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Hillview-Porter Regional program : a case study of a multiple stakeholder environmental dispute using a system science approach

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HILLVIEW-PORTER REGIONAL PROGRAM
A CASE STUDY OF A MULTIPLE STAKEHOLDER ENVIRONMENTAL DISPUTE USING A SYSTEM SCIENCE APPROACH

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Master of Science

By

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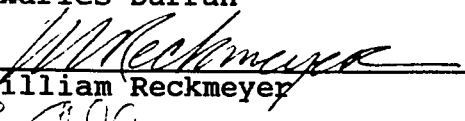

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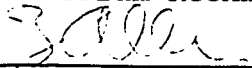

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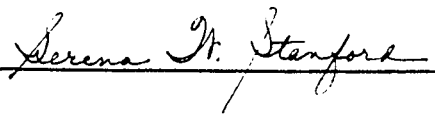

ABSTRACT

HILLVIEW-PORTER REGIONAL PROGRAM
A CASE STUDY OF A MULTIPLE STAKEHOLDER ENVIRONMENTAL DISPUTE
USING A SYSTEM SCIENCE APPROACH

by Judy C. Fulton

This thesis addresses the question of how multiple stakeholder environmental disputes (MSED) develop as systems which overwhelm conventional problem solving models. It addresses this through a case study of a real world MSED to understand its structure, behavior, and evolution, and how it thwarted various efforts to "solve" it.

Research on this subject reveals that the interdependency that is created between the stakeholders and the complexity of the situation require new management strategies. However, a paradigm shift in how society perceives environmental problems is necessary before these strategies can be developed and used effectively. This shift would be away from conventional approaches that focus narrowly on technical issues and deal with different interests through adversarial relationships, to one that can include and address different interests and multiple perspectives.

To my Mother, who knew I could, and
Michael, who insisted

ACKNOWLEDGEMENTS

I wish to express my sincere appreciation to Professor Charles Darrah for his time and commitment toward the completion of this manuscript. Special thanks are due to Dr. Rifkin for his suggestion that I look at the contributions of the mediation field in environmental disputes, and to Mary Lazzeri and Mike Creech for reading and rereading multiple drafts and giving me much needed emotional support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BPA	Barron Park Association
CEO	Chief Executive Officer
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Remedial Cleanup and Liability Act
CRP	Community Relations Plan
DCE	dichloroethylene
DHS	California Department of Health Services, Toxic Substances Division
EIR	Environmental Impact Report
ENSR	Name of a consulting firm
EPA	Environmental Protection Agency
FS	Feasibility Study
HMCC	Hazardous Materials Coordinating Council
HP	Hewlett-Packard Company
HPRP	Hillview-Porter Regional Program
IRM-FS	Interim Remedial Mitigation - Feasibility Study
MSED	Multiple Stakeholder Environmental Dispute
P.A.W.	Palo Alto Weekly (a local newspaper)
ppb	parts per billion
PRPs	Potentially Responsible Parties
RAO	Remedial Action Order

RI/FS	Remedial Investigation / Feasibility Study
RPs	Responsible Parties (Responding Parties)
RWQCB	Regional Water Quality Control Board - San Francisco Bay Region II
SCVWD	Santa Clara Valley Water District
T.T.	Peninsula Times Tribune (a newspaper)
TCA	trichloroethane
TCE	trichloroethylene
VOCs	volatile organic compounds

CHAPTER I

MULTIPLE STAKEHOLDER ENVIRONMENTAL DISPUTES

The ability to manage multiple stakeholder environmental disputes (MSEDs) reflects the conceptual models used. Typically these models are not used consciously nor made explicit, making it difficult to assess their adequacy. Yet the difficulty in managing MSEDs, and their increasing frequency, requires a new look at conventional models for environmental problem solving. This thesis presents a case study of a real world MSED from a systems perspective to better understand the constraints they place on conventional problem solving models.

1.1. Identification of Problematic Situation

Environmental problems are complex and frequently difficult to manage effectively. The increasing number of environmental disputes involving multiple stakeholders has exacerbated this situation. Multiple stakeholder disputes are defined here as disputes with more than two parties involved in a controversy. Such disputes are a common occurrence in human affairs and often are not distinguished

from two party disputes, although some scholars believe multiple stakeholder disputes are fundamentally different from two party disputes due to their increased complexity (Bacow and Wheeler 1984, 116).

Multiple stakeholder disputes present participants with overlapping networks of possible agreement, while simultaneously increasing potential sources of conflict (Bacow and Wheeler 1984, 104). They exacerbate logistical problems of coordination and bring together a wider variety of problem definitions and acceptable solutions. All of these attributes increase the potential complexity of MSEDs compared to two party disputes.

MSEDs also pose a significant challenge to environmental regulatory agencies. However, these agencies mandated to protect the environment, have come to rely on approaches that have led to an increasing dependence on the advice of technical experts[1] and procedures. These types of approaches do not address the potential complexity of MSEDs. They will be referred to collectively as *conventional approaches* in this thesis.

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[1]The important role of science in our society has been well documented. The following are just a sampling, with full references in the list of sources consulted: (Berman 1981; Bronowski 1965; Capra 1982; Harman 1988; Kuhn 1962; Ravetz 1971; Rifkin 1990; Worster 1977).

A dilemma emerges when the technical experts become included in MSEDs, for their expert opinion is just one perspective among many. Precisely how this expertise becomes integrated into a solution satisfactory to diverse stakeholders is contentious. Another limitation of conventional approaches is that they lead to expensive, time consuming litigation that does not address the "real" problem (Bacow and Wheeler 1984). Perceptions of unfairness, inefficiency, inappropriate scheduling of activities, and unresponsiveness to impacted parties are all too common.

The reasons cited for this ineffectiveness are numerous. They include: inherent defects in the system resulting from the "statutory embodiment of environmentalism" (Ruckelshaus 1985), dealing with symptoms while disregarding underlying causes (California 2000 Report 1982), narrow perceptions of reality that no longer are adequate for dealing with major problems (Capra 1982), the breakdown in decision making techniques by institutions resulting in actions based on inadequate conceptual models (Glass and Watt 1989) and, the loss of a unified world view and the conflicting social actions that result (Larnson 1989).

Though there is disagreement about why conventional approaches are inadequate, there is consensus regarding

their inability to resolve disputes. An alternative approach referred to as environmental dispute resolution was developed to redress the problem. Bingham (1986, *xv*) uses the phrase *environmental dispute resolution* to refer collectively to a variety of approaches that allow the stakeholders to meet face to face to reach a mutually acceptable resolution of the issues in a dispute or potentially controversial situation. Initially supported by governmental and research foundations, environmental dispute professionals have found a limited market for their services. There are serious concerns about their ability to remain neutral if the service is paid for by a client with a preferred outcome. According to a study by Cormick, Putton and Bellman (Amy 1987, 80), only where the disputants have a relative balance of power and have come to an impasse in the controversy do parties even seek dispute resolution services. This excludes most disputes from the benefits of such services, since a balance of power is seldom realized.

Regardless of the present problems of environmental dispute professionals, it is likely that services like theirs will become increasingly important. Perceptions of environmental problems have changed due to new technological capabilities. With the technology to detect chemical pollutants in the parts per trillion range, to view the earth from space, and to process large quantities of

information, people are developing a global awareness about the complex consequences of our actions on the environment. Many are reshaping their values and priorities based on this awareness. The increase in environmentalism may relate to the growing awareness of the long-term consequences of our actions, but this alone does not lead to agreement about what to do. Instead, this increasing awareness has brought many more people into environmental discussions and debates with sharply divided views.

In addition, legal and procedural trends increase the likelihood of MSEDs. New legislation and the creation of court precedents have further opened the doors to multiple stakeholder involvement. Some states require that identified stakeholders participate in a negotiation process.[2] Regulations and procedures requiring that environmental protection agencies involve communities also exist. There are also new strategies as agencies attempt to deal with geographically expansive problems such as groundwater contamination. An example of this is the grouping of potentially responsible parties together under one enforcement order, automatically creating a multiple stakeholder dispute situation.

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[2]Amy (1987), a political scientist, warns that this may not be an appropriate use of this method.

Environmental problems are not always contained by political or legal boundaries, and as boundaries are crossed the number of stakeholders increases. One solution has been the creation of agencies whose boundaries match natural air or water basins. Still, these agencies can not transcend national boundaries, nor can they deal with the interactions between air, water and land. The different interests of impacted parties and different jurisdictions of agencies inevitably lead to the involvement of multiple stakeholders.

Finally, the principle that people should have direct input on issues that affect them is a highly held value in our society, one that leads to the search and support for mechanisms that encourage this type of participation. With this value MSEDs then become a critical and important arena to practice responsible citizenship.

The increasing frequency of MSEDs presents a problem as well as an opportunity. Multiple stakeholder disputes can end as costly litigation cases or in impasse where nothing is resolved. In some situations the substantive issues get lost among the less tangible, but just as real, group and personal dynamics. This represents a cost to society in resources spent on unyielding issues or in the consequences of forcing premature, unsustainable resolution. The opportunity represented by the participation of different groups and interests is that of increased variety

of perspectives and information. Systems philosopher C. West Churchman notes, "there are no simple questions and . . . the process of addressing a specific question will eventually require answers to more and more questions" (Churchman 1982, 117). It requires a "sweeping-in" process of bringing together a broad spectrum of viewpoints and perspectives on the issue. This process of widening the scope of issues may increase the likelihood of a wise and sustainable solution.

1.2. The Conceptual Framework to the Research Problem

This thesis addresses the question of how MSEDs develop as systems which overwhelm conventional problem solving models. It addresses this through a case study of a real world MSED to understand its structure, behavior, and evolution, and how it thwarted various efforts to "solve" it.

The thesis uses a conceptual framework which may be described as systemic. A conceptual framework allows analysts to organize and interpret observations and data. Descriptively, the conceptual framework acts as a filter through which the analyst sees and as such, it sensitizes analysts to some phenomena, as it blinds them to others. Yet a framework is necessary to sort all the details into something meaningful to the purpose of the inquiry.

For this study the conceptual framework must explicitly address the complexity of MSEDs. The goal is to allow us to understand this complex phenomenon while keeping its identity as a whole intact. It must capture multiple perspectives of the problem situation without assuming that there is one correct view.[3] Many observers and participants of MSEDs believe the key to understanding them is that their stakeholders see the same situation differently. The systems approach includes the observer in the system and allows the investigation to include multiple perspectives and viewpoints.

Finally, the conceptual framework must incorporate change through time and identify patterns of change. The dynamic nature of human activity and interactions makes a static view of the system inappropriate. In this study I use the systems approach to look at an MSED as a system

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[3]Many scholars have addressed the importance of identifying different understandings of a problem situation. The understanding, accurate, useful, or not, can determine the system of relationships between participants by their affect on whom decision makers consider as "experts" with legitimate viewpoints (Rifkin 1990). Analysts need multiple models or viewpoints to develop a rich picture, to sweep in as much as possible to choose relevant aspects of a system (Checkland 1981, 166). The different perspectives also represent different models of a situation. The importance of using multiple models in determining a fuller problem formulation is supported by Allison, Steinbruner, Andersen and Linstone's work (Linstone 1984).

which becomes something that emerges from the interaction of its parts and the larger systems that constrain it.

Following Ashby, I define a system as "a set of variables selected by an *observer* with the constraints across variables he either discovers, hypothesizes or prefers" (Krippendorff 1986). Checkland expands this point by stating that a system is an observer construct or model (Checkland 1981); accordingly, a system is not separate from its observer. The critical test is whether the systems approach enhances our understanding of why MSEDs are problematic to those involved, and how new ways of resolving them may be developed.

1.3. The Case Study: Hillview-Porter Regional Program

The Hillview-Porter Regional Program (HPRP) came to my attention as I was working as an environmental regulatory specialist for a computer firm.[4] In this role I managed an investigation for possible groundwater contamination on a site located in the Hillview-Porter area. Over the next year I watched as the situation changed from a locally defined problem to an ill-defined regional one. I recognized that the frustration and confusion over the issues was somehow connected to the interdependence of the

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[4]Appendix B outlines the author's background in the environmental field.

stakeholders, although the nature of that interdependence was unclear. Most of the participants agreed that something was not working, but the nature of the problem was different depending on who was asked. After leaving the firm, I decided to follow the situation while working toward a degree in the Cybernetic Systems Program at San Jose State University.

At the heart of the controversy was groundwater contamination that resulted from past chemical handling practices of various firms in the area. There were multiple contamination sources, some of which resulted from leaking pipes and sumps from buildings no longer standing and industrial tenants who had long since moved. Other sources of contamination were on the sites of current industrial tenants. Over the years chemicals from these sources had penetrated the soil, reached groundwater and began flowing toward a residential community.

This occurred in the area shown in figure 1, at the base of the coastal foothills on the bay side of the San Francisco peninsula. Several creeks flowed through the area, the most important of which is Matadero Creek which separates the Barron Park residential community from the Stanford Research Park.

The Stanford Research Park is part of the original farm that Leland and Jane Stanford granted to Stanford

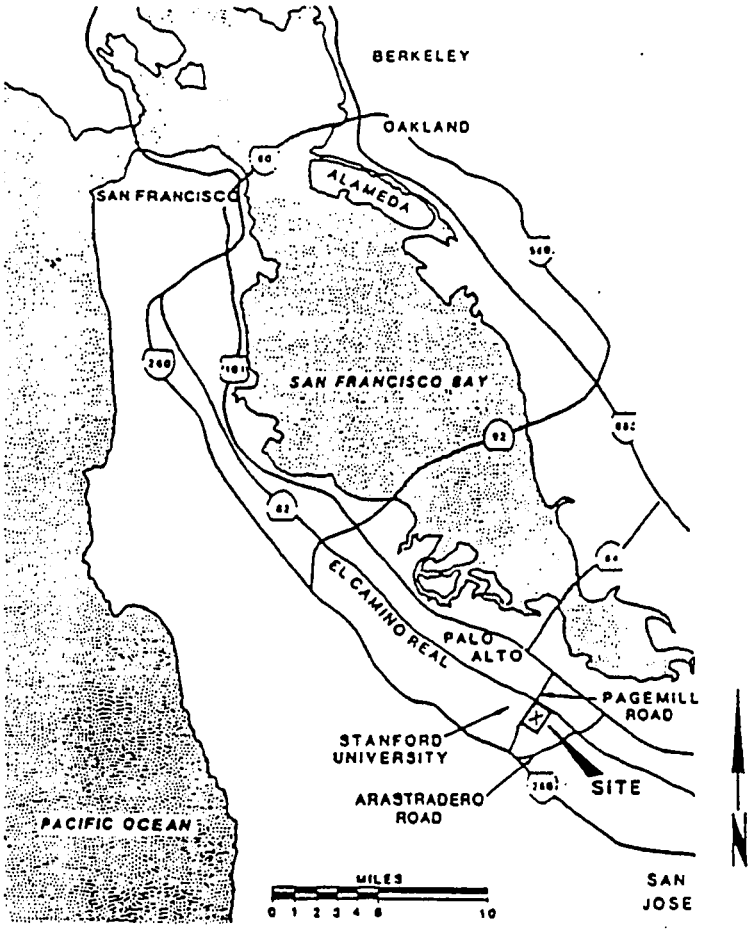

Figure 1. Location of Hillview-Porter Site, Palo Alto, California (Source: CH_2MHill 1986a)

University with the condition that it could not be sold (Allen 1986). The majority of industrial tenants that have leased this land are involved in research, electronics, microwave or bio-technologies. The part of the research park that was believed to contain the sources of contamination is called the Hillview-Porter site, the name

coming from two streets that cross through the center of area. Figure 2 shows a map of the region.

The Barron Park community is situated north-east and down stream from the Hillview-Porter site. The community has a history of activism, primarily through the Barron Park Association (BPA). BPA is a homeowner association that sponsors Boy Scout troops, plants trees, and generally deals with any issues that may impact the community.

The actors involved in HPRP can be grouped into three categories. The first consists of those parties potentially responsible for the contamination. It includes Stanford University as the landowner, and the industrial tenants known and suspected of contributing to the groundwater contamination. They are referred to as potentially responsible parties (PRPs) or responsible parties (RPs), depending on the strength of the evidence. The second group consists of those parties potentially impacted by the contamination. It includes the residents of the Barron Park community. The third group consists of those parties mandated by law to regulate the contamination. It includes the California State Department of Health (DHS) as the lead agency, with the San Francisco Bay Regional Water Quality Control Board (RWQCB) and the Environmental Protection Agency (EPA) as supporting agencies. The City of Palo Alto also participated, but in a minor role. Table 1 lists the

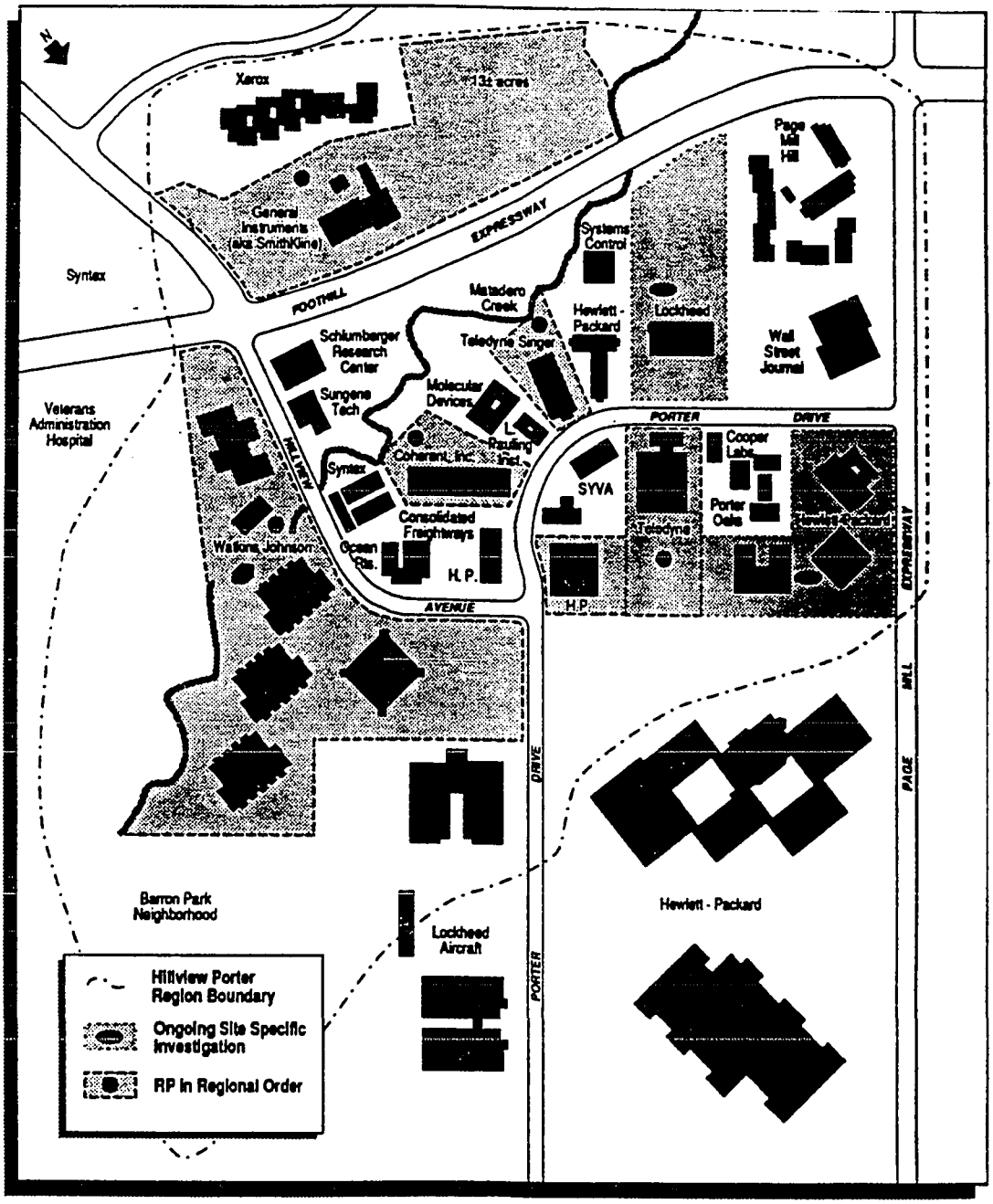

Figure 2. Hillview Porter Region (Source: ENSR March 1989a)

stakeholders and their relationship to the groundwater contamination.

I chose the HPRP as a representative multiple stakeholder environmental dispute because the diverse stakeholders have clearly differing viewpoints and interests regarding the contamination. Like all MSEDs, the case is complex, ambiguous, ill-structured, and problematic to those involved.

The complexity, always the result of problem formulation, stemmed here both from the differing viewpoints about the groundwater contamination, and from the technical difficulties of cleaning up multiple, overlapping contamination plumes[5] in a complex geological regime. In addition, the case was complicated by the many laws and regulations that applied to it and the resulting overlap of governmental agencies' authority.

The ambiguity was due to the low concentrations of toxic chemicals found in the groundwater under the community. Available technology and knowledge are unable to provide definitive answers about health risks or cleanup effectiveness at these low concentrations.

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[5]A plume describes the contaminated portion of the groundwater. The contaminants flow with the groundwater away from the source, in some ways, similar to smoke from a smokestack. Plumes take different shapes depending on the chemical released, and lithology and hydrology of the area.

Table 1.--Stakeholders' Involvement in HPRP

Group I: Potentially Responsible Parties

Stanford University: Owns the Stanford Research Park land and is landlord to the industrial tenants located there. Potentially liable for cleanup costs if tenants do not, or are unable to mitigate groundwater contamination.

Industrial Tenants:[a] Located in the Stanford Research Park, potentially responsible for the release of chemicals to the groundwater. Are liable for cleanup of the contamination if shown responsible.

Group II: Impacted Community

Barron Park Community: Located adjacent to the Stanford Research Park. Concerned about the potential health threat and decrease in real estate values.

Barron Park Association: Consists of Barron Park residents who attempt to create a role for themselves in groundwater decisions that affect the community.

Group III: Regulators

RWQCB: The state agency responsible for water quality.

DHS: The state agency responsible for hazardous waste regulations and public health.

EPA: The federal agency responsible for environmental protection.

City of Palo Alto: Local city government responsible for California Environmental Quality Act (CEQA) implementation, and local ordinance enforcement. City libraries acted as information repositories.

[a] The industrial tenants consisted of three categories: those named by the regulating agency as 1) responsible, 2) potentially responsible, or 3) shown not have contributed to the groundwater contamination.

The case was also problematic and ill-structured. This was exemplified by the frustration experienced by the participants. The regulatory agency discovered that their conventional procedures backfired and led to unexpected responses from the other stakeholders. Industrial tenants had to transform their normal relationships with each other and work as a group to function in a new procedural environment. The community had to be continuously vigilant so as not to lose ground in the battle to determine who had the right to shape final decisions.

Although HPRP is a typical MSED, it is unique in one aspect. The lead regulatory agency had attempted to use an untested procedural approach that grouped different industries together under one regional enforcement order. This created a subset of multiple stakeholders consisting of the various industries named in this order. This arrangement does not detract from the value of studying this case as a representative MSED, but instead adds more complexity to an already ambiguous situation.

1.3.1. Research Conduct and Design

In designing this study, I relied heavily on the people I met during my work as an environmental specialist. These relationships allowed me access to people and information that otherwise would have been unavailable.

Though working from the inside brings with it special insights, the wealth of data sometimes obscures the broader patterns. The management of the primary, detailed information gathered from 1988 through 1990 became a major challenge of the study.

My research consisted of collecting archival data to be used in the description of HPRP as a chronological sequence of events and in its analysis as a system. I collected data from various sources for the years between 1982 and 1990.

I adopted the case study approach to explicate how one MSED unfolded through time. This approach is appropriate when the research focuses on a contemporary phenomenon in its setting, when the phenomenon is not clearly distinct from its context, and when multiple sources of data are employed (Yin 1989, 23). The HPRP case clearly fits these criteria.

The objectives of the study necessitated a close-up, empirically rich description of the HPRP case as a basis for subsequent modelling. While the literature review of similar case studies was helpful, most previous studies evaluated procedures or recorded events, but not organizational processes or relationships. They are presented primarily as legal case studies and decisions,

regulatory program evaluations, and dispute resolution studies.[6]

The sheer complexity of MSEDs requires that we spend considerable time to understand them. To explore the interactions and relationships between impacted organizations and the community, empirically rich data is needed. A case study methodology allowed the investigation to retain the holistic and meaningful characteristics of real-life events and the exploration of operational links that must be traced through time.

Data for the case study was oriented around a broad set of concerns that included the background and chronology of events, identification of the individual and institutional actors and their capabilities, description of how they act in and view the world, the relationships between the actors, and the problem definitions from each group in this dispute.

Data collection included interviewing representatives from community groups, regulatory agencies, politicians, local government, environmental staff, lawyers, consultants, and newspaper staff. These interviews were supplemented by

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[6]The case study review consisted of documented cases from Gail Brigham's book, Resolving Environmental Disputes, A Decade of Experience (1986), my experience in the field, court cases, and case study descriptions from policy and program review literature (Hatry, Blair, Fisk, and Kimmel 1987; Putt and Springer 1989).

extensive observation of meetings and an archival review of public and private documents. Appendix A includes a more detailed review of this process.

In choosing the individuals for interviews I began with a general knowledge of who was involved from my experience as an environmental specialist. I also noted the citizen groups and individuals present at public hearings or reported in the press.

The prospective interviewees were selected with the intent of getting a representative sampling of the different groups that must have been affected by HPRP. I initially chose them from the Department of Health Services' mailing list of over 500 concerned individuals and groups. This list was then narrowed by picking individuals who reflected common viewpoints and removing groups that were not involved. For example, environmental groups were not actively involved in the case. Likewise, some parties were not accessible at certain organizational levels. For example, many corporate representatives declined to be interviewed but several officers of the group representing the companies as a group, were available and very helpful.

1.4. Significance

MSEDs are a subject worth exploring. The nature of MSEDs has not been adequately formulated in the literature,

and it seems we lack the tools and the understanding to deal with their human and social aspects. The significance of this study lies in its attempt at understanding MSEDs through the use of a systems approach. By dealing with the systemic characteristics of MSEDs, design for better processes and tools for effective action can be achieved.

The case study itself may serve as a microcosm of other larger environmental problems. Global problems such as ozone depletion and major weather changes, where groups with seemingly different interests must come together to create some sort of resolution, may exhibit some of the same characteristics. MSEDs are not only poorly understood, but may also reflect the processes used to build our goals and visions of the world we want to live in, now and in the future. By understanding how people organize around an environmental issue we might unlock the constraints to building a unified vision, and likewise distinguish where disagreement truly deserves to be preserved.

CHAPTER II

THE CASE STUDY - PART I

This chapter describes the Hillview-Porter Regional Program (HPRP) as a chronology of events which were often perceived differently by the various stakeholders. The chronology is broken into four distinct phases, each of which is characterized by particular themes, problems and issues. This chapter describes the first two phases of HPRP, while chapter III describes the final two.

Phase I describes how a localized approach to groundwater contamination expanded into an unbounded and ill-defined regional approach. It was this redefinition that brought together a melange of unwitting and unwilling stakeholders. Phase II describes the stakeholders' expectations and perceptions of the problem.

2.1. Phase I: The Original Problem

The original problem started when Watkins-Johnson, a high technology electronics company, detected low levels of groundwater contamination during a 1982 investigation of a subsurface tank at their Stanford Research Park facility.

The tank investigation complied with new state underground tank regulations enforced by the Regional Water Quality Control Board (RWQCB). At that time the RWQCB decided that the only action required was continued monitoring of groundwater by Watkins-Johnson.

Two years later, Watkins-Johnson removed a diesel tank from the site. They installed four wells to comply with the City of Palo Alto's underground tank closure regulations and discovered that chemicals were at higher concentrations in the wells up gradient, than those down gradient of the diesel tank.[1] Soil samples taken near the tank did not show chemical contamination. Both these findings suggested that the source of some or all the contaminants may have been located elsewhere (CH_2MHill 1986b).

It was the results from this routine monitoring procedure that revealed a larger contamination problem of unknown scope and magnitude. The discovery of chemical concentrations above state action levels warranted further action.[2]

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[1]Gradient refers to the flow of the groundwater. Up gradient is similar to saying upstream for surface water.

[2]State standards refer to chemical concentrations that require action (e.g, close or limit access to a well, treat the water, substitute water source, etc.) if detected in drinking water. Five parts per billion is the action level for TCE, 200 parts per billion is the action level for TCA.

At this time groundwater contamination was still a new environmental threat, and state regulations and regulatory staff focused on underground tanks as contamination sources. The RWQCB found themselves in a quandary when none of the surrounding companies reported having underground tanks. Though there was clearly a problem, it fell outside their procedures. As a RWQCB engineer was reported to remark later, "We didn't have any basis to require any of the nearby companies to do anything else" (T.T. 1986b). Without a known potential source, and lacking the ability to pay for investigations themselves, the RWQCB transferred the case to the California Department of Health Services (DHS), a state agency with access to funds giving them the ability to conduct investigations.

Meanwhile, the adjacent Barron Park community was only dimly aware that the contamination could pose a threat. This neighborhood is distinctive due to its self-identity as a community, and the level of activism in the Barron Park Association (BPA), a homeowners association. BPA is a well organized group that guards the character of the neighborhood and acts against any threatening development. Groundwater contamination was to become such a threat.

2.1.1. A Regional Approach

The RWQCB began the five month process to transfer

responsibility for Watkins-Johnson and four other sites to DHS in 1985. The site transfer decision was consistent with the South Bay Ground Water Contamination Enforcement Agreement. This agreement between the RWQCB, DHS, and EPA, outlined their relationships to sites in which they had overlapping regulatory authority, and reflected the availability of the different agencies' resources.

As lead agency, DHS began by asking Stanford University[3] to sample water from private wells in the Barron Park community and Matadero Creek (ENSR 1989a). This data was used to establish if there was a health threat to the Barron Park residents from the Watkins-Johnson property. The University agreed to perform the sampling and informed the Barron Park community of their intent. The BPA quickly organized a public meeting with Stanford University and the City of Palo Alto as co-sponsors. The residents requested information about the well testing: Were they at risk? What was going to be done? Who was going to do it? They used the ties they had to the City and the University in an attempt to get answers. This meeting was the first of what would become quarterly public meetings.

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[3]Under state and federal law, landowners are responsible for contamination on their property whether they are directly responsible for it. The exception here is if the operator or tenant of the property takes responsibility.

Stanford tested six of the seven private wells in the community (Wahler Associates 1986), five of which were clean. The sixth well had very low concentrations (9 ppb) of contamination by organic solvents, and the owner of the seventh well refused them access. Fortunately, all well results were below state standards. Matadero Creek sample results however, showed levels of organic solvents in the 300-400 ppb range (Wahler Associates 1986), a concentration high enough to require action. Stanford completed the work by notifying the Barron Park well owners of the test results.

During the same period, the RWQCB sampled Matadero Creek above and below entrances to the Watkins-Johnson property. This time only the chemical TCE exceeded state standards. The total contaminant concentration downstream from Watkins-Johnson was also lower (ENSR 1989).

The results from the creek sampling added more pieces to the puzzle, but the picture was far from complete. The ambiguity of the test results concerned BPA and propelled their president to seek reassurance from the City of Palo Alto, Stanford University, and DHS.

Instead of reassurance, all three organizations stated they did not intend further testing of the private wells (ENSR 1989a) due to DHS's evaluation that there was minimal risk to the residents and that the groundwater contamination

had not affected drinking water. Though the residents used their private wells for irrigating yards and gardens, and children played in or near the creek, this water was not considered a drinking water source. DHS gave a higher priority to testing groundwater up-gradient from Watkins-Johnson to establish the source of the contamination (ENSR 1989a).

The project activities were moving smoothly for DHS. Decisions and actions were still within familiar procedural ground, but this was not to last. Alan Lui, the DHS project officer responsible for Watkins-Johnson, began to see the combination of factors as beyond normal practice for groundwater contamination cases and he began pushing for a "regional approach" to the problem.

DHS confronted the need to identify the sources of contamination, a situation complicated by commingled plumes, multiple contamination sources, and the possible risk to the Barron Park Community. The complexity that emerged from linking these concerns drove DHS to adopt a regional approach. The impetus for this change was the need to address what a site-by-site approach could not: the interconnected nature of the problem.

The region was geographically defined because of the need to locate the potential multiple sources of groundwater contaminates. However, the relationships between

stakeholders within this region remained undefined. Thus, "regionalism" intertwined the fates of the stakeholders without guidelines on how they should work together. This increasingly complex system was one in which many normal procedural tools were inadequate.

The problem was redefined as regional initially to simplify the task of managing multiple sites and merged plumes, but by doing so the number of stakeholders grew. Ironically, this again increased the complexity of the issue.

2.2. Phase II: Coming Together - The Assembly of Stakeholders

In this section, I explore the emerging regional problem through the perspectives of the stakeholders. The story resumes in early 1986, and focuses on an important shift from a problem solving paradigm to a relationship building one. Phase II ends with a growing crisis coming from the failure to create working relationships between the stakeholders.

Phase I ended with DHS realizing the need for a regional approach. This approach was not thoroughly defined nor agreed upon by all the stakeholders, nor could anyone anticipate its repercussions. Despite this, DHS's effort focused on the technical aspects of resolving the contamination. It consisted mainly of developing a

methodology for discovering potentially responsible parties (PRPs) over a large geographical region.[4]

Two developments characterize phase II. First, an increasing number of stakeholders were identified as new PRPs. Second, as the stakeholders came together, their dissimilar interests and perspectives created significant tension within the regional approach. The agency, PRPs, and community discovered they needed to work together but there was little history of their doing so. They now had to create working relationships in an environment of potential legal and economic risks that would be borne individually.

It was also during this phase that the substantive problem began to be better defined. DHS hypothesized that the contaminated groundwater found under Watkins-Johnson was also seeping into and flowing parallel to Matadero Creek, then under the community. This suggested that while the current level of contamination was not an immediate health risk, without intervention the risk would increase. DHS considered the first step as finding the sources of

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[4]DHS classified the Stanford Research Park industrial tenants doing groundwater investigative and remedial work, and Stanford University, under various legal titles: PRP= potentially responsible parties, RP= responsible party. The tenants later came to refer to themselves as "responding parties," since they did not believe themselves to be solely responsible, just the ones responding.

contamination and to test the hypothesis for groundwater movement toward the community (Wahler Associates 1986).

2.2.1. The Department of Health Services

The transfer of cases to DHS allowed the implementation of the Carpenter-Presley-Tanner Hazardous Substance Account Act and Bond, commonly known as the State Superfund. The Act is codified in the Health & Safety Code Sections 25300-25395 (Taylor 1990). This legislation not only provides funds, but gives DHS the response authority to cleanup releases of hazardous substances, as in the Hillview-Porter case.

The funds come from recovery actions against parties liable for hazardous substance releases, plus taxes and fees from generators handling more than 500 pounds of hazardous waste annually. The seed money came from a 1984 general obligation bond bill for $100 million (Taylor 1990). The press reported that at the time Hillview-Porter was first eligible for Superfund money there was only $35 million left in the account (Kleid 1986).

State fund availability limited the scope of any approach, thus requiring DHS to pinpoint PRPs. PRPs would then be required to pay for their groundwater investigation and mitigation. Under the Act, DHS must require responsible parties (RPs) to cleanup their sites under DHS supervision.

Only if the RPs cannot be identified, or if they do not meet DHS requirements, can the agency authorize state funded cleanup. Accordingly, the problem definition went beyond the purely technical when capturing the flow of money became as important as the flow of contaminants.

For a case to meet the authorization requirements under Superfund the agency must follow specified procedures and processes. This places different requirements on Superfund sites than non-Superfund sites (DHS 1988a). The Superfund cleanup process (figure 3), includes site characterization and potential remedial action studies.[5] The information from this work is then presented in a plan for remedial action that is consistent with federal regulations. DHS uses this as a template for action that case-specific conditions must conform to.

In addition, Superfund requires that DHS involve the public in cleanup of hazardous waste sites by informing them of site activities, responding to their concerns, providing opportunities for involvement in decisions and access to information (DHS 1988b). PRPs, with DHS supervision, write

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[5]This includes finding contaminant source areas, determining chemical backgrounds and concentrations, identifying the plume extent, and characterizing the geology of the area.

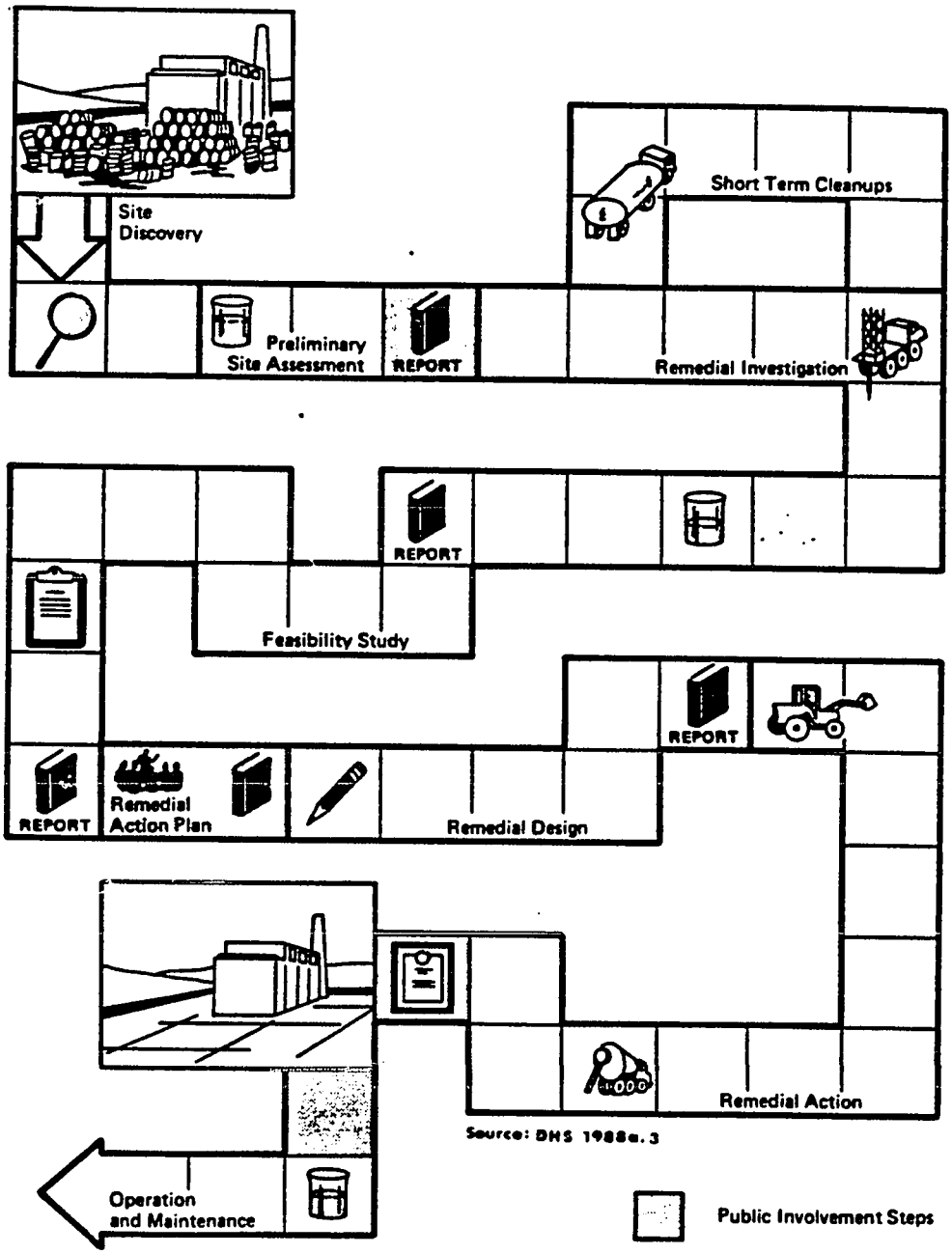

Figure 3. A conceptualization of DHS's cleanup process. (DHS 1988a.3)

a document called a community relations plan (CRP) that describes how this is done.

2.2.1.1. Phase II Agency Activities

It was not until after Hillview-Porter was listed as a state Superfund site that DHS attempted to create working relationships with the community. Involving the community had been outside their normal operating procedures, but to conform to state Superfund procedures DHS now needed to venture into this unfamiliar activity.

DHS contracted CH_2MHill, an environmental consulting firm, to perform much of the work associated with Hillview-Porter. CH_2MHill was chosen partly because of previous work performed in the area with DHS. They completed most of the field work and reports connected with the CRP, and also the preliminary site assessment and the soil gas study. It appears that 85-90% of the superfund money went to paying for these services.

DHS and CH_2MHill worked together on the community relations plan through the fall of 1986. DHS organized their first community meeting for HPRP just before completing the plan. Prior to this BPA initiated most of the meetings with the stakeholders.

It was evident in a letter written by CH_2MHill[6] that DHS and their consultant wanted to be well prepared for the community meeting. The letter included "a tentative agenda, fact sheet, and a list of possible audience questions" and went on to explain that, "The audience probably will contain both technical and lay people, with industry representatives, as well as citizens. Some may be concerned; some may be frustrated or angry." They were not prepared for what did happen.

The newspapers called the December public meeting "unusual," because it accomplished the opposite of what was intended (Kleid 1986). DHS intended to relieve community anxiety, but instead they left the residents upset and the local elected representatives concerned about DHS's ability to deal with the situation. DHS staff saw themselves as willing to share information, and felt frustrated at the demand for certainty before final data was available.

State Assemblyman Byron Sher would later write that DHS left the community with the impression that determining the full implications of contamination problems and cleaning up the site would be a very lengthy process. This was probably an accurate assessment since the agency did not want to present an unwarranted, optimistic impression of

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[6]CH_2MHill to DHS, 9 December 1986. TLS.

their progress. They felt it better to present a worse-case scenario based on approved time lines, instead of being in a position of raising expectations and then failing to deliver what was promised.

The community complained that there was no new information, no hard data, no action plan, and no forward motion. The press described the president of BPA as feeling depressed. In comparison, the manager from DHS was presented as optimistic when he told the audience, "We want to establish a constant feedback, feed-forward process with you" (Kleid 1986).

This meeting marked the beginning of the decline in the relationship between BPA and DHS. Clearly, events were taking an ominous turn. The agency lacked ways to elicit the community's concerns, expectations and perceptions of the situation, and therefore could not address them. Instead, DHS meticulously followed its procedures. It was business as usual, although the nature of the environment in which that business was conducted had changed dramatically.

Meanwhile, DHS completed two documents: the CPR and the Preliminary Site Assessment. The next step was implementing a soil gas survey. This survey played a major role by determining potential contamination sources on a regional scale.

DHS spent the first six months of 1987 securing the funds, developing the soil gas survey approach, and generating the workplan for it. Consultants sampled soil gas throughout the Hillview-Porter area during July, to determine where chemicals were present in the soil and groundwater.

Soil gas technology is qualitative and is very context sensitive. The detection of contaminants requires careful interpretation of the results from surrounding areas. Accordingly, the consultant's report had many qualifiers, but it did support DHS's hypothesis: that Matadero Creek acted as the transport mechanism between the research park and the community (CH_2MHill 1987a, 1987b). The results also suggested chemical "hot spots" that needed further investigation.

2.2.1.2. Relationships with Other Stakeholders

DHS met with Stanford University in July 1987 to discuss their expectations which included the university taking a lead role in identifying tenants who may have contributed to the groundwater contamination. DHS reminded Stanford that, as landowner, it was liable under the law if responsible parties were not found. Stanford argued that DHS should be the lead and wanted minimal involvement for

itself. It responded slowly to DHS's request for the names of contacts for past tenants.

DHS's relationship with the community remained distant since it was unaccustomed to dealing with the public, and instead focused on procedural requirements. Relationships with the research park tenants were another matter. DHS believed that Stanford would ultimately act to incorporate them into a regional problem solving effort. The impression given by DHS staff was that they hoped to deal with the region as an entity and not involve themselves in the details of the sites. Later they would speak of themselves as naive.

2.2.2. The Landlord and Tenants

DHS's desire that Stanford take the lead in identifying and motivating the PRPs was evident in DHS legal orders for research park sites. These orders always identified both Stanford and the industrial tenant as equally responsible parties. Stanford did not accept this role and, in more than one case, refused to sign these orders. However, it never did take the procedural option of challenging the orders (CH_2MHill 1988a), nor was Stanford ever formally found recalcitrant by the agency.

Stanford responded to DHS as it would an obstacle, it went around it and aimed its efforts at higher political

levels. They went to the lawmakers to lobby for change in the laws under which the agency operated. On November 7, 1986, members of the State Senate Committee on Toxics and Public Safety Management met with Federal attorneys, Stanford officials, and other property owners at a time when at least two of the committee members were introducing new bills on toxics to the legislature. It was reported in the press that Stanford urged them to use language that protected the "innocent landowner" (Gibbons 1986), the position Stanford believed itself to be in.

Stanford also adopted a protective policy against future tenants. It established that new leases would require tenants to meet all state regulations for handling hazardous substances, including regular monitoring for leaks. The ninety-nine year leases established in the 1950's, lacked provisions to regulate hazardous material usage.

By constrast, the industrial tenants maneuvered within the existing constraints and tried to protect themselves by not volunteering information. One industry representative described a ubiquitous fear among companies of being pulled into a "procedural monster" where even their good intentions could be used against them. No tenant wished to stand alone or be a "deep pocket" targeted by DHS.

Part of this caution came from the large costs involved in any groundwater case, costs that could be borne for decades. No company wanted to shoulder that burden, especially if they were not responsible. They insisted on knowing who was responsible before they allowed themselves to be categorized as RPs. Since the regional effort had to pinpoint individual RPs as "more responsible," tenants did not trust the process to ensure a fair and equitable resolution.

The relationships between the university and the tenants were established primarily through layers of lease agreements, but were also influenced by the amount of money the industrial tenants donated to the university.[7] The relationships between the tenants themselves were nonexistent or adversarial. Some tenants were competitors in the same market, but the uncertainty about the source of the groundwater contamination linked all their fates. In some cases, the staff members involved with environmental protection and compliance for the tenants had created relationships through shared training seminars and

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[7]Many tenants held subleases and in several cases held leases two or three times removed from the original lease with Stanford University.

professional organizations that would later be used to ease tensions.

In summary, the industrial tenants perceived a need to move cautiously. They did not assume too much responsibility unless there was clear evidence of their involvement. The spectrum of industrial tenant responses ranged from efforts to minimize their involvement, to voluntary investigations documenting the presence of contamination.

2.2.3. The Homeowners Association

The year 1986 was a time of explosive activity for the Barron Park Association, a year marked by letter writing, meetings, phone calls, press releases, organizing symposiums, and even an appearance on television (July 1986 KQED "Express" show). It was reported that BPA leaders were lobbying government officials, demanding help from the university, and holding regular meeting with public health experts (Bailey 1986).

Interviews with BPA members suggested that residents were alarmed and wanted information they could understand. They wanted to be kept updated. They were afraid it would take too long to complete groundwater investigation and cleanup before damage to their health and real estate values occurred. The CRP documented that they perceived a

reluctance by the industrial tenants to use available data to hasten cleanup action, as well as a lack of coordination between government agencies. They desired opportunities for more meaningful discussion between themselves and the involved agencies (CH_2MHill 1986a). Later, their concerns would shift to DHS itself.

The community and Palo Alto city officials expressed their concerns in letters to Governor Dukemejian. Though the city officials focused on budget items affecting toxic programs, BPA's list focused on their neighborhood. Like Stanford, their response was to move up levels of authority to change the constraints under which actions were considered.

BPA also expressed a need to build its credibility as an organization. Members felt discounted as "hysterical housewives" or unreasonable environmentalists. It was important that other stakeholders and government agencies perceive them as credible, concerned citizens with valid, legitimate interests.

BPA actively sought to build their credibility and widen their power base by working with the media and local politicians. They developed working relationships with their elected officials. The BPA president talked with the aides of both Assemblyman Sher and State Senator Rebecca Morgan at least twice a month through breakfast meetings or

phone calls. According to the aides, it was these informal interactions and not DHS, that were their primary source of information about the Hillview-Porter situation.

In addition, BPA leadership nurtured their ties with the media. Besides preparing formal press releases they also gathered data and information that made them a repository of reliable information. This, coupled with an eagerness to talk with the press, made them an easy first contact for the media regarding Hillview-Porter.

BPA's president saw his greatest impact through becoming a "relationship broker" by bringing together groups of people who would not otherwise meet. He also hoped to improve the existing relationships by fostering the dialogue needed to create a common language for dealing with the groundwater problem.

BPA was also instrumental in organizing several groups, each with a different toxics focus. It organized the Hazardous Materials Coordinating Council (HMCC) with the City of Palo Alto as a forum to discuss toxic issues. The city facilitated this monthly public forum. BPA also organized public meetings and an annual three day symposium on toxics in their community. They used these events to inform and educate, while bringing people together. They called for roundtable meetings with various agency staff,

industry representatives, and residents to discuss concerns and solutions about HPRP.

BPA also wanted to widen the discussion beyond groundwater. Within BPA there were several committees that reflected the varying concerns connected to living next door to a research park. Their concerns, exacerbated by repeated threatening incidents, included air quality degradation, stormwater run off, spills to Matadero creek, chemical storage, evacuation procedures, traffic, noise, and odor.[8] So sensitive were the residents that reportedly the presence of soap foam in the creek set off a rash of complaints and rounds of water testing (T.T. 1986c).

Despite these incidents, the community felt that its relationships with the university and the industrial tenants were productive. They were beginning to meet with representatives from Stanford and some companies more regularly, and they felt their input would be incorporated into any plan of action. At this point community leaders focused their attention on ensuring BPA involvement in the process. They insisted that decision makers sustain a

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[8]BPA October 1986 Toxsafe milestone data base included chemical spills resulting in evacuations, explosions, solvents and PCB tainted oil in Matadero Creek and Stanford Ditch.

commitment to community health issues and consider impact on home property values.

Early in the process community leaders stated to the media that they had no complaints about how the state agencies were handling the case (SJMN, 1986a, 1986b). This perception reversed during the first public meeting organized by DHS. As noted earlier, DHS was ineffective at building relationships between itself and stakeholders. It continued to engage in defining problems and solutions based on their procedures. BPA had offered to distribute leaflets advertising DHS's December 16th public meeting and wanted to cosponsor the affair, in the tradition of previous meetings. Despite this, DHS refused to cosponsor the meeting and BPA responded by reneging on their promise to help distribute flyers. Animosity between the heads of the two organizations was building and the meeting itself left BPA disgruntled. "It's a comedy, a sad comedy," said the president to the local press. "I'm rather frustrated. The intentions are good and I applaud their efforts, but it just isn't enough" (Kleid 1986).

BPA's frustration with DHS's approach increased. Months later, DHS presented the soil gas results from the previous summer. BPA leadership rejected the DHS presentation with complaints that, "This isn't new information--we knew this two years ago!" (T.T. 1987). DHS

reportedly was frustrated because the community did not distinguish between hypotheses and supporting evidence, and made unattainable demands for certainty. Also during this meeting, DHS finally told the community that there was no immediate health threat, a claim that did nothing to alleviate community concerns. State Assemblyman Sher was reported to have said DHS should do "something bold" (T.T. 1987).

The Supervising Head of Site Mitigation at DHS commented after the meeting that the state only allocated his agency $35 million to cover the whole state. They needed to rank cases by their threats to public health and the environment. When told of BPA's frustration, he said: "People don't like hearing their problem isn't the worse."

DHS approached this situation and handled the meeting as a technical problem that focused on reducing health risks. The community's broader view of the problem included: how the agency operated, how different agencies coordinated activities, the uncertainty of scientific risk analysis, and the establishment of the community role in addressing issues affecting their neighborhood. The local press portrayed the state officials and the Barron Park

community as clearly at odds over the seriousness of the toxic pollution in their neighborhood (T.T. 1987).

2.3. Summary

This chapter described the coming together of HPRP stakeholders to address an ill-defined problem and how a regional groundwater contamination problem overwhelmed organizational resources and standard operating procedures. The stakeholders in the case were thrust into new interdependencies that they were unprepared to manage.

DHS formulated the problem as one of discovering the sources of groundwater contamination. Because of the complexity of this task, routine, site-specific investigation and mitigation procedures proved inadequate; "regionalism" was the response. This transformed a narrow technical problem into a complex one of interorganizational relationships. The inability to build those relationships became, in effect, another facet of the problem to be solved.

The need to work together, coupled with the lack of adequate means to do so, created a fundamental tension. The stakeholders had profound incentives to protect their interests since costs would be borne individually. The inadequacy of DHS's procedures exacerbated tensions among the stakeholders. These tensions increased markedly and

eventually became the object of efforts to control them, the topic to which we now turn.

CHAPTER III

THE CASE STUDY - PART II

This chapter continues the story of the Hillview Porter Regional Program (HPRP) through the summer of 1990. Phase III follows HPRP as it approached an impasse in which normal procedures and routines were ineffective. Phase IV then describes how the crisis forced a reorganization that offered a partial solution.

3.1. Phase III: Heading for an Impasse

Phase III highlights the increasing antagonism between DHS and the Barron Park community, and the inclusion of more Stanford Research Park industrial tenants as PRPs. It is characterized by the crystallization of positions and tensions between the stakeholders.

In December 1987, Clifton Davenport replaced Alan Lui as DHS project officer responsible for HPRP. He continued gathering information to identify the sources of the contamination found under Barron Park and in Matadero Creek; first by requesting that all sites performing investigative work submit reports for review, and then by requesting

all chemical use and release information from the past and present tenants within the Stanford Research Park. The previous summer's soil gas survey, in combination with chemical use histories,[1] and a historical occupant search,[2] made up the regional methodology for the area.

Davenport classified sites into categories of "not responsible" or "potentially responsible" based on the information collected. He then discarded those sites with negligible soil gas results and no history of using the chemical compounds of concern. He targeted the remaining sites with both high soil gas and a history of chemical use for further investigation.

Davenport later reported that he became overwhelmed with the increased work load that came with managing all the regional and site specific activities. He believed additional case handlers were needed to oversee the individual sites. DHS responded by creating a team responsible for HPRP. This team included a manager, staff members who focused on site specific issues, and other staff

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[1]Chemical use histories consisted of reporting what chemicals were ever used at a site and included detailed information on any soil, surface or groundwater analysis, and any incidents that may have resulted in the release of chemicals to the environment.

[2]The historical occupant search consisted of reviewing lease and tenant histories for the land parcels in the research park.

members who focused on regional issues. Even so, the workload remained heavy and DHS hoped that Stanford would assist by collecting and transmitting data from its industrial tenants. However, Stanford maintained its position of least involvement, in the hope it could avoid the liability risk associated with the groundwater contamination.

DHS was also hindered by the response from the industrial tenants. Many could not meet the original forty-five day deadline for the chemical use histories and some tenants ignored the request. Even when tenants did respond, much of the data was vague or missing.

From the tenants' perspective, DHS was not sensitive to the amount of effort and cost involved in the request for chemical use histories. Those with little chemical use gave the most adequate reports because the information was readily available. Other sites with decades of history in the area, such as those belonging to Lockheed and Hewlett-Packard, faced the prospect of compiling large amounts of data and finding records that were no longer available or that never existed.

Those tenants that started site investigative work voluntarily did not feel DHS went far enough in identifying PRPs. They were concerned that the agency would stop looking after identifying a few "deep pockets." If DHS did

not identify and ensure that all PRPs did investigations, these tenants feared they may have increased their liability risks by the work they had done.

Tension was building in the community during this period. The BPA president described the community as feeling ignored by the agency. It seemed to him that DHS did nothing about the contamination underneath their neighborhood. He believed DHS's focus on finding PRPs was inappropriate when people's health could be at stake.

3.1.1. Stopping the Agencies

The frustration of the community and the concern of the research park tenants came together over the attempt by RWQCB to transfer more sites to DHS. This new transfer threatened both the community and industry, but for different reasons. Both worked to stop the transfer of sites, a show of influence that reshaped their relationship to DHS.

The effort to transfer additional sites began in the spring of 1988 when the South Bay Toxics Management Group met again. Effectiveness, they claimed, required that one agency manage neighboring sites sharing physical characteristics (geology, hydrology, etc.) when there was evidence of a regional problem. RWQCB was also short on

resources. In April, the community and tenants became distressed when they learned of this plan.

The representatives of one tenant, Hewlett-Packard, wrote letters and held meetings outlining their concern to the agencies. They felt that bringing in a new agency with different procedures and requirements could slow down progress in dealing with the groundwater problem. They also feared that decisions and agreements made between them and the RWQCB would be invalid if they were unacceptable to DHS. The potential costs that this could introduce were felt to be significant.

Industrial tenants contacted the community's BPA leadership to learn how they felt. BPA shared their concerns and had publicly accused DHS of being lax in overseeing cleanup operations. The had revealed to the media that they felt DHS wasn't responsive to the community's needs (Hill 1988) and also expressed their concerns by deluging Assemblyman Sher with letters asking that he stop the transfer.

The press reported that both Sher and BPA claimed victory when Sher thwarted the transfer to DHS (Lapin 1988). Sher had removed the reason for the transfer by diverting $400,000 of state funds to the RWQCB, giving them six new

positions (Gullixson 1988a).[3] These mechanisms of influence were outside the DHS control.

3.1.2. Formalizing the Relationships: The Regional Remedial Action Order

The second important development during phase III was the legal relationships formed through the creation of a regional Remedial Action Order (RAO).[4] This occurred during 1988, when much of DHS's efforts on the case was directed at drafting and issuing this order. It was also during this period that DHS's behavior changed to reflect what one staff member described as a "new philosophy." They admitted they had been dictatorial toward the involved industrial tenants, but now they wanted to find something workable for everyone. The new approach would be to create agreement during the initial decision stages, speeding up the process later. To perform this, they needed participation and input from the stakeholders.

A major element of the RAO was an outline for the RI/FS[5] work plan that DHS, their consultant, Santa Clara

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[3]Sher could do this through his role on the state budget committee.

[4]Remedial Action Order: a legal document outlining remedial actions and compliance schedules. DHS has authority to set fines and fees if its conditions are not met.

[5]Remedial Investigation and Feasibility Study

Valley Water District (SCVWD), and RWQCB produced in March 1988. This outline identified what sort of information DHS needed to define and mitigate the contamination. It became the criteria used to judge if plans submitted by the parties were adequate and contained the minimum work necessary to meet DHS requirements. DHS thought this would speed up the review process: a plan based on the outline should be acceptable to the agency without major revisions.

It was also at this time that DHS first attempted to formally define the region, a critical issue since the boundaries had legal and financial implications for those within it. Ideally, it would have included all areas that could be connected because of use, geology, and groundwater features to the contamination in the community. Yet limited information required the final decision be a compromise between scientific facts and political realities.

DHS's definition of the region was also influenced by community members expressing their concern that naming Barron Park as a Superfund site would affect home resale values. DHS finally defined the Hillview-Porter Region as having two areas: the Hillview-Porter Site (an area within the Stanford Research Park), plus the "area of investigation" that consisted of the Barron Park Neighborhood and Matadero Creek. Figure 4 shows the relationships of the areas to each other. The

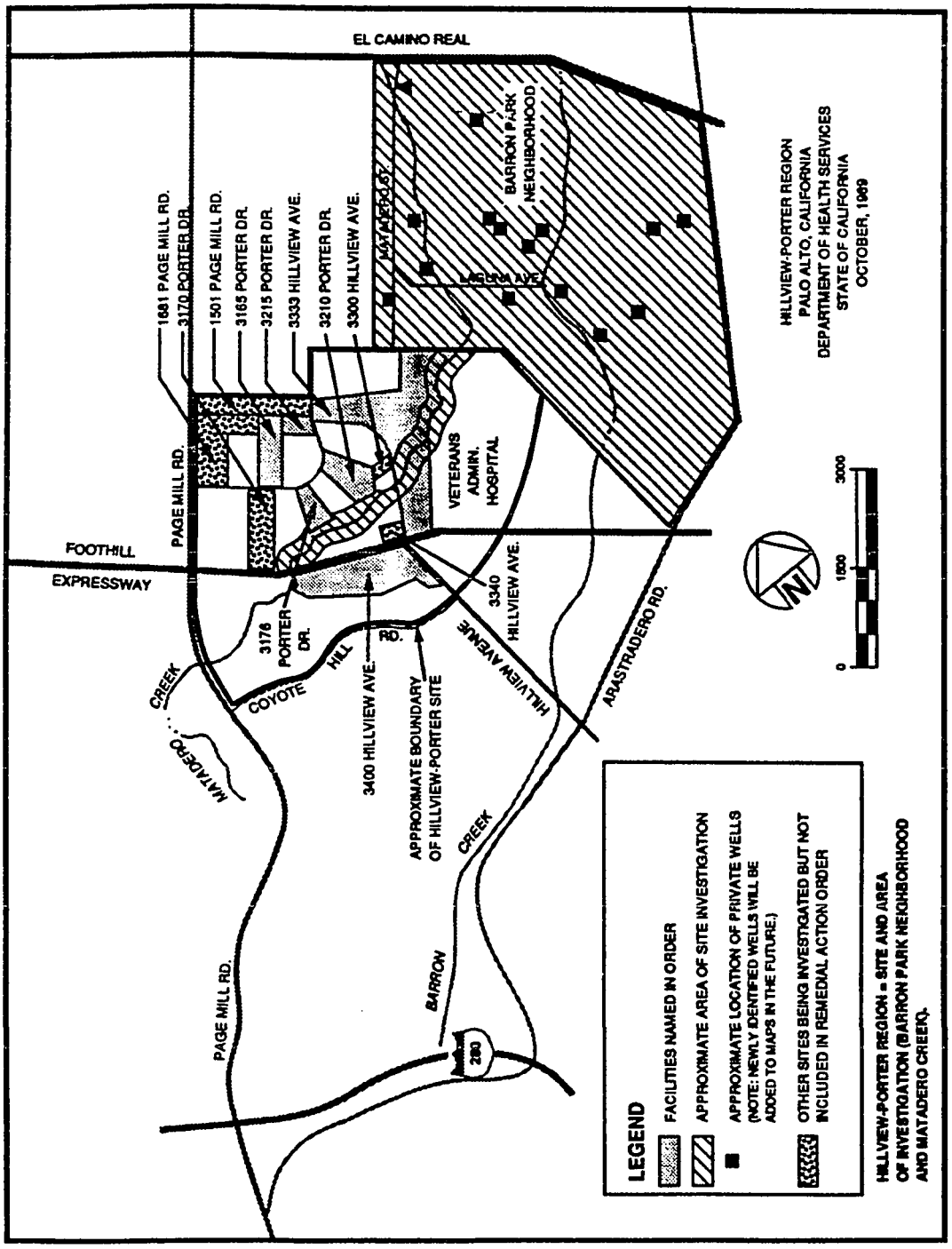

Figure 4. Hillview-Porter Region: Site and Area of Investigation (Source: Department of Health Services October, 1989)

responsibility for work in the "area of investigation" would fall on those tenants named on the RAO, thus increasing their stakes and risks in the matter.

In September 1988, DHS asked for comments from the PRPs and the community on the RI/FS work plan outline. The industrial tenants' attorneys responded with questions about costs and the allocation of resources between the various tenants. The community responded with concerns about administrative procedures and the potential impact on real estate values. The uncertainty about the regional approach elevated tensions and concerns in both stakeholder groups.

Later in September, DHS called a meeting of the industrial tenants it planned to name in the RAO to inform them of its intent and to discuss and alleviate any concerns about the RAO before it was completed. About forty people, mostly industry representatives, their consultants, and their attorneys, were present.

Tenants currently performing groundwater investigative work were to be named in the RAO, but DHS wanted them to be assured that others would be included when more information was available. DHS wanted the RPs to have control of the details and costs. Still, they also wanted the named RPs to know that if DHS did the remedial work, the RPs would be charged triple the cost for it.

Stanford was present at the meeting, and DHS was also considering naming it as an RP. However, Stanford representatives assumed the role of meeting facilitators: they had the attendees sign-in and made sure outside observers left. They also brought representatives from Clean Sites, Inc., to offer mediation and facilitation services. This firm was founded to act as an independent and neutral facilitator to help accelerate the cleanup of hazardous waste through voluntary participation. Dr. Donald Kennedy, President of Stanford University, was on its Board of Directors.

During the meeting, the firm promoted its services and distributed literature, although the tenants showed no interest. They reportedly did not trust a firm selected by Stanford, nor did they see a need for the services. Attendees later stated that Clean Sites appeared as a direct link to DHS, and they wondered why they should pay for an organization that could not be trusted to be solidly on their side.

After the question and answer period, DHS left the named RPs to discuss how they were going to organize themselves. It was an awkward situation for them; they did not know each other well, the situation was new, the risk

was great, and trust had not had time to build. Still, DHS expected them to speak and act as a group.

DHS's intention to name twelve different parties as RPs on one RAO galvanized concerns. Most tenants preferred that DHS split the problem into related areas and not address it as a regional issue. One concern was the possibility that DHS had not used all the information available to them before naming RPs. Another was whether DHS had done everything possible to locate past lessees. Others wondered privately, if they should cooperate or stall.

A few months later the RAO was formally adopted, but it included deadlines that were difficult for the named parties to meet: ten days to notify their intent to comply, thirty days to select a project engineer or geologist, and sixty days to submit a detailed RI/FS work plan suitable for implementation.

Stanford was one of four parties included on the RAO that did not respond to DHS's deadlines. The other three were past and present master lessees of one site, but their tenants (Singer and Teledyne-MEC) did comply. Stanford later notified the agency and the press that although they missed the deadline, they were "committed to cooperating fully to make sure the order is complied with" (Kazak 1989). After interviewing Stanford representatives I found that

this statement was not intended to mean they were undertaking the investigation or contributing financially to the cleanup. Instead, Stanford would seek to encourage the tenants to respond to that task. In effect, they sought to act as a quasi-regulator and altogether avoid being considered an RP.

Senator Morgan's office and the Palo Alto Weekly, a local newspaper, supported Stanford's position. DHS tolerated this position, the industry group resented it, and the community found it unacceptable. Meanwhile the rest of the named RPs came forward to comply with the state order.

BPA responded strongly in the press about the RAO.[6] They complained about the schedule: they wanted quicker actions and more precise deadlines, they wanted the agency representatives to stop "dragging their feet," and they wanted immediate action to stop the spread of contamination. They complained about the order itself, claiming it was toothless and that DHS was lax in failing to prod a quick response from the companies. They complained that the lack of state funds for enforcement took the bite out of the order. They claimed that DHS couldn't do the job and that

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[6]The articles included: Kazak, Sept. 14, 1988; Gullixson, Sept. 8, 1988; Gottlieb, Dec. 11, 1988; SJMN Editorials, Dec. 13, 1988; Shapiro, Dec. 14, 1988; Gottlieb, Dec. 17, 1988; PAT, Dec. 20, 1988; T.T., Editorial, Dec. 26, 1988.

EPA should take over. BPA was very reluctant to wait until 1997 for the state to begin cleaning up toxics in their neighborhood. Their representatives agreed: both Senator Morgan's and Assemblyman Sher's office were reported as finding the order's schedule "unacceptable" (Gotlieb 1988b).

The stakeholders were heading for an impasse. Only DHS could force industry to comply and gather the information to implicate additional sites. Only the industry had the resources and processes to act quickly; and only the community had the political influence to bring in the support of elected state officials and the media. Yet they did not work together, for there was dissension among them concerning the purpose and consequences of the remediation system. They did not acknowledge that the various groups, their perceptions, and their relationships with each other were themselves becoming part of the problem.

3.2. Phase IV: System Crisis and Reorganization

Phase IV includes events from January 1989 to June 1990. In contrast to phase III, it is characterized by the development of new organizational patterns that allowed the various stakeholders to work together more effectively. This section, though still presenting the chronology of events, focuses on the structure and processes of the new

organizational patterns and communication channels that developed around the impasse.

3.2.1. Technical Steering Committee

The first new organizational pattern consisted of smaller, more frequent meetings between the stakeholders. BPA called them roundtable meetings and DHS called them the Technical Steering Committee. It included representatives from DHS, BPA, the industry group, Stanford, SCVWD, and the City of Palo Alto. By limiting the number of participants it created a more intimate setting and allowed for deeper discussion. DHS documented and facilitated these meetings.

The motivation toward creating a more intimate setting for information transfer came from the pressure BPA's president and state representatives placed on DHS.[7] BPA wanted to be included in the Hillview-Porter cleanup process.[8] Now that DHS had named the companies and was falling into its oversight role, BPA's concern over being left out increased. The BPA president recommended

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[7]This started December of 1988 when the BPA president and state representatives met with the Chief Deputy Director of the Toxic Substances Control Division to discuss the "unacceptable" schedule for the cleanup. In addition, the president of BPA started what the press called a "personal crusade" against what he saw as agency incompetence and disregard for community's concerns.

[8]John Joint, BPA President to Denise Kato, DHS case officer. 17 March 1989. TSL.

repeatedly, "that a roundtable be formed with representatives from the key concerns, namely the industry, the DHS, the Landlord, the community, and appropriate elected officials."[9] DHS responded by initiating the Technical Steering Committee in late March 1989. These meetings were held monthly until September of 1989, although they alone were unable to create the working relationships needed to relieve the impasse.

3.2.2. The Industry Group

Another new organizational pattern was created when several industrial tenants formed an informal "industry group." This resulted from DHS naming them collectively on the regional RAO. The industry group initially consisted of past and current tenants of six sites in the research park (see figure 4). The various company representatives brought diverse specialties to bear on the problem. The members included environmental professionals, facility managers, environmental engineering consultants, in-house council, and

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[9]John Joint, BPA President to Howard Hatayame, Unit Chief, DHS. 31 Dec. 1988. TSL.

retained lawyers.[10] The industry group was dynamic and evolved as its members worked together as a group.

3.2.3. The Impasse

A cleavage was appearing as the industry group and BPA drew away from Stanford and DHS. The following two episodes illustrate the uncertain relationships between the stakeholders at this time. Ultimately another reorganization of the stakeholders would be required.

3.2.3.1. RI/FS Work Plan Trials and Tribulations

The first episode concerned the difficulty of the industry group and DHS in arriving at an agreed upon RI/FS work plan. Even with DHS's RI/FS outline, the actual generation of a working document that fulfilled DHS's requirements was a daunting task for the industry group. In December 1988 they hired ENSR as their regional consultant and by February 1990 they submitted the first draft of the RI/FS work plan.

The DHS staff found this draft plan unacceptable. In a public meeting, DHS explained that both the agency and the

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[10]The retained lawyers' approaches were not conducive to cooperation. This led the company representatives to limit the lawyers' role as the advantages of working together became apparent.

industry group had not discussed their assumptions. They corrected this by holding monthly meetings.

Finding that their draft proposal was unacceptable frustrated the industry group. They believed they had demonstrated good intentions by submitting the RI/FS plan proposal within two weeks of DHS's request. The industry group intended to meet DHS requirements, but could not understand why DHS held them to what they considered unrealistic deadlines. The plan they submitted reflected what could be done within the time designated. An industry representative reported that the group's frustration turned to disbelief when DHS went to the press complaining about the RPs' poor performance. The industry group felt that DHS was trying to create a division between it and the community by blaming it for schedule delays. They felt DHS was as much at fault by requiring unrealistic work schedules.

Four months later the industry group submitted a revised RI/FS work plan. DHS rejected it again. They remodified and submitted it a third time in July (ENSR 1989a). The industry group's chairperson complained that DHS could not make what it wanted in the RI/FS work plan clear because it did not know itself. Meanwhile, the

community wanted to play a more active role in the decision making.

3.2.3.2. The Matadero Creek IRM-FS

The second incident concerned who should perform the study on Matadero Creek. Denise Kato replaced Davenport as the third DHS case officer brought in to manage HPRP. She contracted with CH_2MHill for a study on possible ways to mitigate the contamination in Matadero creek. This study was called an Interim Remedial Mitigation-Feasibility Study (IRM-FS): "interim" because it was a temporary, partial solution to the migrating contamination, and "study" because it would only support some future plan for action. This study would not only address the worst exposure route, Matadero Creek, but also would show the community that the agency could respond to their concerns. Kato felt DHS was finally doing something to speed up the process.

DHS management had approved the study and it was to be announced during the June public meeting. DHS chose to perform the work only because of industry's inability to submit an RI/FS acceptable to DHS. Under state Superfund laws DHS could do the work and charge the RPs triple the cost. DHS notified the industry group about their plans two days before the public meeting. Coincidentally, the industry group held their monthly Technical Meeting that

day. Within one day, the industry group prepared a plan for creek sampling that also would be presented at the next day's public meeting.

The public meeting was unexpectedly volatile. To paraphrase a company representative's description:

> I had gone outside for some fresh air when my attorney tapped me on the shoulder, saying; "You don't want to go in there." It was amazing. The newly appointed lead to the DHS group was screaming at one of our attorneys; "You can't distribute that here! We haven't reviewed or accepted it yet!" She was referring to our group's plan to study Matadero Creek. Grabbing the papers back from DHS, our attorney yelled; "You can't enforce that! That would be a violation of our first amendment rights!"

The community argued that it did not make sense for DHS to do the study if the industry group volunteered to do it. A few days later, after a phone call from the BPA's president to DHS, the agency finally agreed to allow the industry group to do the study. Matadero Creek sampling started July 1, 1989 (ENSR 1989b).

In summary, both the Matadero Creek and the RI/FS episodes resulted in procedures backfiring and progress stalling. The inability to generate an acceptable RI/FS plan led to an impasse. Some factors that led to this included the industry group's management of their consultants, DHS's schedule, the various levels of project management, the report review and acceptance process, the

influence shown by the community, and the differing problem definitions of the stakeholders.

3.2.4. The RI/FS Work Group

Up to this point the different stakeholders had formed fleeting coalitions, but were unable to work together effectively. The third new organizational pattern consisted of the RI/FS work group. The stakeholders hoped it would bring together those representatives who had the authority to make decisions. This attempt was different, because for the first time the stakeholders came together as equals to solve a mutual problem.

All the stakeholders felt frustrated with the lack of agreement and results. Yet the situation that needed changing looked different from each stakeholder's perspective. The problem for DHS was obtaining an acceptable, timely product from industry so they could show progress on the case. The industry group's problem was reducing the lag time and the expense of writing the RI/FS work plan.[11] The community's problem was having DHS include them in the decision making process. Stanford also wanted

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[11]The practice had been that the industry group's consultant write the plan with the information they gathered. This would be reviewed by the group members. Changes would be made and then the plan would be submitted to DHS. The agency would then review it. If not approved it was sent back with comments and the sequence was repeated.

to be part of the process, but not so close as to be implicated as responsible for the contamination. By naming them as an RP, DHS had already put them in a precarious position.

The stakeholders were coming to the realization that they needed to work closer together, although translating this into action remained difficult. The industry group had written the agency suggesting the formation of a RI/FS task force. The community had been asking for a "roundtable" format from the beginning. In a Technical Steering Committee meeting DHS introduced their version of the task force and asked for feedback. Everyone agreed on one thing: something had to change.

During the public meeting in October 1989, DHS announced the plan to form an RI/FS workgroup. They also introduced Peter Johnson, the industry group's recently hired third party administrator.

Johnson brought with him a desire for a cooperative, respectful relationship with both the community and DHS. With his state agency background he could empathize with DHS, and still show loyalty to the companies that had hired him. Though hired as an administrator to ensure things ran smoothly, he functioned as a facilitator for the new RI/FS

workgroup. In this role he organized the meetings so that the participants could focus on the RI/FS work plan content.

The RI/FS workgroup included Johnson, an industry group representative, two community members, and the project manager and technical support staff from DHS. The industry group's consultant attended in order to document the meetings, but did not participate. The total number of participants, not including the consultant, was to remain under eight. The intent was that the group would be technically oriented: even the community members had backgrounds in engineering, toxicology, and chemistry.

The work group used various processes to address the concerns of its members. They first clarified the objectives of the RI/FS work plan. They shared the development of the issues. They came to agree, as a group, with DHS's position of no immediate risk to the community. When they made technical decisions, they made the rationale explicit to everyone. These decisions included determining the location of the monitoring wells, drilling methodology, and sampling techniques. They modified agency guidelines for technical decisions and methodologies through group discussion and consensus. Agreeing on the process for decision making was as important as the final decisions.

As the facilitator, Johnson kept the group focused on goals and biased toward action. By the second meeting the

others in the group took on a more dynamic role. Together they established the objectives for the work plan.[12] They met three times, six to eight hours each, and produced an RI/FS work plan that was approved by the DHS in only two days.

3.3. Summary

The Hillview-Porter Regional Program included multiple stakeholders with varying perceptions and relationships to a complex groundwater contamination problem. The focus here has been on the events that led to a reorganization of the processes and structures in which the various stakeholders dealt with this issue and with each other.

In Phase I, DHS reframed the groundwater problem from a local problem to a regional one, forcing new procedures and relationships to emerge. This reframing was an attempt at dealing with the contamination detected in Matadero Creek and the Barron Park neighborhood.

The reframing introduced two constraints on problem solving. First, past and present tenants needed to

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[12]The objectives were: 1) To establish a basic understanding of chemical distribution in the shallow groundwater, 2) To do an initial evaluation of stratigraphic vertical/horizontal conditions, 3) To evaluate the Stanford Research Park / Barron Park groundwater connection, 4) To do an initial evaluation of the concentration and type of chemicals distributed in different depths of the groundwater.

determine their relationship to the contamination plume. This required the correlation of data and the timing of activities not seen in single site cases. Second, it required that stakeholders build working relationships with each other.

The first requirement was primarily technical, although working relationships were necessary when stakeholders needed to respond to the HPRP. To fulfill the second requirement, the stakeholders needed to understand that the regional approach created a situation requiring working relationships, despite the absence of historical connections or procedural tools to accomplish this.

Stakeholders became more involved in the process and DHS generated a better technical definition of the problem situation during the Phase II. Yet the relationship building aspects[13] needed for successful implementation of any technical solutions had not been addressed. The agency was aware of this and attempted to address it, but with no success. At this time, DHS discounted health threats to the community and focused on identifying RPs to finance any cleanup activity.

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[13]These aspects included developing processes to learn about each others' concerns, establishing trust, validating positions: developing processes that encouraged working together instead of constraining each other.

It was during Phase II that the stakeholders, especially the community, began to voice different opinions on what the problem was and how it should be addressed. Stakeholder response took two forms. First, they went above DHS to the legislature. Second, they stayed within DHS's constraints, but resisted full cooperation.

In Phase III, tensions increased because of two issues linked to DHS's regional RAO. The first was the need for the jointly named RPs to function as a group. Second, the stakes grew for the community and industry group as DHS's position firmed. Not having input into DHS's decisions could result in a stakeholder's interests not being addressed. The community's primary concerns were harmful health effects and decreasing property values. The industry group's concerns dealt with the allocation of cleanup costs among RPs, and the total cleanup bill.

The threat of DHS's RAO caused the stakeholders to attempt to override agency authority in several different ways. First, the combined actions of the community, the industry and State Assemblyman Sher, successfully thwarted the site transfer from the RWQCB to the DHS. More subtle were the responses that resulted in DHS's inability to manage the area successfully in the manner it had expected. Stanford refused to take an active role as go-between with the research park tenants. The tenants were unwilling or

unable to produce information in the form and within the timelines DHS required. The community was more organized and had more influence than DHS acknowledged.

In addition, DHS's attempts to speed up the process failed, nor could they alleviate concerns of the community or the industry group. Even the attempt at giving the other stakeholders opportunities to review and comment on agency plans did not bring the results DHS wanted. The approaching impasse was clear.

During Phase IV, the crisis between stakeholders emerged, as well as the attempts to address it. The crisis presented itself as the inability of any stakeholder to resolve anything. The industry group could not get acceptance from DHS for an RI/FS plan. The community could not get their viewpoint incorporated in the decision making. The agency could not meet its own timeline and was stopped in its attempt to carry out its own studies.

Three different organizational patterns were used in attempts to cooperate. The first was the Technical Steering Committee. It was primarily informational but allowed the expression of viewpoints from all stakeholders in one forum. The second was the industry group. It represented the forced organization of the named RPs and their attempt to transform individual interest into group interest. Third was the RI/FS workgroup. It was a task force that focused

on producing an RI/FS work plan for the area and included representatives from the community, the industry group and the DHS.

It is clear from this case study that environmental disputes involving multiple stakeholders and perspectives are complex and require ways to address this complexity. Two key facets of that complexity are the relationships between the stakeholders and their unique perspectives on the problem. Current procedures and approaches did not effectively deal with these issues.

Still, questions remain: What are the specific characteristics of MSEDs not addressed by the procedures and approaches used in the HPRP? What can be learned from this single case that would be helpful in designing strategies that would be more effective in an MSED situation? These issues will be examined as HPRP is analyzed as a system in the following chapter.

CHAPTER IV

THE SYSTEMIC NATURE OF STAKEHOLDER INTERDEPENDENCE

This chapter discusses the systemic nature of the stakeholders' interdependence, how it was problematic, and why it was difficult for them to address. Section 4.1 examines how systemic characteristics were manifested within HPRP. Section 4.2 explores why the stakeholders were unable to address the requirements of their situation and the repercussions that resulted. Finally, section 4.3 discusses why the conventional approach created disincentives against managing stakeholder interdependence.

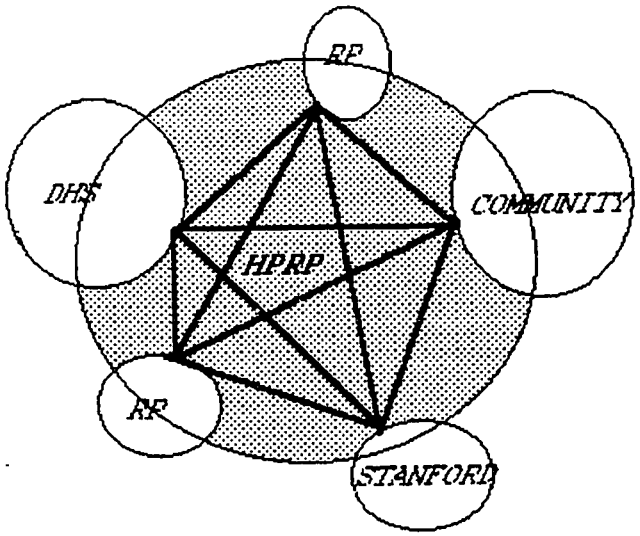
4.1 The Systemic Nature of an Interdependent Environment

Interdependence refers to the relational structure between the stakeholders within HPRP. This structure produced a situation that linked the stakeholders through the outcomes of their collective behavior. It was a dynamic situation where actions of one stakeholder would reverberate through the structure that constrained them all. Their attempts to respond altered the situation but not their capability to manage it. These evolving relationships constrained action, and thereby constituted an

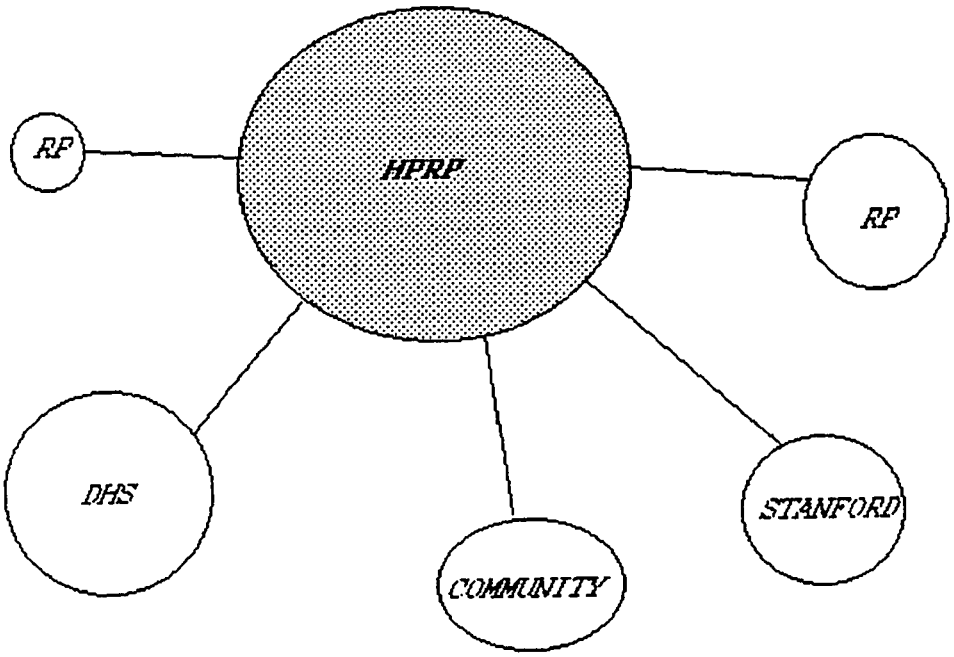
"interdependent environment" in which each stakeholder acted.

Figure 5 is a schematic comparing the interdependent environment of HPRP to a situation in which each stakeholder has an independent environment. The characteristics of an interdependent environment are different from an independent environment, and these differences affect the capability of the stakeholers to effect outcomes. These characteristics lead to different requirements for successful action. One such requirement, as discovered by the HPRP stakeholders, is the ability to create working relationships between the stakeholders. The foundation of working relationships depends on mutually discovered commonalities between the stakeholders, and this, in turn, includes learning about each other's perspectives on the issues.

Learning other stakeholder perspectives is not a simple matter of asking representatives of the various stakeholder organizations what they think. Perspectives are dynamic and change through time as the stakeholders learn more about the situation and each other. Furthermore, they are manifested in what stakeholders do, and not in just what they say. They reflect the type of working relationships formed by the stakeholders, and in turn, those relationships affect the perspectives. It becomes an iterative process



INTERDEPENDENT ENVIRONMENT



INDEPENDENT ENVIRONMENT

Figure 5. Schematic of interdependent environment and independent environment.

that proceeds as the need to work together becomes obvious and collectively, if reluctantly, agreed upon.

The complexity increases when one considers that stakeholder organizations (e.g., BPA, DHS, Stanford University, and the other RPs) do not promote or contain homogeneous perspectives. Within each organization there are multiple perspectives and conflicting interests that must be addressed. A tool that is helpful in analyzing these multiple perspectives is the work by Linstone (1984), who identifies these perspectives as personal, organizational and technical. Each perspective differs in its time horizons, types of constraints, modes of inquiry, goals, and ways of communication. Appendix C includes a summary and table of these perspectives and their characteristics.

In general, the personal perspective deals with the expectations, needs, and ambitions of specific individuals within organizations. The personal perspective played a large role for those individuals who were promoting their careers within the context of HPRP.

The organizational perspective focuses on issues of justice and fairness within a social infrastructure. Organizational goals are directed at stability, continuity, action and implementation. The DHS's and industrial firms' staffs demonstrated this perspective when they acted to

serve organizational objectives (e.g., controlling the budget, scheduling, planning).

The technical perspective is the home of science and technology. Its ethical claim is in its rationality. Yet, a technical perspective may over simplify problems by limiting variables and relations. The goals for this perspective are problem solving and a product (e.g., study, design, explanation). DHS staff and environmental professionals operated within this perspective when applying technical expertise to the problem. Table 2 represents examples of perspectives taken by the different HPRP stakeholders.

An interdependent environment requires that stakeholders consider the effect that their organizations have on working relationships. Significantly, stakeholders such as the industrial firms, DHS, and BPA differed as organizations which maintained working relationships.

First, the decision-makers of industrial firms often received only filtered information through staff briefings and memos about HPRP. Sometimes the chief executive officer would not be aware of an issue until asked to approve an expenditure. The decision making power of the staff reflected the resources they controlled, and varied from organization to organization.

Table 2. – Multiple perspectives within HPRP

STAKEHOLDER	PERSONAL	ORGANIZATIONAL	TECHNICAL
COMMUNITY	Do something now! Resentment/Distrust of Agency Building constituency - Political aspirations Concern: Health, Children, Real Estate Values	B.P.A. role as watchdog Position as legitamate stakeholder Need for agreed upon public position History of activism/ involvement	Belief in "technical fix" Use of survey technique for documenting community opinions
AGENCY	Need to be recognized as competent Promotional opportunity Recognition for new approach Confused/ Resentful over community reaction Distrust of Industry	Must follow procedures Risk aversion strategy Need to build a defensable case to those within Agency that reflects their values and priorities	Contamination not seen as immediate health threat Goal of investigation was to establish responsible parties so that private funds could be used
INDUSTRY	Dealing with requirements is time consuming New situation, uncertain about approach Resentment- feeling pushed/ set-up to look bad Opportunity to gain experience and recognition	Cautious about volunteering information Concerned about equity and fairness reasonableness, options How to look cooperative without giving away the store Distrust other industries untill proven Balance cost with benefit	Determine chemical use history Look for evidence of a source of groundwater contamination Determine how much of the problem is the result of their activities
CONSULTANTS	Need to appear competent , knowledgable and cofident Need to promote own area of expertise Promotional opportunity	Need to enhance reputation of company - keep and gain clients Need to keep solvent- increase the need for their services.	Problem will be framed in the area of consultants expertise; legal, geological, engineering...
POLITICIANS	Opportunity to be concerned and respond to constituency Press and media opportunity Evidence to support bills Evidence to attack others' legislation Opportunity to support or move funding to areas you support	(Questioned procedures and timing of other organizations)	(Had copies of technical reports, were seen as a waste of paper- just wanted summaries)
LANDOWNER	Did not feel responsible	Needed to look cooperative and be part of decision making process in order to protect organizational interest.	Questioned technical assumptions but not approach
FUTURE GENERATIONS	Do I have clean water to drink and is the env. healthy? New perceptions of risk Different priorities	Procedures to deal with past and to prevent future harm Strategy to cope and continue	New knowledge: new risk New technology- aquifer restoration point of use treatment, mute No technology

DHS was more bureaucratic, and exists within a highly structured governmental hierarchy in which day-to-day management of HPRP was a staff function. Its organizational structure diffuses decision-making through the agency's various levels. Administrators dealt with policy and planning, specifically matters of precedent setting and consistency with existing policy. An administrator's concerns were very different from those who dealt directly with the case, and acted as filters by dampening certain issues while amplifying others.

Another significant characteristic of DHS is the time required to respond to a change in the situation. The organization has created a rigid structure by replacing certainty and expertise of individuals with organizational standards and procedures (March and Simon 1958). Though this may be an efficient protocol, in this setting it led to problems being reformulated to match procedures, or being shuffled from one program to another. The organization had limited flexibility to match qualitatively new problems that arose within HPRP.

Third, BPA was very different from both the industrial firms and DHS. It has a volunteer board that chooses its officers annually. Still, only a few individuals repeatedly fill these official roles and the positions of the organization during the case began to reflect their

viewpoint. BPA's reaction time was very short because their decision-makers were directly involved.

The different organizations within HPRP not only had different structures and response times, but also would send representatives of varying decision making power. Those differing capabilities to decide, in addition to an inability to communicate internal organizational constraints or have them accepted by others as valid, made attempts at working together more difficult.

To function within an interdependent environment the stakeholders required different types of processes and information than those normally used. They needed mechanisms to elicit concerns and share perspectives in order to identify areas where commonality existed or could be created. The participants instead had to deal with a process they did not believe would serve or even consider their interest.

The systemic nature of an interdependent environment was not initially apparent to the stakeholders. They attempted to act separately, only to see their intended results lost due to the responses of the other stakeholders. They could still thwart each other's attempts; figuratively, a push from one could cancel a pull from another. Independent actions by a single stakeholder became less

significant to the outcome than the collective actions and behaviors of the whole.

When stakeholders acted independently, they often did not anticipate the reactions of the other stakeholders; in fact, their actions could backfire. This inability to control or predict the outcome compelled the stakeholders to seek out ways to work together. This was most dramatically shown by DHS when it changed its philosophy toward the other stakeholders by shifting from a dictatorial style of relating to one that actively sought agreement, and which needed the participation and input of the other stakeholders.

Over time a pattern emerged from the stakeholder attempts at working together, one of groups reorganizing into increasingly closer working relationships. Figure 6 illustrates this tangent in a timeline depicting the formation of the various groups and coalitions. At the core, these reorganizations were also the result of an ill-defined problem coupled with a lack of mechanisms to solve it.

The stakeholders never directly dealt with how to work in an interdependent environment partly because of the DHS's responses and requirements to the groundwater contamination. But even DHS's conventional problem-solving approach was overwhelmed when it did not fill the requirements of an

interdependent environment. The situation was one in which the outcome would exist by virtue of the stakeholders' relationships to each other: that the resolution of the problem was contingent on the stakeholders' ability to manage their interdependence.

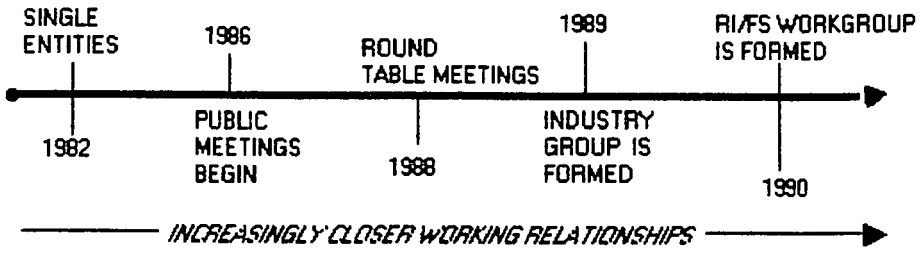


Figure 6. Timeline of stakeholder group and coalition formation

4.2 Dysfunctional Behavior and the Problems that Arose

Dysfunctional behavior impaired the stakeholders' ability to function within an interdependent environment. Specifically, if their behavior did not allow them to meet the requirements of interdependence, it was dysfunctional in the sense that their own and other's goals could not be achieved.

Inaccurate assumptions and expectations supported dysfunctional behavior. Stakeholders could not deal with their situation because of their assumptions about what

should work. One such assumption was that outcomes could be controlled and predicted. The conventional approach used by DHS depended on its ability to do this as shown in the "cleanup process" template on page 31. But all the stakeholders shared this assumption, and they experienced surprise when their actions did not produce the expected results.

Examples of unanticipated outcomes plagued the DHS in its management of HPRP. First, it was shocked by the degree to which its intentions backfired during the first public meeting. Then, in its attempt to follow procedures and effectively manage state resources, it instead roused the frustrated community and threatened industry which then stopped its further involvement in other research park sites. In addition, its attempts to speed up the process resulted in a delay of almost a year, with multiple revisions, before there was an acceptable RI/FS work plan. This listing only highlights the difficulty of the "control and predict" model in this case.

Unanticipated results also were a problem for the community and the RPs. BPA's attempt to speed up the process by asking for information from DHS instead slowed the process by taking staff time away from the problem. For example, one staff member estimated she spent 50% of her time responding to these requests. Both industry and

Stanford found that attempting to decrease their liability instead eroded their ability to work together, making them even more at risk from lawsuit and regulatory repercussions.[1]

The stakeholders also expected to send signals through their actions (e.g., writing letters, making public statements, proposing a plan) that would elicit particular responses. This was demonstrated by the community in their attempt to motivate DHS through communicating with their elected representatives, by DHS when it stated it could use Superfund money to finance cleanup, and by the industry group when it "volunteered" to do the IRM/FS on Matadero Creek. These actions functioned primarily as signals to the other stakeholders. However, problems arose when the "receivers" could not accurately interpret the signals and respond appropriately. The effectiveness of sending signals relied on a shared base of information and assumptions that was not always present between the stakeholders.

Given the different organizational response times, a stakeholder could interpret a delay as intentional non-responsiveness. BPA did this when DHS took so long in responding to their requests for information. The situation may have been similar for some industries that missed the

[1]An industry lawyer thought that the decision to remove lawyers from spokesperson positions to more advisory roles came out of this observation.

DHS timelines; yet DHS was unable to acknowledge or evaluate the validity of internal organizational constraints.

In this interdependent environment, determining an appropriate response to the groundwater contamination, the regulatory requirements, and to each other was difficult for the stakeholders. This relates to another problem that arose from the stakeholder perceptions of the situation: they were unable to acquire information that they needed because they did not recognize their situation had different informational requirements. They did not recognize that if their actions depended on the actions and responses of the others, they needed to know something about each other. Not knowing what each other thought the "real" issues were, or what each other considered as in their interests or as a disincentive or barrier, acted to constrain the stakeholders' ability to function effectively.

Lacking information about each other also led to their inability to motivate or persuade others and decreased the options available for resolution. Complicating the situation further was how each stakeholder defined the problem in terms of their interests, perceptions, and concerns. They were not trying to solve the same problem.

Yet before this type of information could be shared, the stakeholders needed to acknowledge their interdependence and establish processes for facilitation that were also

protective of their interests. The conventional approach did not recognize the significance of stakeholder interdependence nor had procedural tools that filled this criterion.

Stakeholders also had difficulty getting information about the impact of their actions. They were unable to get feedback on their actions separate from the collective result. They could not self-correct or know, with any certainty, that they were moving in the right direction in addressing the situation. Also, since the group as a whole was not working closely together, the stakeholders could not correct their collective behavior. No one managed this collective behavior and it led to outcomes that not only ran counter to the goals of the stakeholders, but also could, arguably, run counter to the goals of larger social interests (social, economic, political and environmental). Figure 7 illustrates the stakeholders' difficulty in getting the information they needed.

The most serious outcome from the collective behavior of the stakeholders was the impasse (see p. 62). In this situation no progress toward resolving anyone's problem could be made. Because the stakeholders were interdependent they could constrain each others' actions, but because they

failed to manage this interdependence they could not work toward a resolution.

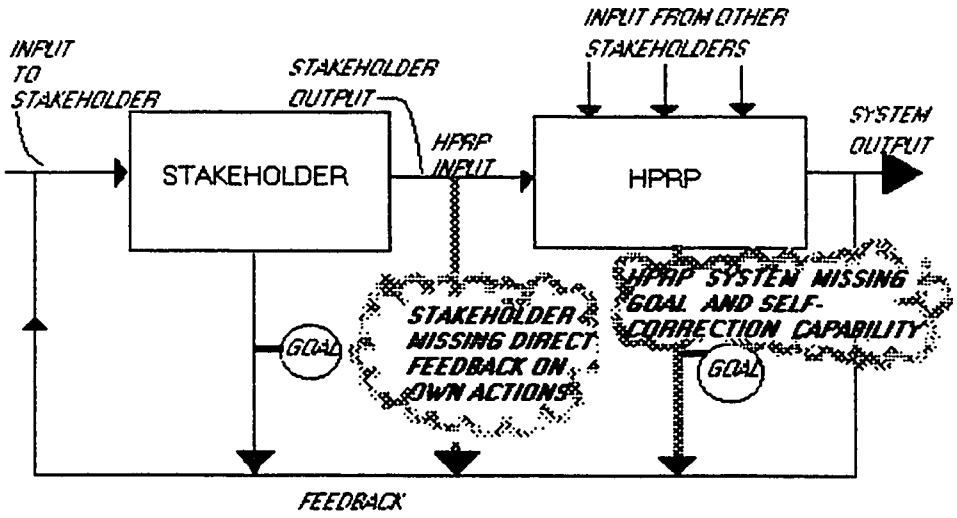


Figure 7. Distortion of goal-seeking behavior within HPRP.

In general, it was as if the stakeholders did not know they were interdependent nor realize the systemic aspects of their situation. They would bump into the system without realizing the consequences and therefore could not adjust to the complexity it introduced. Instead they did what they had always done. It took years of frustration and an impasse before they collectively saw the necessity of working together.

One reason for this may be in the stakeholder's underlying assumptions about "how things work." The change

to working together represented a shift in organizational paradigms. Though this shift was short lived, since stakeholders reverted to more traditional ways of dealing with each other after the dissolution of the RI/FS work group, it does pose the question of how appropriate current approaches are. However, the stakeholders also rejected the option of environmental dispute resolution services through Clean Sites, Inc. This again points to the importance and difficulty of knowing about each other and working together in disputes involving multiple stakeholders.

4.3 Disincentives of the Conventional Approach

It would be inaccurate to say the difficulties the stakeholders experienced resided primarily within themselves. They instead resulted from the stakeholders' interdependence in an environment that also acted to constrain their ability to deal with it. It appears from the case study that at least two conditions made interdependence difficult to address effectively: (1) there were strong disincentives in the conventional problem-solving approach used by DHS; and (2) the significance of the stakeholders' interdependence was not acknowledged. These conditions are discussed below.

The first condition consisted of the profound disincentives within the conventional problem-solving

approach. These took the form of constraints on the DHS and the potential financial liability on the PRPs and RPs that would be assumed separately. As noted in chapter I, the conventional approach has an ingrained bias toward reductionism and simplification reflecting its technical perspective. This bias is built into the structure and procedures of the DHS. Here, problems need to be classified into pre-established bureaucratic categories of existing programs before resources can be made available. It is when these standardized categories must handle technical variations and anomalies to specific situations that these generalized rules of the institutional environment are often inappropriate (Meyer and Rowan 1977, 37).

DHS's rigid procedures and categories were a disincentive in its attempts at building working relationships with other stakeholders. Its ability to build working relationships was also eroded by the organizational need, as a condition of involvement, to pre-formulate the problem situation before any discussion with stakeholders. DHS would respond to procedural problems with further simplification and reduction in variety. Its attempts to manage the situation instead narrowed options for resolution. Still, it was these procedures that

legitimatized DHS's involvement and protected it from any future legal challenges to its authority and actions.

The DHS procedures also acted as a disincentive to the RPs and PRPs primarily because fairness and equitable cost allocation was not one of its goals. The RPs and PRPs therefore were compelled to follow strategies that were not compatible with sharing information and working together. There was a constant tension between the need to create a problem-solving system out of elements with profound incentive to avoid involvement.

One disincentive was the result of how our dynamic regulatory system reflects the changes in a larger environment of scientific, political, economic, and social realities.[2] RPs and PRPs were affected by the uncertainty this represented, because any response to the groundwater contamination could be revisited by DHS, or another agency, in the future under new criteria. Under the current legal system it was safer not to become involved, if possible,

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[2]Scientific aspects include the scientific models, theories, accepted logic, practices, and methodologies accepted by environmental scientists. Political aspects include past political and legal decisions, policy, regulations, and the mechanism of an electoral system. Economic aspects include the state of the economy, rate of unemployment, economic base of the community, and the public's perception of these elements. Social aspects include world views on what is appropriate action, the perceptions of what are unacceptable risk, and the rights of individuals and communities.

because the act of responding could be construed as admittance of guilt now or in the future.

Another disincentive was experienced by industries considering the option of voluntarily performing investigative and remedial work. Those that had done so were made more liable by the DHS's strategy of selecting RPs without a concerted effort to identify and name all PRPs. Those that had not started found a reason to wait until required to by the DHS. DHS did not focus on this aspect since their goal, which was to identify RPs to do the remediation, was met without identifying everyone. It was the DHS's position that if the named RPs wanted others to share the cost they would have to pursue or sue them on their own.

In addition, because of the liability issue and high cost of groundwater remediation, industry found it necessary to divert effort and resources to protecting itself. Strategies included placing wells in locations that would bring in additional RPs if contamination was found, not sharing information that could imply their involvement, and resisting technical interpretations that weakened legal arguments. All this only slowed progress in resolving the environmental threat.

Finally, the question arises of how disputes of this sort can ever be resolved when environmental laws specify

and constrain "solutions." This suggests that even if DHS developed processes that would allow multiple viewpoints, it would still operate in a regulatory environment that constrains it to produce a certain "official" output.

This chapter explored the nature and repercussions of the stakeholder's interdependence, and why it was difficult to address. Underlying much of this is the conception of "how the world works" that color the way institutions and people approach a problem. The next chapter will focus on what kind of shift would be necessary to allow stakeholders to address their interdependence directly and the conditions that new procedures, strategies and incentives would need to meet to function within the interdependent environment of MSEDs.

CHAPTER FIVE

CONCLUSIONS

This thesis has examined a specific MSED to understand its implications for the problem-solving approach used to address it. A single case cannot establish the general characteristics of MSEDs, nor is that the goal of this thesis. Rather, the goal here is to explore how the complexity of MSEDs occurring within an interdependent environment require a much different approach toward resolution than available in technical conventional problem-solving models. This chapter sketches the changes in thinking that this alternative approach represents.

5.1 MSED Management

We have seen that one stakeholder could not control the outcome in this interdependent environment. We also saw that by working together, the stakeholders could manage the process so that a particular outcome was more likely. To meet the requirements of this situation the notion of control was replaced with that of management.

The inadequacies of the conventional approach used in this case study were demonstrated and analyzed. Though less complicated environmental disputes may be resolved by conventional approaches, they were clearly inadequate for the situation represented here. They were unable to guide stakeholders to control or manage the outcomes, and in fact, stakeholders' action based on the assumptions of these approaches made the situation worse.

There are many compelling reasons for fostering an ability to manage MSEDs. One is that MSEDs have become an increasingly active social forum for formulating our collective values and shaping the future for the environment. Another reason is if those most directly involved do not learn to manage MSEDs, they will likely be taken out of their hands and decisions will be made by people unfamiliar and unconcerned with local needs or interests, such as judges, government bureaucrats, and politicians. The benefits of this would be dubious.

The obstacles to effective management are formidable. It cannot occur spontaneously because of the constraints of policy, procedures, and decision making frameworks inherent in the approaches currently used to address environmental disputes. To be effective, management of MSEDs and their increased complexity will require a shift in our thinking and new tools and approaches that support that shift.

5.2 A Shift in Our Thinking

We can envision the sort of paradigm shift implied by this case by comparing aspects of the conventional approach to their counterparts in a new one (table 3). This discussion is necessarily speculative, yet it is based on the preceding analysis of this case. The focus is on those aspects that encourage or discourage the creation of working relationships between different stakeholders. Working together represents a shift in paradigm supported by the requirements of an interdependent environment.

The first seven aspects listed on table 3 are related; they all affect a groups ability to generate a shared vision or ideal solution. They create the subtle structure of policy and expectations that shape stakeholders' relationships to each other. The notion of defending yourself against "them" is at the root of the old paradigm. An approach more suitable to an interdependent environment would be to transform "them" into "us," and build a problem-solving team. The case study showed how the interdependent environment compelled the stakeholders in this direction. The following discusses these aspects in more detail.

The first aspect, building a strong argument that supports a particular viewpoint or interest group, has been fundamental in environmental problem solving. This strategy

Table 3.-- Paradigm Shift

OLD	NEW
Relationship Between Stakeholders	
Strong argument supporting a viewpoint	Facilitation of various groups working together toward a mutually acceptable solution
Incompatible goals are not made explicit	Incompatible goals are made explicit-trade offs dealt with
Conflicting facts dealt with as right/wrong, win/lose	Conflicting facts are representations of different world views, interests or concerns (win/win)
Misperceptions are not explored leading to antagonism Different viewpoints are dismissed as not legitimate	Misperceptions dealt with-goal to bring group to an understanding of each others viewpoint- viewpoints are considered legitimate
Experts know and need to "educate" others	No experts - group works together as a team
Information is held back	Information is freely shared
What is Considered Knowledge	
Ephasis on data generation to support scientific-basis for decision making	Emphasis on values and using our limited knowledge and understanding to make a difference
Need for pseudo-certainty	Accepts uncertainty within defined tolerance limits
Rational, scientific decisions are the ideal	Balanced decisions that consider various viewpoints and values are the ideal
Technical, engineered solutions are preferred (partition the problem from its source)	Policy, procedure, resource use modifications are preferred (eliminate the source
Who Should Make The Decisions	
Top down decision making	Decisions made at lowest level by those most involved
Dealing With Complexity	
Does not deal with all the critical variables - denies the complexity of the issues	Acknowledges complexity by seeking methods/tools for dealing with it

is still supported by the possibility that the final decisions will be made in a court of law. Still, it only guarantees a lengthy, expensive legal battle if played out to its end. There is, of course, the possibility of losing the case and destroying a party's ability to work successfully with the others involved. The new approach focuses on building a vision that supports multiple viewpoints. Solutions, not defense, are the focus.

The old approach also assumes a right/wrong stance, where there are pre-established legitimate concerns, with knowledgeable experts and ignorant laypersons. This approach limits participation, narrows the problem's scope, and gives an illusion of control. It does not work in an interdependent environment where an expert's technical knowledge will not be carried out unless the concerns of non-experts are addressed. The new approach would balance technical knowledge and human values with a bias toward inclusion, a focus on communication and determination of underlying interests, team work, information sharing, and mutual learning. A successful strategy means everyone must win; otherwise no one does. Yet, what it means to win may be different for each stakeholder. Information, validation, and feedback become more important in this setting.

The next four aspects in table 3 are also related to each other; they decide what is valid knowledge and how we

know this. In the old paradigm the belief in a rational, scientific model of reality is overpowering. But it becomes dangerous with the subtle shift from "we can know" to "we do know" that occurs when scientific models become regulatory mandates. This "arrogance of knowing" can blind us to the repercussions of our actions. This bias also prefers the quick fix of technical, engineered solutions. The new approach would link knowledge and values with a conservative respect for the nature of complex systems and the limits of our understanding. Solutions would focus on fundamental issues and not depend on short-term fixes that often create additional long-term problems.

The following two aspects on table 3 deal with whom should make the decisions. Decisions are made from the top down in the old approach. As shown in the case study, the local situation was forced into a generalized category. Processes and procedures drove actions. This structure hinders the ability for multiple stakeholders to create a shared goal, since the goal is being imposed from the outside. The new approach would empower local stakeholders most directly affected and would require more flexibility from outside legal and regulatory controls.

The last aspect addresses how we deal with complexity. The old approach deals with complexity by reducing it to simpler parts: an approach that often destroys the integrity

of the whole making it impossible to find the critical variables and operational links that may lead to a fundamental solution. The new approach would acknowledge the need for these links and focus on creating tools that will allow for their inclusion. Table 4 outlines several fundamental conditions any new tools or approaches would need to meet.

Table 4.--Requirements of New Tools and Approaches

* Can reconcile goals, relationships, and organizational differences between stakeholders.
* Can process, document and present information in a timely, understandable manner.
* Can facilitate group processes that include:
  - decision making mechanisms
  - conflict resolution
  - group goal and vision generation
  - evaluation of outcomes
* Can maintain the purpose and integrity of stakeholder group.
* Are biased toward inclusion and rich problem formulation.
* Prefer a balance between technical knowledge and human values.

5.3 Implications to the Environmental and Systems Fields

This study is a systems application that could make a difference to environmental professionals. It demonstrated the serious limitations with the conventional approaches and how the nature of interdependent environments are not

compatible with these approaches. The requirements of an interdependent environment will make effective management of MSEDs look very different from what professionals have come to expect.

This study demonstrates that the approach and problem-solving framework used in handling environmental disputes are as important to a solution as science and technology. In addition, there are structural constraints within participating organizations that can lead to distortion within the system and misinterpretation by other stakeholders. There is a need to work at the level of the system to minimize the distortion and lag time that erodes stakeholders' ability to work together. The environmental field is advised to train people in tools that will enable them to understand and better manage MSEDs.

This study also presents an opportunity for systems scientists to build a conceptual model of the processes and structure of MSEDs. MSEDs cannot be totally described as systems for they have non-predictive parts, and non-generalizable aspects in which individuals make a difference. Furthermore, MSED's structural

> . . .elements are only loosely linked to each other and to activities, rules are often violated, decisions are often not implemented, or if implemented have uncertain consequences, technologies are of problematic efficiency, and evaluation and inspection systems are subverted or rendered so vague as to provide little coordination (Meyer and Rowan, 1977. 24).

Still, there is a significant role for systems scientist. Systems thinking will be instrumental in determining the structure, and the resulting behaviors within specific MSEDs. This will enable the development of new, more effective structures that support positive behaviors and outcomes. The vision is to develop tools that empower those involved to generate solutions that reflect not only effectiveness, but sustainability and wisdom.

5.4 Follow on Studies

Follow on studies based on the findings of this study would include identifying how to give stakeholders the appropriate tools for managing MSEDs. Regulatory agencies may not be capable of this because of their regulatory mandate and organizational structure. This exploration should include the possibility of local government or dispute resolution firms in a facilitating role in MSED processes.

Also, using multiple MSED case studies, a generalized model of how they evolve through time could be developed. This model could help identify the type of processes and tools most useful at different points in the MSEDs life cycle. In addition, further study is needed on constraints to changing MSED approaches, and also procedures to be used once the management paradigm have shifted.

These studies would not establish a new problem-solving paradigm, but they may well document the serious limitations and costs of present approaches. Changing paradigms in a field is a lengthy and often tortuous process. It is hoped that this thesis has contributed to a critical examination of one such paradigm, and at least suggests what a new one might look like.

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GLOSSARY

Amplifier: A signal filter function, emphasizing a portion of the signal over another.

Aquifer: A highly permeable layer of rock or soil that holds or can transmit groundwater (Moran, Morgan and Wiersma 1980, 628).

Behavior: A succession of states (Ashby) starting with the first and ending with the last one observed. The protocol of an observed system's changes from one state to the next. Whether behavior is merely identified by its name described in terms of a transformation or function, or represented by a generative device, it must ultimately refer to or reproduce a sequence of states or a trajectory in space (Krippendorff 1986).

Black box method: A strategy for investigating a complex object without knowledge or assumptions about its internal make-up, structure or parts. The method aims at either a formal description of the transformation rules linking inputs and outputs or the construction of the outside of the "black box" (Krippendorff 1986).

California Environmental Quality Act (CEQA): California state law codified in Public Resources Code section 21000 et seq., Title 14, CCR section 15000 et seq.

CCR: California Code of Regulations.

CFR: Code of Federal Regulations.

Chlorinated hydrocarbons: A class of chlorine containing chemicals, some of which are toxic, carcinogenic, and may bioaccumulate (Moran, Morgan and Wiersma 1980, 629).

Cleanup: A vague term used to mean removal of environmental contamination. May refer to a return to a pristine state; the removal of contaminants to the lowest level technically attainable; or the removal of contaminates to a reasonable level protective of human health and

the environment, implying risk reduction, not restoration.

Coalition building: Activities that lead to realizing shared interests and motivation for mutual support, among different parties.

Communication channels: That part of a communication chain in which signals are transmitted from a sender to a receiver. A channel involves a single physical medium that spans the difference in time and in space which separates senders from receivers (Krippendorff 1986).

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980: A federal law codified in Federal Superfund, 42 USC section 9601 et seq. It is also reflected in California law codified in 40 CFR, California Superfund Health and Safety Code section 25300 et seq.

Conceptual framework: The way analysts makes sense of and organize observations and data. Descriptively, the conceptual framework acts as a filter through which the analyst sees.

Constraint: The difference between a set and a subset indicating that the variety that exists under one condition is less that the variety that exists under another. For observers, constraints become apparent when they find that a system can assume fewer states than are logically possible or hypothesized by them. Within a Cartesian principle, a constraint is the complement of a relation, the former contains all states excluded by the latter (Krippendorff 1986). Constraints include species, personal, and situational limitations.

Conventional approach: Used here to refer to a scientific, technical and expert-based approach to environmental problems that do not attempt to explicitly address the social, political, and relationship building aspects of problem formulation, dissolution, or solutions.

Cybernetics: From Greek *kybernetes* (steersman). Initially, the science of control and communication in the animal and the machine (Wiener). Treats ways of behaving--not what it is, but what it does; how systems regulate and reproduce themselves, learn, and evolve.

Deep pocket: A term used for profitable companies that are perceived to be able to absorb cleanup costs without going bankrupt.

Dynamic system: A system in an ongoing process, not static.

Emergence, Emergent Properties: The principle that whole entities exhibit properties which are meaningful only when attributed to the whole, not to its parts (e.g. the smell of ammonia, or the wetness of water). Every model of a human activity system exhibits properties as a whole entity which derive from its components activities and their structure, but cannot be reduced to them (Checkland 1981, 314).

Environmental dispute resolution: Refers collectively to a variety of approaches that allow the stakeholders to meet face to face to reach a mutually acceptable resolution of the issues in a dispute or potentially controversial situation (Bingham 1986, *xv*).

Facilitation: Any activity that forwards group work by establishing processes and protocols that enable participants to focus on the task at hand. Requires a foundation of trust to be effective.

Feedback: Information about results that is used to change behavior. A circular causal process in which a system's output is returned to its input, possibly involving other systems in the loop (Krippendorff 1986).

Filters: A device that takes a signal string which is undefined in terms of scale and converts it by a process of integration into a scaled message. Low-frequency characteristics of a signal may be deemphasized by a filter which places greater significance upon high-frequency behavior. Alternatively, high-frequency aspects of the signal may be smoothed and averaged such that they become a less important part of the defined message than they were of the signal. The patterns of integration which are used in a filter may be very exotic and can even be influenced by aspects of the signal as it is encountered (Allen and Starr 1982, 268).

Frequency (domain): A mode of discussion where events are not seen as occurring at points in time, but rather according to the frequency of their recurrence (Allen and Starr 1982, 268).

Goal constraining: Internal and external barriers, both behavioral and situational, to attaining goals.

Goal convergence: (see Second-Order Cybernetics) The coming together, agreement, over a preferred outcome.

Goal seeking: (goal-oriented) Behavior of a self-correcting system directed toward a preferred outcome or final condition. Attribute of systems whose behavior is specified not only by its current state or its past history but crucially by some preferred future state or behavior, a goal toward which it convergences (Krippendorff 1986).

Goal: Final condition or series of conditions, the convergent directions of any self-correcting process.

Gradient: The slope of the surface of the watertable. Used to determine the direction of groundwater flow.

Groundwater: Water below the land surface that is at or above atmospheric pressure, saturating the subsurface material in which it is found.

Hazardous substance: A toxic or dangerous material identified by federal and state regulations.

Hazardous waste: A toxic or dangerous waste material that meets the definition of such, within federal and state regulations.

Hierarchy: The principle according to which entities meaningfully treated as wholes are built up of smaller entities which are themselves wholes . . . and so on. In an hierarchy, emergent properties denote the levels (Checkland 1981, 314).

Holistic approach (Holism): An approach using a process of identifying the components of the whole, identifying their interconnections, choosing a way to represent these elements and these interconnections, and "studying" the resulting model (as a whole) to develop a Gestalt appreciation of the whole (Glossary on Cybernetics and Systems Theory 1984). It is related to the synergistic approach with its emphasis on the whole as being greater than the sum of its parts.

Hot spots: Highly contaminated areas.

Industry group: The group formed by the industrial tenants named on the regional RAO.

Input: That which is changed by a transformation process. Inputs may be concrete or abstract (Checkland 1981, 318).

Interim Remedial Mitigation-Feasibility Study (IRM-FS): A study of the workability of a selection of actions to temporarily or partially lesson the impact of contamination on the environment.

Law of requisite variety: (Ashby) You must have as many ways of being as the system you are controlling or managing.

Linear: A relationship among variables in which any one of the variables can be expressed as a constant plus a sum of the other variables each multiplied by a constant (Allen and Starr 1982, 270). The whole is equal to the sum of its parts.

Mediation: The act of intervening as a neutral party between conflicting parties to promote reconciliation, settlement, or compromise.

Mitigation: The activities undertaken to lessen the environmental impact of a situation.

Multiple stakeholder environmental disputes: (MSEDs) More than two parties involved in a controversy over an environmental issue.

Negotiation: A process where different sides work out agreements to further their own interests.

Nested hierarchy: A restricted type of hierarchy which has the requirement that upper levels *contain* lower levels (Allen and Starr 1982, 274).

Organizational patterns: Refers to different assemblies, groupings or organizations, and their processes, that the stakeholders participated in.

Output: That which is produced by a transformation process. Outputs may be concrete or abstract (Checkland 1981, 318).

Paradigm: The pattern underlying the process of constructing theories and explanations and thereby affecting the form of the body of knowledge within a social domain. Paradigms carry their own source of justification and are therefor less obviously related to or challenged by empirical evidence. Kuhn describes the history of science as a succession of paradigms, transitions resulting not only from the emergence of empirical phenomena an existing paradigm is unable to explain, but also from socio-political interests within the scientific community (Krippendorff 1986).

Plumes: The flow of contaminates within groundwater.

Potentially responsible parties (PRPs): Refers to parties implicated in a Superfund site for cleanup liability.

Problem formulation: An activity aimed at identifying a problem by specifying (a) the undesirable and problematic state currently occupied, (b) the resources currently available to move away from that problematic state, particularly the available courses of actions, the combinatorial constraints on using them, etc. and (c) the criteria that need to be satisfied to say that a problem no longer exists or is solved. This activity defines the cognitive gap between what is and what is desirable and delineates the resources for closing it. A good definition of what the problem is is believed to be more than half of the way towards its eventual elimination (Krippendorff 1986).

Problem reformulation: Changing how a problem is perceived. Can result from increased information, persuasion, creativity, or change in emphasis.

Problem solving: An activity aimed at closing the cognitive gap en route to a goal by employing acts or processes neither immediately nor obviously suitable towards this end (Krippendorff 1986).

Reductionist: An approach using a doctrine that maintains that all objects and events, their properties, and our experience and knowledge of them are made up of ultimate elements and indivisible parts (Ackoff 1974, 8).

Reframing: To shift how a situation is percieved by changing the context in which it is held.

Remedial Action Order (RAO): A legal document outlining remedial actions and compliance schedules. DHS has authority to set fines and fees if its conditions are not met.

Remedial Investigation / Feasibility Study (RI/FS): Activities to collect data on the extent and severity of environmental contamination to be used in developing possible remedies. Several potential remedies are then compared, and evaluated for workability in the specific case.

Responding parties (RPs): A term coined by the industry group to highlight the fact that responsibility had not been determined for the contamination found under the Barron Park community.

Responsible parties (RPs): A legal term in (CERCLA) 42 USC section 9607(a), for a party responsible for cleanup on a Superfund site.

Roundtable meetings: A format where various stakeholders meet to share information on equal footing.

Second-Order Cybernetics: The cybernetics of systems involving their observers as opposed to the cybernetics of systems that are observed from the outside (v. Foerster). Second-order cybernetics is a more recent development, involves the observer as a constitutive part of a circular organization and includes as concerns; self-reference, epistemology, autonomy, self-government, and autopoiesis (Krippendorff 1986).

Self-organizing System: A system which changes its basic structure as a function of its experience and environment (Glossary on Cybernetics and Systems Theory 1984).

Signal: A string or strings of energy or matter in transit between a transmitter and a receiver; its meaning is undefined (Allen and Starr 1982).

Soil gas: Vapor found in the unsaturated zone of the soil above a groundwater table.

Stakeholder: Someone who claims an interest in the matter. In the case study, this included governmental agencies, industrial tenants, impacted communities, and landowners.

State action levels: State standards refer to health based action levels developed by the DHS. These are chemical concentrations, once detected, that flag an action response (e.g., close or limit access to a well, treat the water, substitute water source).

State Superfund: A short hand term for the Carpenter-Presley-Tanner Hazardous Substance Account Act and Bond, codified in the Health & Safety Code Sections 25300-25395 (Taylor 1990).

Structure: Those features (components and processes) of the system that persist through time.

Sweeping-in: An approach to problem formulation that acknowledges the interconnected nature of most issues. (Churchman) Broadening the discussion by bringing in all related aspects before narrowing the focus.

System boundary: A distinction made by an observer which marks the difference between an entity (system) and its environment (Checkland 1981, 312).

System environment: What lies outside the system boundary (Checkland 1981, 314).

System: Set of elements and relationships that function together as a whole.

Systems approach: An approach using systems thinking; an epistimology which, when applied to human activity is based upon the four basic ideas: emergency, hierarchy, communication, and control as characteristics of systems. When applied to natural or designed systems the crucial characteristics is the emergent properties of the whole (Checkland 1981, 318).

Toxic Substances: Substances that cause serious illness or death in a one-time dose or in low doses administered over a long time period (Moran, Morgan and Wiersma 1980, 638).

Trade-Off: Foregoing some portion of one benefit in order to achieve some increased portion of another benefit; (or) foregoing some portion of a benefit in order to achieve a reduction in some portion of a cost; (or) accepting an increased portion of one cost in order to achieve a decrease in the portion of another cost. Other more complicated permutations of this concept can

be suggested. The term is in wide usage. (Science Policy, A Working Glossary 1973)

Transformation: The process that converts an input into an output (Checkland 1981, 319).

APPENDIX A: DATA COLLECTION AND MANAGEMENT

Appendix A outlines the basic research done for this study and describes the manner in which the information was treated.

Data was collected to obtain information regarding:

1. The background and chronology of events.
2. Who are the individual and institutional actors?
3. What are their resources ?
4. How do they habitually view or act in the world?
5. What are the relationships between the actors?
6. What is perceived to work/not work and what is the criteria for determining this?
7. What is problematic for each role in HPRP?

ELEMENTS FOR DATA COLLECTION

I. Interviews with involved parties

II. Attending meetings

A. Round Table Technical Meetings (approx. monthly)

B. Community Meetings (quarterly)

C. Barron Park Home Owner Assoc. Meetings

D. Others (when appropriate)

III. Review Written Documents

A. Barron Park Association (BPA) Archives: This information consists of copies of correspondence to and from

the BPA, selected newspaper articles, meeting agendas and attendance sheets, and information on BPA.

B.Technical Reports: These are reports generated by consultants working for the various industries and DHS.

C. Legal Documents: These consist of legal documents generated by the DHS that pertain directly to the issue.

D. Laws, Regulations, and Guidelines: I approached this category by first determining what the applicable laws, regulations and agencies were. This was done with material that I have accumulated through professional seminars and course work. I then referred to summaries of the statutes, backing up the findings with complete law and regulatory citations if necessary.

E. Newspaper Articles: The Palo Alto Main Library keeps a card index of the local newspapers (Palo Alto Weekly, Peninsula Times Tribune) broken out by topic. By looking under the following headings I was able to find complete citations back to 1963: Water Pollution, Hazardous Substances, Industry, Stanford University, Associations, and Homeowners Associations.

F. Fact Sheets: These are summaries, written by DHS, EPA or the industries, of actions taken.

G. Technical Background Information: A majority of this came from course work done in groundwater, risk assessment and treatment technologies. Discussions with

professionals in the field and bibliographies found in current technical reports were used as a guide.

INTERVIEW METHODOLOGY

The method I utilize in conducting interviews consisted of the following:

1. Phoned prospects to set up an appointment and explained my purpose further.

2. Took notes at the time of the interview, backed it up with a taped account of the interaction after the interview, and wrote a brief summary. In some cases I would record my observation or internal state in a "research diary".

I selected the prospective interviewees with the intent of getting a broad representative sampling of the different divisions of groups that may be impacted by the Hillview-Porter site mitigation effort. I chose from the Department of Health Services' mailing list of over 500 listings. Table 4 lists the divisions and groups with the number of individuals approached in each.

Most of the interviews lasted from one to two hours when just addressing the questionnaire. The historical accounts have lasted up to four hours. Both Barron Park Association and Department of Health Services have been very supportive by providing written documentation in addition to the interview.

Table 4.-- Interview List

	Group or Organization	Number Contacted
	Citizen Groups, Property Owners and Individuals:	
	Barron Park Association	2
	Barron Park Residents	2
	Politicians and Staff:	
*	Palo Alto Mayor	1
*	Palo Alto City Manager	1
	Rebecca Morgan (State Senator)	1
	Bryon Sher (State Assembly)	1
	Media:	
	Palo Alto Weekly (Newspaper)	1
	Stanford University:	2
	Industries not yet listed:	
-	Lockheed	1
	Listed Industries:	
	Hewlett-Packard	3
	Watkin-Johnson	2
	Coherent	1
-	Teledyne	2
	Regulatory Agencies:	
	Regional Water Quality Control Board	4
	Environmental Protection Agency	1
	Palo Alto Fire Department	1
	Department of Health Services	2

-: Refused to be interviewed
*: Delegated interview to staff member

The purpose of interviewing is to document an individual's viewpoint. I would attempt validation during the interview to insure I documented it correctly. This was done by paraphrasing what I understood them to say and by reviewing my notes with them.

When validating an organization's viewpoint I would ask an individual to answer the questions as a company representative, as well as their viewpoint reflecting their particular function. I had also contacted more than one individual in the more involved organizations.

MEETING ATTENDANCE

The other source of data has been through meeting attendance. I have or will attend the following meetings as part of my data gathering:

Hewlett-Packard Groundwater Workshop: Consisted of project managers of groundwater projects within H.P. and Howard Hatayama, Chief of the Department of Health Services (DHS) Site Mitigation Unit as guest speaker, discussing DHS organization and their approach to regulating groundwater investigation and repudiation.

Hillview-Porter Regional Remedial Action Order-Industry Representatives Only: The DHS organized this meeting to present their viewpoints and introduce the regional plan. Also, it was to be an opportunity for industries to talk together and come up with a shared strategy. I was able to attend the first half, but was asked to leave when the industries started to discuss possible approaches. I was told by the Clean Sites and Stanford representatives that the industry representatives would feel

uncomfortable talking about allocation of funds in front of someone not directly involved.

Barron Park Association Board Meeting: I attended one meeting to better understanding how this group operates.

Hazardous Materials Coordinating Council: It is an informal group established by the Palo Alto City Manager as an ad hoc committee to provide a forum to exchange information relating to hazardous materials and environmental protection among local citizens, regulatory agencies, government officials, businesses and industry.

Peninsula Industry and Business Association: I attend their Environmental Affairs committee meetings. A recent meeting of interest had Russ Wyler, of Washington EPA, as a guest speaker, talking on E.P.A.'s role in the environmental mitigation arena. This is an industry group that meets monthly.

The purpose of attending the various meetings is that it gives me a direct impression of the groups involved versus the impression that comes from interviewing an individual. I get to see their public face. It is also an effective way to collect data and information, both formal (from the speakers) and informal (talking with and observing the participants).

Information is collected through note taking, written handouts, observing the setting (who is and isn't there),

the type of interactions between the participants and with myself, and an overall gestalt of the event.

The data was managed by recording and sequencing events from all sources by date. This allowed for patterns over time to emerge, and showed the operational interconnections between various stakeholder actions and reactions.

APPENDIX B
AUTHOR'S BACKGROUND IN THE ENVIRONMENAL FIELD

Environmental Specialist: September 1991 - Present
Stanford Management Company
Responsible for technical review of environmental reports, performing environmental assessments for new land aquisitions.

Environmental Specialist III: November 1990 - August 1991
California Regional Water Quality Control Board-Region II
A journeyman level position responsible for performing complex environmental analysis, research, and investigations; writing final reports and correspondences, and answering difficult questions from the public. Included the overseeing of groundwater contamination investigations and the review of technical reports for Class III landfills cases.
Graduate Student Position: May 1989 - October 1990
Responsible for technical review of groundwater monitoring well installation and design, and QA/QC programs.

Environmental Consultant: August 1988 - January 1990
JCF Environmental Regulatory Compliance Services
Specialized in Hazardous Materials Management Plans (HMMP), and environmental permits. Clients: precious metal recovery firms, auto body shops, plating shops, and silicon wafer fabs. Services: attaining Hazardous Waste Hauler registration, air permits, regulatory impact studies and reports.

Environmental Specialist: August 1983 - September 1988
Hewlett-Packard Company
Responsible for developing and managing environmental compliance programs: permitting, hazardous material storage, groundwater investigation/remedial action, monitoring, closure and decontamination, hazardous waste disposal and shipping, and emergency response training. Gave in-house employee trainings and management briefings. Knowledgeable in the requirements of Federal, State, and local laws and regulations.

Laboratory Technician: June 1980 - August 1983
City of Sunnyvale Water Quality Control Plant
Responsible for laboratory analysis (physical, chemical, microbiological) of wastewater in a tertiary treatment plant and a potable water supply.

Appendix C. Multiple Perspectives
Source: Linstone 1984, 64-65

	TECHNICAL(T)	ORGANIZATIONAL(O)	PERSONAL(P)
WORLD VIEW	SCIENCE-TECHNOLOGY	SOCIAL INFRASTRUCTURE: HIERARCHICAL...EGALITARIAN	INDIVIDUATION
ETHICAL BASIS	RATIONALITY	JUSTICE/FAIRNESS	MORALITY
Goal	Problem solving Product(study, design, explanation)	Stability and continuity Process Action and implementation	Power, influence, prestige Status maintenance or improvement
Modes of inquiry	Abstraction and modeling Data and analysis	Dialectic/adversary Negotiated reality/consensual	Intuition, persona, Individual reality, Experience, learning
Time concept	Technological time	Social time	Personal time
Planning horizon	Far Often little breadth	Intermediate distance Intermediate breadth	Short distance Variable breadth
Discount Rate	Minimal	Moderate	High (with rare Exceptions)
Constraints acceptance,	Problem simplification by limiting variables, relations	Fractionating/factoring problems Problem delegation to others or avoidance if possible	Hierarchy of individual needs (security, self-fulfillment)
	Cause and effect	Agenda ("problem of the moment") Bureaucracy often pervasive	Challenge and response Each construes attributes of others
	Need for validation, replicability(or "audit trail")	Political sensitivity and expediency Loyalties, credentials Restricted access by outsiders (caste) or recruits members (sect)	Inner world (subjectivity)
	Objectivity emphasized	Reasonableness, common advantage	
Characteristics	Prediction	Recognition of partial unpredictability Long-range planning often ritualized	Need for certainty, beliefs, Creativity and vision of the few
	Optimization (best solution)	Satisficing (first acceptable solution) Incremental change, slow adaptation Parochial priorities	Cope with few alternatives or variables only
	Feedback loops recognized		Game playing
	Quantification Use of averages, probabilities Trade-offs	Standard operating procedures Compromise and bargaining Monitoring and correction	Focus on simplistic hypotheses rather than scanning many, Leaders and followers, mystique
	Uncertainties noted: many caveats	Uncertainties avoided Fear of error	Fear of change and unknown
Communication	Technical report, briefing	Directive, conference, interview Private language with insiders Hortatory language with public	Narrative (story), discussion, speech Importance of personality