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Technology, Risk, and Place: Siting a Radioactive Waste Dump in California's Ward Valley

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by

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A plan to build a low–level radioactive waste dump in the Ward Valley near Needles, California has generated significant controversy. This controversy provides an excellent example to investigate the dynamics of conflicts over the siting of noxious facilities. While the literature about risk and hazard should illuminate such situations, it leaves the problem of expert-lay disagreements largely unsolved. I review what seem to be some weaknesses of risk and hazard research and introduce a new method for understanding conflicts over risk–taking. My contention is that risk-related decisions are based on appeals to what I call a "narrative matrix"– the intertwining sets of narratives about personal identity, place, nation, nature, and science that form the psychological backdrop for moral decision making – rather than on purportedly objective risk assessment. Applying this insight to the Ward Valley conflict exposes the strategies that various actors use to appeal to common elements of the narrative matrix and allows for a discussion of the underlying sources of conflict.

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Chapter 1

INTRODUCTION

If all goes as planned, California will have a low-level radioactive waste dump in the Ward Valley of the Mojave desert in 1996. However, things have not been going as planned. Some residents of Needles, California, twenty miles from the proposed site, along with the Fort Mojave Indian tribe and several non-profit groups, are legally challenging its construction. The site is part of critical habitat for the endangered desert tortoise. Some Californians, both citizens and politicians, have voiced concern that the dump would contaminate the Colorado River, also twenty miles distant. Geologists from opposing sides of the issue have come to conflicting conclusions on this question. Portions of the medical establishment vociferously support the dump's construction, while others oppose it, and the nuclear power industry is strangely silent.

The decision to build the Ward Valley dump allows the investigation of how we, as a society, go about deciding to introduce a new hazard, to take a new risk. Typically the discussion about taking risks has been dominated by those who would weigh out costs and benefits and presume to designate the rational decision for society. Opposition to such a decision process, when expressed by those living near a proposed project is usually pejoratively dismissed as a NIMBY (Not In My Back Yard) reaction, given neither weight nor respect (Amour 1984). In this thesis I will develop a different way to analyze the situation, one which I believe will better illuminate the dynamics of the conflict.

The driving force for a conflict over nuclear waste in California is clear; there is a legal mandate to build a radioactive waste dump. Federal legislation in the early 1980s passed the responsibility for disposal of low-level radioactive waste to the states in which it was produced. California's efforts to comply with this legislation culminated in the designation of the Ward Valley as the site for a radioactive waste dump. With this designation a whole set of questions arose. Would residents near Ward Valley acquiesce to its construction? Should California risk having

radioactive materials migrate into the Colorado River? Is the site a dangerous new hazard or a necessary risk?

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The outline of the thesis is as follows. Chapter Two presents background information on radioactivity and radioactive waste. A brief history of the treatment of radioactive waste in the United States is given, followed by a more detailed summary of the legal actions that led to the choice of the Ward Valley as the preferred site for a nuclear dump in California. Chapter Three explores the academic literature on risk and hazards and suggests the alternative method for explaining the inconsistencies one inevitably finds in siting noxious facilities, based on narrative theory. Chapter Four returns to the example of the Ward Valley and three areas where actors are trying to define roles for others in the conflict, followed by a summary of the legal history of the project, showing the importance of these areas to the outcome of the project. Chapter Five then explores the implications for looking at siting disputes as appeals to elements of the narrative matrix that may be shared among culturally, nationally, or geographically identifiable groups.

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Chapter 3

RISK, HAZARD, AND NARRATIVE

The proposed radioactive waste dump at Ward Valley is an example of the government and its constituents on the brink of making a decision about a controversial risk. Making decisions about risk and hazards has long been the subject of extensive study from various theoretical and practical approaches. It seems to me that this research has failed to illuminate the motivations for actors involved in conflicts over taking risks. This failure stems from a tendency to reduce the factors considered to the point that the explanatory framework becomes a caricature. In this chapter I will review the research on risk and hazard. This involves tracing four general areas of interest, the engineering-influenced quantitative risk assessment, cultural construction of risk, the more cognitive risk perception school and the human ecology approach to hazards. Second, I will present what I believe is a more inclusive way to understand how people and institutions evaluate hazards, by looking at the stories that comprise their narrative matrices, and how the roles that they attempt to impose on others fit into those matrices. I use this view to suggest what may be a productive way to look at the conflict over Ward Valley, which I then implement in the next chapter.

Research on Risk and Hazard

Risks and hazards seem to be inevitable components of living in modern society (Giddens 1991), but the meanings of the two terms differ between popular and academic usage. In common

parlance the idea of risk involves exposing oneself to a danger in return for some known payoff. Risks are "taken" and often "calculated," suggesting the appeal to a mental calculus using consistent rules. Hazards, on the other hand, are things to be avoided and feared (Winner 1986). They may be natural or technological, but certainly undesirable. Also in common usage, natural hazards are seen as unavoidable, while technological hazards are not.

Scholarly usage is not so value-laden and is somewhat less clear. Cutter (1993) defines risk as the "measure of likelihood of occurrence of [a] hazard," and hazard as a "much broader concept that incorporates the probability of the event happening, but also includes the impact of magnitude of the event on society and the environment, as well as the sociopolitical contexts within which these take place. Hazards are the threats to people and the things they value, whereas risks are the measures of the threats of the hazards" (Cutter 1993:2). But like their commonsense notions, these two definitions also lead to different approaches, people who study hazards tend to concentrate on how to mitigate and minimize, while people looking at risks tend to emphasize quantification to determine how to balance risks with benefits.

In terms of intellectual history, there is a distinction between risk and hazard research. They started with different foci, but have come to share much common ground in recent years. Risk studies can be seen as one tradition starting with quantitative risk analysis and giving rise to a school of more interpretive cognitive and cultural studies of risk. Throughout, risk analysis has been used to study technological risks. Hazards studies started as an approach to address natural hazards and has gradually moved to include technological hazards, and to overlap considerably with the cognitive strand of risk assessment. What follows is a brief survey of the development of these three strands of research. By no means is it exhaustive or comprehensive—I have chosen to omit the more sociologically-minded school of disaster studies because it does not address risk-taking—but it should provide an indication of general trends (for more complete descriptions of the development of these fields, see Covello 1983; Douglas 1985; Mitchell 1990; Misa & ElBaz 1991; Cutter 1993).

Quantitative Risk Assessment

Quantitative risk assessment was developed in the 1970s by academics, but with industry support, as an attempt to roll back tough environmental legislation enacted in the 1960s (Misa & ElBaz 1991). The seminal article in this area is Chauncey Starr's 'Social Benefit versus Technological Risk' (1969). Starr suggested an approach for establishing a quantitative measure of benefit relative to cost for accidental deaths arising from technological developments. He based his method on two explicit assumptions. First, historical records of accidental deaths are adequate for revealing patterns of fatality arising from technological developments. Second, "historically revealed social preferences and costs are sufficiently enduring to permit their use for predictive purposes." Proceeding from these assumptions, Starr then "converted into a dollar equivalent" the "social benefit derived from each activity." With this information he plotted the benefit per person compared to the fatalities per person-hour of exposure for voluntary and involuntary technological hazards. Using this method he drew some conclusions about willingness to take risks in America.

• Voluntary risks are accepted at levels roughly 1000 times that of involuntary risks.

• The risk of death from disease seems to be the psychological yardstick for determining the acceptability of a risk.

• The acceptability of a risk is relative to the third power of the perceived benefits.

• The acceptance of risk is influenced by public awareness of it.

• Design objectives for atomic power plants that are derived from economic criteria have lower levels of risk than those normally accepted for power generation.

The last point is one that confirms the suspicion that quantitative risk analysis was designed to help justify certain technologies. Starr later elaborated on his proposal (Starr *et al*. 1976), but the essence of the approach had already been set. Quantitative risk analysis has at its core the belief that decisions about technology can be made according to a monetary calculus in which costs, determined by quantifying loss of life and productivity, are balanced with total "social benefits." Two studies about nuclear power using quantitative risk assessment gained much public attention (U. S. Nuclear Regulatory Commission 1975; Inhaber 1978; see Schrader-Frechette 1980 for a review). The Rasmussen Report (U. S. Nuclear Regulatory Commission 1975) was an attempt to tabulate all of the deaths that occurred during the course of nuclear power production, from uranium mining and processing to power plant operation. On the basis of these tabulations some scientists, mostly engineers, have argued that it is hazardous *not* to build nuclear power plants (*e*. *g*., Beckmann 1976) because fewer deaths have been attributed to nuclear power than to coal power.

Quantitative risk assessment presents a curious picture of how people make decisions. This approach assumes that everyone is constantly and rationally comparing their risk of death in an activity with the cash value of the benefit of that activity. This is surely incorrect (see Shrader-Frechette 1985a, 1985b; Hanke 1981; Kelman 1982 for critiques of cost-benefit analysis); the reactions of people to danger, and their choices to subject themselves to danger, seem to be much more complex than this reduction to dollars and cents. And indeed, when it became clear that people were not acting according to the sort of linear functionality described by Starr, researchers began to investigate the more qualitative and cognitive aspects of human perception and reaction to risk. However, quantitative risk assessment endures as a policy tool. So, for example, a bill called the Risk Assessment Improvement Act of 1994 was introduced to the 103rd Congress asserting that "Risk assessment is a scientific procedure for evaluating and quantifying the magnitude and severity of environmental hazards which may threaten human health and ecological resources," and proposing the expansion of the risk assessment program in the Environmental Protection Agency and adding risk assessment to virtually all environmental regulation is an explicit goal of the newly Republican Congress (U. S. House of Representatives 1994). At least two other risk assessment bills have been introduced in the 104th Congress.

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Cultural Constructions of Risk

Cultural and cognitive approaches to studying risk were developed in the 1980s as a response to the simple fact that public perceptions and decisions did not coincide with conclusions drawn using quantitative risk assessment (Misa & ElBaz 1991). The central tenet of these studies was that human risk-taking is inseparable from the values held by an individual and the groups of which he or she is a member. While the ideas used to develop this thesis had been expressed earlier (Douglas 1976; Douglas 1976/1982), they were articulated strongly by Douglas and Wildavsky in *Risk and Culture* (1982).

Douglas and Wildavsky try to explain why fears about hazards are not necessarily linked to solid, statistical evidence and why people emphasize some risks and not others. Their explanation is based on the assertion that "the perception of risk is a social process," leading to the explanation that people who live in different kinds of social organizations are inclined to accept and avoid different sets of risks. This "cultural theory of risk perception" suggests that people's complaints about hazards and risks should never be taken at face value, but instead should be interpreted in light of the form of social organization being threatened or preserved. For example, if a person is worried about radiation from a nuclear power plant, their concern must be based on an aversion to centralized government. In this way, Douglas and Wildavsky use their insights to attack environmentalists by portraying them as "sectarians" at the "border" of society, without equally turning their distrust to other groups in American society. By making statements such as "The political views of the border are predictably on the left," critic Langdon Winner notes that "[O]ne fascinating accomplishment of *Risk and Culture* is to redefine the political spectrum so that the center now includes the far right" (Winner 1982). Indeed, the book does suggest a way of investigating the underlying values in debates about risk but its execution "ends up an ill-conceived polemic" (Winner 1982). Still, despite the failings of *Risk and Culture*, the idea that human proclivities to accept or ignore risks based on broader cultural beliefs has gained some credence and remains an avenue of research (*e.g.*, Cvetkovich & Earle 1992; Dake 1992).

Cognitive Approaches to Risk

A slightly different tactic for investigating human reactions to risk is to concentrate on personal perceptions. Developing out of roots in psychology and behavioral science, this approach used survey research to understand "risk perception". Covello (1983) provides an extensive review of the emergence of this field through the early 1980s, categorizing the conclusions of risk perception studies as concentrating on three areas: human intellectual limitations, overconfidence, and expert-lay disagreements about risk.

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Expert and Lay Disagreements. A final area addressed by risk perception studies is that of expert and lay estimates of risk (*e.g.*, Kraus *et al.* 1992; Maharik & Fischhoff 1992, 1993a, 1993b; Flynn *et al.* 1994). Risk estimates of experts are found to be well correlated with annual fatalities, while non-expert estimates are only poorly related. To explain these differences researchers have identified factors other than annual fatality rates that may effect public

perceptions of risk. They have found that risks are perceived to be greater if the activity is "involuntary, catastrophic, not personally controllable, inequitable in the distribution of its risk and benefits, unfamiliar, and highly complex." Other factors include whether the hazard is immediate or delayed, exposure is continuous or intermittent, effects are known or uncertain, or always fatal. In short, experts use methods in which a death is a death, while the general public tends to see some ways of dying as worse than others.

Slovic (1987) reduced these factors to two scales, one measuring the amount of dread, the other whether the effects were known or unknown. He concludes that classification of risks according to these two factors allows for efficient prediction of public responses to technological hazards, but maintains that experts should respect the opinions of the public. Others are not so generous; Wilson and Crouch (1987) see the benefit of risk assessment as indicating areas in which the public needs to be educated. They propose to do this by comparing different risks to show the irrationality of public perception.

Viewing the public as irrational is a typical way for experts to explain the differences between expert and lay risk assessments. Freudenburg and Pastor (1992) identify three explanations in for expert/lay disagreements in the risk perception literature: judging the public to be *ignorant*/*irrational*, *selfish*, or *prudent.* The first response is perhaps the most common reaction by proponents of technology (and in legal writing, *e.g.*, Contreras 1992). For example Drottz-Sjöberg and Persson (1993) recommend that "persons who appear unduly fearful of radiation [be] handled with care and [be] recommended professional medical treatment." They also suggest educating people about radiation, and "respect" for people's fears in order to increase trust in authorities. Others (*e.g.*, Keeney & von Winterfeldt 1986) set up the straw man that the public wants a "zero risk" society and claim that because zero risk is impossible the public is irrational (Freudenburg & Pastor 1992; Winner 1986).

Related to the model of the public as ignorant or irrational is the model of social amplification of risk (Kasperson *et al.* 1988; Renn *et al.* 1992; Burns *et al.* 1994). While the explicit thesis is that "events pertaining to hazards interact with psychological, social, institutional, and cultural processes in ways that can heighten or attenuate individual and social perceptions of risk," the implicit assertion is that social actors selectively report and emphasize certain events and thereby cause the perception that a certain risk is larger or smaller than it really is. This leads to the conclusion that the public is not aware of what the "real" risks are, and that somehow everything would be better if the media (and others) would not make things sound worse than they are. Critics of this view (Rip 1988) wonder if the social amplification of risk should be counteracted.

There is an opposing view that the opinions of the general public should be considered prudent. This view sees citizen evaluations of risk as augmenting those of experts, providing attention to a big picture which may be ignored by scientific specialists "who have been hired to look after the technical details" (Freudenburg & Pastor 1992:44). Here, it is asserted that the differences between experts and lay persons arise because each group asks questions which are of little concern to the other. Adherents to this view also find considerable fault with that portion of the risk perception literature that leads to the conclusion that the public is irrational (see Schrader-Frechette 1990). For instance, it becomes clear that experts as well as the public have biases, use faulty heuristics, and show great variation between fields of expertise (Perrow 1984;

Freudenburg 1988; Barke & Jenkins-Smith 1993). Scientists too are guilty of "overconfidence, insensitivity to erroneous assumptions, erroneous beliefs about the precision of estimates, failure to understand ways in which apparently solid results have been influenced by methodological choices, and the tendency for estimates of extremely low probabilities to be effectively nonfalsifiable" (Freudenburg & Pastor 1992).

There is another way in which public views of risks are understood as rational and justified. Related to the area of "risk communication" some scholars have concentrated on trust as a key element in explaining public reactions to risk (*e.g.*, Bullard 1992; Flynn *et al.* 1992, 1993; Freudenburg 1993; Frey 1993; Kasperson *et al.* 1992; Slovic 1993; Slovic, Flynn & Layman 1991). These authors point to the lack of trust between professional risk assessors and the public and suggest a few different reasons for it. Kasperson *et al.* (1992) point to a "broad loss of trust in leaders and in major social institutions in the U. S. since the 1960s," and recommend that risk communication attempt to establish trust by listening to the public and addressing the reasons for mistrust. Slovic (1993) presents the idea that there are "technological and social changes that systematically destroy trust,"—for instance, the media only report bad news—and calls for "ways to work constructively in situations where we cannot assume that trust is attainable." Freudenburg (1993) offers a more sociological explanation for lack of trust in situations concerning technological risk. He singles out the increased division of labor in modern society and the concomitant levels of interdependence, which create the opportunity for *recreancy*—"the failure of institutional actors to carry out their responsibilities with the degree of vigor necessary to merit the societal trust they enjoy" (Freudenburg 1993:910).

Current research on risk perception and the cultural construction of risk, as described above, has much in common with research in the hazards tradition. I now present a brief review of the human ecology tradition of hazards research before summarizing what I see as the weaknesses of research on both risks and hazards.

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Narrative and Place

There are two points to be made about the concept of place in the context of risk and hazards. First is that one of the important ways in which places are created is through telling stories about them. Second is that people tend to derive identity from connection to a place and that places can therefore provide strong motivations for human actions. These are important features to recognize because they represent a different way of making decisions than that which is normally supposed by risk and hazard studies.

Tuan (1980; 1989; 1991) stresses the importance of language in cultivating and maintaining a sense of place. "Words have great power in creating place," he writes, citing the stories and rituals used by Australian aborigines to center themselves in the world (Tuan 1980:6). The process of naming, examined in depth by Carter (1987) with reference to Cook's charting of Australia, has the power to create places. This does not mean that places do not exist before they are named, but that names bring them into focus respective to the set of people naming them. Children often develop their own names for places with friends, giving them a significance that

is not accessible to the adult world. Cook's naming was creating places for the entire Western world.

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Perhaps it is almost too obvious to note that places are important to identity. But consider a few examples that support this assertion. Living on the "West Side" or in "The Valley" have implications for identity. Being from Glendale means something different than being from Compton. Where I grew up in Maine, being from Orono meant being associated with a University and a more educated population than being from the mill town of Old Town. Being from a farm carries a different meaning than being from a city. Associations with places are incorporated in identity and influence both what one does in that place and how one relates to other places. Tuan (1980) distinguished between two sorts of attachments to place: "rootedness" and "sense of place". Rootedness is characterized by an unexamined knowledge of a place through long habitation. Unfortunately he only uses examples of traditional societies, but the concept, I believe, applies to modern situations. A sense of place is a more self-conscious awareness of the history of a place—a knowing about rather than knowing. But both of these attachments to place may influence reactions to environmental threats.

A subset of having a sense of place may be what Leopold has called the "land ethic" (Leopold 1949). In contrast with a sense of place, the idea of a land ethic is predicated on a connection to a place not so much as a human place, but as a natural one. Awareness and understanding of places as non-human may contribute as much as anything to opposition to technological hazards. In one of the few glimmers of common sense shown by the risk professionals, Clark Bullard, Chairman of the Central Midwest Interstate Compact from Low Level Radioactive Waste Management, notes that "An alternative explanation of the NIMBY syndrome, one that is more consistent with the data, recognizes that local opposition groups are composed mainly of individuals who have a strong attachment to the land" (Bullard 1992:718). This "attachment to the land" is a sense of place, but one more tied to understanding places as not only the home of humans.

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Defining Radioactive Waste: What Goes in Ward Valley

Another issue which has become the locus of controversy has been the character of wastes to be disposed of at the Ward Valley site. These battles are of a different nature than those about the desert tortoise, but they do, I believe, have many features in common. In both cases the proponents of the dump seem to be trying to define an element of the plan in their own terms. For the tortoise, proponents attempted to define the interests of the tortoise such that the dump would be acceptable, while opponents took the opposite tact. In this second instance, proponents are attempting to define low–level radioactive waste as the harmless byproduct of medical procedures in an attempt to garner public support for the project. These definitions and redefinitions are expressly calculated to fit into a narrative about the situation—either a narrative about US Ecology rescuing the desert tortoise from the dangers of I–40 or, in this next example, a nuclear dump allowing for better continued health care. Dump proponents are counting on the fact that these narratives will fit in with the collective narrative matrix of the public—that is, that

these events will resonate so strongly with certain aspects of the public's narrative matrix that they will overpower those elements that may conflict with different elements of the narrative matrix.

The characterization of the sources and make–up of radioactive waste, called the "waste stream", is one of great public consequence. The way in which the public thinks about the sources of low–level waste understandably influences the degree of public support for a low–level radioactive waste dump. Therefore, I trace this issue through newspaper accounts, mostly in the *Los Angeles Times*, but also in the *New York Times* and the *Wall Street Journal*.

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Who is an Expert?

The Committee to Bridge the Gap Technical Review and the Wilshire Report have sparked considerable conflict. At the root of these conflicts seem to be conflicting ideas about the credibility of the scientists involved. The proponents claim that those criticizing them are renegade activists, unqualified to address the issues, while the critics maintain that their arguments are scientific, and if investigated, the truth will become apparent. This, like the other examples discussed in this chapter, is a fight over roles—the proponents try to convince the public and the legal system that they are the experts and that critics are unqualified while critics maintain the high ground of superior science.

Clearly dump proponents have been successful in defining the issue of potential contamination as scientific. The responses to public comments to the DIES/R were similar to those comments about the desert tortoise. "Comment noted" was the stock response to visceral claims that nuclear waste just doesn't belong twenty miles from the Colorado River. And in fact, no one seems to contest the definition of the problem as one of science. While I return to that issue later, consider for the moment what the issue becomes, one of identifying which scientists are qualified to speak on behalf of the geology of the Ward Valley basin. Nowhere is the question of who gets to play the role of the expert more evident than in the conflict over the Wilshire Report.

The authors of the Wilshire Report initiated their participation in the Ward Valley conflict by offering their expertise to the Secretary of Interior. Because their action was their own initiative, and not an order by their superiors, the deputy for Secretary Babbitt asked that they respond as individuals. Their initial memo to the Secretary was just that. The subsequent response to US Ecology's rebuttal (the Wilshire Report) was also written as individuals. The acting director of the USGS did not want to make it a peer reviewed report because it might have "led to accusation that we were trying to gag them, [which] would have detracted from the important discussion of the merits of the Ward Valley site…" (Wilshire *et al*. 1993:2). So the Wilshire Report was distributed with the disclaimer, "This report does not represent the policies or positions of any government agency. It does represent the professional judgments of its authors who are employed by the U. S. Geological Survey as research geologists. The report has been reviewed by professional scientists in geology, hydrology, isotope geochemistry, and soil physics, and has been modified by consultation with many experts in these fields within and outside of the USGS." Clearly the geologists are not working as citizens; the only thing that

differs about their report from a USGS official report is that it was not officially "peer reviewed" by the organization. Unofficially, it was reviewed by three USGS researchers (a geologist, an isotope geochemist, and a geophysicist).

Even given the extensive review and support of the Wilshire Report inside the USGS, the response of US Ecology was that the "memo is an unfortunate example of the ability of advocacy groups to use the good name of the [USGS] for such political purposes." Furthermore, US Ecology vice president Steven Romano continued to assert that "The issues have been looked at by credentialed people who have independence, people other than US Ecology, and the consensus is that the project poses no danger to public health" (Clifford 1993b). The tactic of dump proponents is clear; the critics, no matter how qualified, are politically motivated, while the US Ecology scientists are the experts.

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By now, this sort of argument should be familiar to the reader of this thesis. Although the prestige of the involved institutions is greater, the argument is the same as comments made on the initial EIS/R. There is what seems to be an interminable conflict over who is qualified to assess the situation. What is most ironic is that throughout arguments over conflict of interest and who is qualified to be an independent expert, both sides appeal to science for vindication of their positions. While conflicts of interest certainly are important, if what I have argued in this thesis is true, the scientific facts will not give a clear–cut indication of whether or not the Ward Valley dump should be built. Assume for a moment that science could predict the future of the Ward valley dump with 99.9% accuracy, and that we knew that minute amounts of radiation would leak to the ground water in 10,000 years, and into the Colorado River in 20,000 years. Even with this knowledge US Ecology, DHS and BLM would still support the dump and the residents of Needles along with Committee to Bridge the Gap, Los Angeles Physicians for Social Responsibility and Southern California Federation of Scientists would oppose it. The decision to build a dump in the Ward Valley is a moral decision, and as I have argued, more likely to be influenced by the degree to which the roles set out by project proponents and opponents resonate with the narrative matrices of the politicians charged with making the decisions and the public than by the sort of quantitative weighing of risks and benefits that risk assessment implies.

Chapter 5

CONCLUSION: NIMBY RECONSIDERED

The fate of the Ward Valley is slowly being sealed. The National Academy of Sciences panel all but gave its stamp of approval, and the land transfer has been announced by Secretary of Interior Babbitt. However, the terms of the transfer have not yet been arranged (they may include further tritium testing), and lawsuits remain unresolved in the California courts. Still, there are important lessons to be learned from the fight over Ward Valley, no matter whether the dump is built or

not. My analysis of the dynamics of the conflict allows for a deeper understanding of the fundamental motivations behind the conflict. I take here a brief look at the three areas of contention again, to assess the potential for success for the factions, and to tease out the fundamental differences that fuel the conflict.

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Nuclear power is the issue here, not medicine. Of course Winner/Wagner and Associates is absolutely correct in trying to cloak the dump in the veil of medicine and academia—two sectors with widespread public support. Nuclear power is another issue altogether. To build the Ward Valley dump is to solve one of the large problems facing the commercial nuclear power industry today—low-level waste from power plant decommissioning. Nuclear power needs this escape hatch for a problem that will only get bigger. That opponents of the dump uncover this largely-hidden agenda means that members of society would like to have some sort of say in what technologies are accepted and promoted. Chemotherapy may be acceptable but nuclear power, which produces waste dangerous for 10,000 years, may not be. The nuclear industry is probably afraid of this reaction, which is why it has partaken in such a blatant misinformation campaign. Tactics aside, the added message of this conflict is that people can (and I believe should) distinguish between technologies and would like to influence whether or not a certain technology is used.

The issue of groundwater contamination has become the most hotly debated topic in the ongoing deliberations about Ward Valley. Proponent's would like the legal bodies to believe that their experts have the true claim to knowledge, and that the scientific method will allow them to find "the truth" regardless of their interests. Ironically, they accuse those who question the science as being politically motivated. Science becomes contested ground, pitting experts from one side against the other, with critics on both sides impugning the objectivity of experts on the other. What the actors fail to notice (or acknowledge) is that science cannot answer the question "how safe is safe enough?" or "Is it right to contaminate groundwater 5,000 years from now?"

Debate over objectivity and experts clouds the underlying issue of the relationship of society to the earth. The decision to dump radioactive waste in a hole in the ground is moral, not scientific. Comments made by residents around the proposed site illustrate this point. Bill DeWitt of Goffs (a tiny town north of the site) said, "I think they're messing up the desert when they start putting junk like that in" (La Ganga 1993). Fort Mojave Indian Steve Lopez expressed his views this way, "For us to have this unnatural project in a natural land that is sacred to us just doesn't go. … I'd rather have a nice clean drink of water than a pocket full of gold" (La Ganga 1993). These are statements of value, which can be contrasted with dump proponents who call the Ward Valley "Godforsaken." These comments indicate the differences between the narrative matrices of various groups, especially concerning places. For some, the judgment of radioactive waste is that it "doesn't go" in the desert—radioactive waste conflicts with that part of their narrative matrix that is concerned with places, specifically the desert. Of course, others would may not share the same narratives about the desert and therefore see no problem with dumping waste there. But rather than addressing those underlying points of conflict, they dismiss comments like "It doesn't go" as inappropriate for the discourse.

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But there is no progress to be made by arguing that someone is wrong for not wanting a nuclear dump in their backyard. The way to further understanding is to actual discuss the underlying narratives that lead to the conflict—in this case, human relationships to the land, the role and prospect of technology, what kind of future is worth having.

What is cavalierly dismissed as a NIMBY reaction is really one of the only areas in social discourse where people can express their views about the risk, place and technology. This is true because the argument is often "not in *my* backyard" but "not in *anybody's* backyard." Real estate developers disparagingly call this the BANANA attitude (Build Absolutely Nothing Anywhere Near Anybody), but the situation is more complex. The Mayor of Needles was opposed to a certain kind of technology, not to medical technology. Others based their position on a respect for the land. The Committee to Bridge the Gap is opposed to nuclear power. The great potential of the energy created by a NIMBY conflict is that these views can find expression. The levels of discussion are many, but one seems to be pervasive—the distinction between natural and technological. Clearly there are those who do not see a future for ever-increasing technological hazards, just as there are those who see them as necessary risks. As I have argued earlier, the choice is one of adherence to certain sets of stories about what good for society is good, so I cannot here claim that one is better than the other. But in conclusion, I would like to point to some of the implications of our relationship to technology, and show the often-ignored side effects of distinguishing natural from technological hazards.

(snip)

The distinction between the natural and the technological is deeply ingrained in Western culture, so much so that its expressions may seem contradictory. For instance, research subjects shown identical pictures labeled "lake" and "reservoir" significantly ranked the lake as more beautiful (Thayer 1994:64). In another study, respondents found "natural radiation" much more acceptable and less harmful than equal amounts of "man-made radiation" (Reicher *et al.* 1993). The distinction between natural and technological is pervasive and strong. The question is whether this is merely the result of Romantic idealization of nature or whether it has deeper roots.

There are a number of ideas that try to explain human preferences for natural things. With regard to landscapes there are a set of "evolutionary theories" which try to explain preferences, the human naturalness hypothesis, habitat theory and prospect-refuge theory (Thayer 1994). The human naturalness hypothesis presumes that humans have an innate desire to return to the natural environment of their evolutionary past. Evidence of this thought to be found in the immense effort expended in maintaining plants in everyday landscapes, both inside and outside. René Dubos suggested that humans prefer landscapes that most closely resemble those habitats in which their ancestors could satisfy all of their biological needs. This theory is used to explain human preferences for open savanna-like areas, they provide places for hunting and shelter. This idea is related to prospect-refuge theory, which posits that humans prefer areas in which they can see without being seen, *i.e.*, providing both a prospect on the surroundings and refuge from them. Another tendency is for humans to have visceral fears of spiders and snakes, a sort of "biophobia". This too is presumed to have a survival function. Similarly, "biophilia" is thought, by those who see the decline of biological diversity as threatening human existence, as another survival mechanism (Kellert and Wilson, 1993).

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The preference for things natural seems to have measurable unconscious manifestations as well. Roger Ulrich's work showed that patients who have a window with a view of trees recover faster and require less pain medication than those with a view of a bare wall (Ulrich 1984). Upon further research, he found that exposure to scenes of natural landscape apparently produces a profound "quick-onset" reaction in the parasympathetic nervous system, expressed as a heart rate reduction (Thayer 1994:15). This provides evidence that a prejudice for natural scenes is actually beneficial.

Traditional connections to place can also be seen as having a survival component; they entail caring for and protecting the things around oneself that give sustenance. In the modern world it is more difficult to see how caring about places relates to survival. The development of a large, specialized economy means that few people see their connections with the land as a source of life. Few grow their own food, or even know where it comes from. One of the few times people become aware of their dependence on places is when it is threatened by new technologies.

What I am suggesting is that human connections to place, rather than being negotiable cultural constructions, are valuable biological survival mechanisms. The fear of man-made radiation is an excellent example of this point. Proponents of technologies often compare the risk of the technology to some natural risk. The nuclear industry compares its radioactive emissions to natural background radiation (Reicher *et al.* 1993); in *de minimus* regulation industrial emissions are judged relative to the annual risk of dying from disease (Palm 1990). If the risk of the technology is less than the natural yardstick, the proponents assume it is safe. But a simple story shows why this is fallacious.

The Nuclear Regulatory Commission held a public hearing to address concerns about building a nuclear power plant in Vermont. The NRC representative brought a Geiger counter to the meeting and had it running on the table throughout the meeting where it clicked regularly, measuring the background radiation. Near the end of the meeting, he told the audience they had nothing to fear from emissions from the proposed plant. "Look how much background radiation there is already," he proclaimed, pointing to the Geiger counter. From the back of the room a woman shouted out, "That's exactly why we don't need any more!"

The woman made a crucial point; every new risk, no matter how small, is added to the present complement. Life on earth evolved adapting to a certain amount of background radiation, to add extra is unwise. This same point applies to any number of other situations, hazards are cumulative, and in the case of toxic hazards, they are not easily neutralized. For this reason, I suggest that we listen to the stories that people tell about their places, the stories that conclude that "a nuclear dump just doesn't belong here."