middle ground.

6. For example, the commissioner of the DEC, in a ruling on another landfill case, clearly ruled that community benefits should be dealt with outside of the permit process, as an independent agreement between the facility operator and the community. Because such programs do not mitigate environmental impacts, per se, they are outside the scope of the State Environmental Quality Review Act, and, therefore, outside of the DEC's purview (Jurling, 1990).

7. The research reviewed here was conducted as part of the author's preparation for testimony in the lawsuit "Abelman et al v City of Seattle." Research was supported by the law firm of Short Cressman and Burgess, the plaintiff's attorney. The author is indebted to Brian Lawler and Jan Shave of the firm for their support. The case was settled after the research was completed and just prior to the trial date, around the end of 1990. Note that quotes by residents are drawn from the author's field interviews.

END

**DATE
FILMED**

7 / 7 / 93