The House That Uranium Built: Perspectives on the Effects of Exposure on Individuals and Community[1]

Margaret Amalia Hiesinger

Introduction

> Every day the heartbreakingly beautiful canyons that slice through this mesa top convey 250,000 gallons of industrial sewage toward the Rio Grande—itself contaminated with plutonium. Radioactive peach trees have been found growing downstream from the lab and traces of plutonium have been detected in chilies and in the catfish of Cochiti Lake. Honeybees in the canyons have tritium in their bodies.
>
> *--Ruta, Resident of the Four Corners Area*

In the wild grandeur of the American southwest, more than one radioactive river flows through canyons and poisons the surrounding plant and wildlife. The region's beauty inspires hope that these desert Edens might somehow be isolated from human life and left as small, unfortunate pockets of poisoned paradise. However, the physical and emotional sores, cancers, and sickness growing in people's bodies belie such wishes. Contaminated rivers carry radioactive sewage not only to catfish in Cochiti Lake, but to kitchen faucets in Shiprock. The breeze that blows uranium tailings across open plains also blows it into the mouths and noses of people living nearby.

While journalists lament the atrocity of such environmental ruin, anthropologists must trace its roots to human behavior and address the subsequent social consequences. This paper demonstrates the negative impact of uranium mining

---

[1] This paper is based on a senior honor's thesis written in 1999 under the supervision of Professor Laura Nader at University of California-Berkeley. It is the result of a student field research project conducted on the Navajo Nation in 1999, as well as several brief periods of field research between 1993 and 2000. This paper would not have been possible without help and support from several people. They are: Laura Nader and Donald Moore at University of California-Berkeley for their invaluable criticism and encouragement; Madelyn Iris, Leighton Peterson, Kristy Noonkester, and the rest of the Northwestern Ethnographic Field School for making this project possible; Linda Torres and Timothy Benally of the Uranium Education Program at Dine College, Shiprock campus, as well as the rest of the faculty and staff for their time and generosity; and most importantly, the people who shared their time and personal experience about the dangers of uranium.

on people and their communities through a humanistic perspective and examines the larger social context that perpetuates this kind of destruction. The first part of the paper outlines the results of interviews conducted with residents of communities where uranium mining and milling occurs, and focuses on the meaning of their experiences. The second part of the paper extrapolates upon the issues that these informants emphasized and relates their individual experiences to certain cultural paradigms in our society.

Many people besides miners have suffered. Some individuals live in areas where contamination is literally inescapable—where if uranium has not left a physical wound, then it has certainly left its mark in another way. People living in areas contaminated by uranium understand it as a substance that is transmitted easily between objects, people, animals, and the natural environment. They believe that they have been and are currently being contaminated from multiple sources, despite the fact that operative mining and milling sites no longer exist. The richness of their collected narratives demonstrates the complexity of radiation exposure and its effects.

Though mining activity in the Four Corners area ceased over twenty-five years ago, people still live with elevated levels of radiation. What were once mine and mill locations are active communities today. In these places, uranium mining does not represent a closed chapter in American history; it remains a part of ordinary life. People wonder whether their sons will be sterile. They worry about the possibility of falling ill, just like an aunt or uncle did, and discovering that cancer has spread throughout their bodies.

The perceived effects of uranium cover a number of different spheres, incorporating physical, mental, and psychosocial aspects. While informants discuss physical ailments known to be linked to mining and radiation, their stories reveal a much deeper sense of contamination. In addition to suffering from cancers and birth defects, people also feel that their entire bodies and landscapes are contaminated. Miners suffer from guilt and self-blame about contaminating family members. People sometimes identify themselves by their status as resident in a radioactively contaminated community. In addition, the rapid mass death of former miners, combined with concern about the health of the living, weighs heavily on those left behind.

These phenomena and their social context have not been carefully examined. The actions, thoughts, and behaviors related to illness and suffering reveal the way uranium impacts families and communities. Twenty deaths from lung cancer in a small mill town my help researchers link lung cancer to radiation in a clinical study. But how does that community absorb and cope with those deaths? One can not predict or comprehend the long-term impact of a phenomenon like uranium mining without examining all of the facets of life damaged by death, illness, and pollution.

By representing the voices of those living daily amidst the fallout of nuclear activity, anthropologist research bears witness to the everlasting and continuing harm of uranium. First hand accounts by people living with radiation are an important part of any serious argument against the use of nuclear power and weaponry. They reveal the kinds of scars left on individuals, families, and communities that do not show up in statistical surveys.

This insight leads to the paper's next goal: to contrast how local people are affected by uranium versus the way scientific research determines its impact. Scientific standards for determining radiation exposure apply only to a narrow spectrum of circumstances. The infiltration of radiation into the entire organic system renders these methods incomplete and inadequate. Relying solely upon scientific measurement to assess radiation damage ignores the fact that not all damage can be measured quantitatively. Residents witness and experience multiple forms of radiation damage despite having little or no knowledge of radiation levels.

Because the scientific perspective has dominated the investigation of uranium in the Four Corners, official government research has ignored factors unique to Navajo. For example, the way Navajo people utilize their land, and its resources increases their risk for exposure, yet outside researchers have not taken this into account in their studies. They also fail to appreciate the complexities of translation and meaning in explaining their concept of risk to a population that still largely speaks a different language.

My critique of the use of scientific research to the exclusion of other means of collecting information does not constitute a criticism of science in general. Rather, it is a demonstration of the way in which, when used carelessly or to fulfill political agendas, official science can perpetuate dangerous and harmful institutions. It is also a warning about the consequences of ignoring the experiences of community members and local cultural elements.

Several contrasting perspectives emerge as themes throughout the paper. These include visibility and invisibility, the hidden and the illuminated, and voice and silence. Powerful kinds of knowledge and ways of knowing, such as Western science, emerge as visible and possessing a voice. Research has focused primarily on tangible forms of uranium damage, as a result of a visually-based scientific knowledge system. It therefore obscures Navajo and other "non-expert" knowledge which lacks social and political power.

The Uranium industry does, however, recognize Navajo and other rural peoples for their possession of large resource caches and their low per capita incomes. Both the government and industry have targeted Navajos to conduct nuclear tests and deposit nuclear waste on their land in exchange for the promise of money and jobs. This paper explores elements of environmental racism and nuclear colonialism that

shape uranium mining and clean-up efforts. It also describes the government's use of language and metaphors to obscure the forsaking of selected lands (often deserts) and their inhabitants, rendering them sacrifice zones and designated wastelands. These rhetorical devices obscure the colonialist property ideology and adherence to an economic model of nature that declares deserts useless for anything besides nuclear activity. Emphasis on efficiency and minimum cost excludes from the equation the value not only of designated land but also of human lives.

Many of the surreal qualities of nuclear phenomena, such as the vast expanses of time and remote, often exotic, regions they require strengthen the barrier between the executors of nuclear activities and their victims. Yet the voices of the victims remind us of the final consequences despite the attempts by the nuclear industry to hide them.

The last section of the paper outlines the failure of individual monetary compensation to make up for the damage. No retroactive measures can erase the destruction caused by uranium; moreover because compensation is paid to individuals, it does not support communal rehabilitation efforts, such as treatment centers and education programs. Awarding money to victims serves to silence their complaints and provides an easy way for the nuclear industry to continue their dangerous activity.

Background

Officially, uranium mining and milling began in the Southwest in the 1940s. The years that the Radiation Exposure Compensation Act ("RECA") currently recognizes for mining activity are 1947 through 1971. However, an old publication by Union Carbide and Carbon Company displays a picture of a mill in Slick Rock, Colorado dating back to 1900 (Union Carbide Co. 1956: 3). Whether the legacy of uranium mining has existed for more than sixty or over one hundred years, no one can argue that it has made a dramatic impact on both the landscape and lives of people living in the Four Corners area.

Epidemiological studies of uranium mill workers and miners have been performed as early as the 1950s. What has not been as carefully examined are the ways in which these health issues function in relation to the lives of those who suffer from them. Recently, the need to make such connections has been recognized. As noted by Ken Silver, of the Boston University School of Public Health:

> By weaving together technical data and local history in communicating about risks, health agencies can provide working people some official validation for their health concerns, their sacrifices, and the shared memories of their lives at work. [Silver 1996:117]

Another person who has been instrumental in expanding the way officials perceive the effects of uranium is Gilbert Badonie. The son of a uranium miner, and resident at a mining camp for some twenty years, Badonie has become a strong voice in speaking on behalf of families of miners and mill-workers. Mr. Badonie suffers from a mining related disease although he never worked in the uranium industry. Mr. Badonie's experience attests to the chain of illness that has followed from workers through their descendants. This issue raises "a question that's unanswered and virtually un-addressed," (Magazine of the Tufts University Medical Alumni Association 1999: Inside Cover). Mr. Badonie encourages those who grew up under similar circumstances to stand up and share their stories.

Mr. Badonie's work ties in with the Oral History Project - a collection of photo-essays about former Navajo workers and their families. The project, titled "Memories Come to us in the Rain and the Wind," reveals the concern that present-day communities have about their lost relatives, damaged environment, and themselves. George Lapahe, from Two Grey Hills, NM, explains:

> Now they also found some tumors in their inner organs, both my boys and daughters. Where is this coming from? There never used to be stories like this. Now those of us who worked with uranium see our children beginning to be affected by it. [Navajo Uranium Miner Oral History and Photography Project 1997:20]

"Memories Come to us in the Rain and the Wind" has been one of the few, if not the only, publications to illuminate the role of families and communities in the uranium issue.

While years of health studies have confirmed that uranium mining and milling poses numerous risks to the communities in which they are based, many scholars and activists point out the current impact on people today. The message of people like Silver, Kuletz, Badoni and local residents is clear: Uranium must be examined with a multi-disciplinary approach in order that policy-makers and the public alike fully understand the toll it has taken.

Methods, Site, Participants

Participant interviews were used in conjunction with the results of a larger randomly-sampled survey about community uranium knowledge. All place and personal names have been changed to protect the privacy of participants. I conducted my interviews in three locations on the Navajo Nation in Arizona and New Mexico. The first is the town in which I lived, called Thick Water. It is one of the largest communities in the Navajo Nation. The second site is a small uranium-impacted community near the town in which I lived. I refer to this community as Little Valley. The third site is the closest major border town to Thick Water and is called Millstone.

Both Navajo and Anglo participants aided in this study. Some of the major participants include: Melinda Marquez, a woman in her early forties who works in the uranium field. James Garnet is a retired politician in his sixties who lives in Thick Water. His name was given to me by one of the faculty at the college where I worked, as someone who would be knowledgeable about uranium. Janice Calvin came to the study through a chapter meeting in Little Valley. She is a schoolteacher and the daughter of a uranium miner. Betty Ray is also a middle-aged woman who works in Little Valley. Her family received compensation from the government under RECA. Lane Gerald, an Anglo man, lives in a small community just off the reservation between Thick Water and Millstone. A small man in his early fifties, he is a well-known proprietor of several Millstone establishments, and is a former uranium mill worker.

Findings

First, I present the ways in which people describe being exposed to uranium, followed by their accounts of its effects. Next, I examine some of the psychosocial ramifications of uranium that emerged in these interviews. These consist of the perceptions of themselves and their environment as contaminated, the guilt associated with uranium mining, and the social disruption that uranium has caused in Navajo communities.

Means of Exposure

Informants list extensive ways they believe they, and other people, are exposed to uranium and associated radiation. Working in the mining and milling industry represents one direct way, as well as breathing it, using contaminated water, eating it, and playing with radioactive waste. Other modes of exposure include through contact with animals, simply living around it, and through contact with other people.

Everyone except one informant worked as a miner or miller, or had an immediate family member who did. Knowledge of working conditions in the uranium industry led everyone to agree that workers were exposed to high doses of uranium and radiation on the job. Lane Gerald provides one graphic example of the extent of radiation exposure in the mills. He begins:

> I've seen guys work in what they called the "hot areas" [areas with high levels of radiation], um - never be out in the sunshine, and they was all dark-skinned.

According to Lane, the men's darkened skin results from exposure to radiation underground.

Informants not only mention the numerous ways working exposed miners and millers, but also the ways the industry contaminated surrounding areas. Several people note that uranium has infiltrated local and regional water sources. These include rivers, wells, and swimming areas. Lane Gerald describes the runoff from the mills flowing into the Dolores River in Colorado:

> I mean tailings were drippin' in it, I mean it was. . . tailings piles was right on the edge of it, and if we got an extraordinary amount of runoff and stuff, I mean it'd wash it into the river.

The "tailings" to which Lane refers are the piles of unused processed ore leftover from the milling process.

In Lane's Colorado milling town, steam from the mill even heated the local public swimming pool. People often describe family members who worked at the mines on hot days and drank the water that ran through the mine. Families who lived near the mines drank water from wells near the working area. The scale of contaminated water sources ranges from small springs and wells, used by perhaps several families or workers—to major rivers such as the Dolores and Animas—impacting not only select individuals but entire populations as well.

Airborne contamination troubles residents who share concerns about breathing in uranium or radiation. Workers wore no masks or respirators on the job, and inhaled dust from blasting and shoveling. Breathing uranium dust also concerns anyone currently living in the area, as the wind carries the debris and spreads it through out the vicinity. James Garnet says," And the dirt you know, the wind blew like this, it carried [the uranium] somewhere else to somebody's place." In some cases wind has eroded tailings piles to the point where vast regions have been covered with tailings deposits. People living near such places describe being able to watch the piles disintegrate on windy days. As early as the late 1940s, doctors noticed this phenomenon around the Naturita mill, where "a pronounced yellow staining of the rocks for a radius of a half a mile or so from the plant was demonstrated" (Wolf and Eisenbud 1948:3).

Organisms can ingest as well as inhale traveling dust. These include livestock as well as people who eat food near mines or waste piles. People can ingest radiation in other ways besides eating dust-covered food and plants. Some families grew their vegetables in piles of mill tailings. Informants describe the dangers of growing vegetables in contaminated soil and, in one case, of storing them in a root cellar built from radiated wood. Because tailing piles lie out in the open near residential areas, growing food in radioactive soil still poses a threat today.

Parents worry about children playing in contaminated areas. When the mines and mills were still open, ore rocks and piles transformed into regular play areas for kids. Lane Gerald remembers:

> My uncles were driving ore trucks, and I'd go out and some of the rocks would be purple, some would be green, some would be this, some would be that. I was totally amazed by 'em. And I'd go pick the pretty rocks out and I'd put 'em in my closet. Sometimes my mom would get really pissed because she would go in there and I'd have three hundred pounds of rocks in my closet. Which I now know that was radioactive rocks.

Betty Ray feels that she and all of her brothers and sisters have been exposed because "we used to play in that ore." Again, many of the waste piles still stand in the midst of communities today. Adults often mention locations of water-filled mines and nearby tailing piles where local children play.

Other means of exposure pose a less direct, but equally dangerous threat. One such way is through animals that contaminate people who utilize and depend upon their products. Dogs bring it home. Ranchers who graze their cattle near the mill find their bulls sterile and their cows giving birth to two-headed calves.

Just as animals can expose a person to uranium, humans can contaminate each other. This can occur through reproduction or from contact with persons covered in contaminated material. James Garnet explains:

> I have a daughter that's borderline retarded, the second one. During that year in the '60's, we - um, 'cause I spent alooot of time in my - with my dad, brothers, hauling that uranium back and forth.

He feels that if people have been exposed and are young enough to reproduce, then "it can be transferred. Through the woman or man to the next generation." Other participants echoed this sentiment and described birth defects that they believe have been caused by fetal exposure to uranium from a parent. Both parents are thought to be able to contaminate the fetus, as opposed to only the mother carrying the unborn child.

Husbands can also contaminate wives, when they come home covered in debris from the mines or mills. Melinda Marquez tells the story of her aunt who developed cancer throughout her body as a result of having sexual intercourse with her husband. Melinda says:

> My aunt. Her husband would come back to her and he would just go to bed with dust on his clothes, in bed—you know—and had these

> kids. She had cancer in the uterus. She had cancer in her lungs. She had cancer all over. From radiation exposure.

By combining the idea that family members can contaminate each other with the understanding that it can be passed down through generations, radiation exposure becomes a socially contracted problem as well as an environmental one. A web - or chain of exposure - through people's bodies develops as husbands contaminate their spouses who contaminate their children.

With all of the pathways for exposure, some people feel like "it's floatin' all over the place." These remarks indicate that people think simply living near uranium exposes them. They do not differentiate between modes of exposure because they believe their entire area to be contaminated. In his description of life in a milling town in Colorado, Lane Gerald exclaims, "It was all uranium related!" When he speaks of his exposure working in the mill, Lane reflects:

> I think I'm fortunate enough to have got away from it only after just four or five years of exposure - of course I had more then that as a kid, from the time I was about five until the time I was, oh, I'd say in my twenties I lived around it.

Exposure takes on a new meaning as people move from describing certain elements as contaminated, to describing entire communities as contaminated. In some places, the networks of exposure become so entangled that people begin to perceive the vicinity itself as a source of contamination.

Effects on Exposure Communities

Participants speak candidly about the ways in which their communities have been permeated by uranium. They articulate the effects of exposure with equal emphasis and detail. Radiation exposure stems from a wide spectrum of sources, and so do its effects. These range from physical damage to humans and animals as well as environmental impact. Effects also incorporate emotional and social aspects.

Most informants spent a lot of time discussing the physical ailments resulting from exposure. They describe radiation as something that destroys the structure of the body. According to their observations, radiation exposure causes deterioration, accelerated aging, and ultimately, death. It becomes a part of the body and causes abnormal growth. As Melinda explains:

> I think that the radiation causing you to deplete in the . . . immune system, its causing it to lower the metabolism and weaken the body, maybe that's what happened. It caused these sicknesses [such as cancer and diabetes] to take over the person's health a lot faster.

In this passage she explains how radiation allows the body to deteriorate much more easily than it normally would. Other speakers echo this sentiment.

People also describe specific physical ailments caused by radiation. Lane remembers watching his father, also a mill worker, die of a brain tumor:

> He went from, like I told you, about a hundred and forty-five pounds to about eighty pounds. Um, just very shortly. I mean just skin and bones like he had dried leather over his bones . . . His skin turned terribly bad, you know, leather-type quality.

Skin problems, rapid weight loss, and cancer are all common symptoms of people who have worked in the uranium industry. Other noted physical effects include reproductive difficulty, hair and tooth loss, loss of appetite, and respiratory problems.

As a result of contact with uranium, animals suffer from some of the same ailments as humans. Cancer, shortened life spans, and reproductive problems plague exposed animals in the same way they afflict humans. Amongst a rural population that relies upon grazing animals to feed their families and supplement their incomes, livestock contamination has serious ramifications. Lane describes the herd of cattle owned by close family friends, the Snows. After moving their cattle onto open land near the mill, the Snows' herd began to show signs of damage. Lane remembers:

> They were coming out with mutated cows. I've actually seen a cow with two heads - a calf. I've seen 'em with five legs . . . their birthrate went down . . . That particular area, we was lucky out of five hundred cows to come up with a hundred calves.

To qualify the last figure, Mr. Gerald estimated that six hundred and fifty calves were a normal amount for a herd that size. In another instance, Melinda Marquez described an older Navajo woman who butchered one of her sheep to find its insides riddled with cancerous tumors. The woman said her sheep regularly drink from a spring that flows out of an abandoned mine.

Radiation modifies the environment and plant life as well as other living organisms. While some people believe it mutates plants to an abnormally large or lush state and others think it kills them, they concur that it alters their local vegetation. For example, Lane remembers growing "carrots as big as your arm." According to him:

> You could raise damn near anything in [the tailings] and we never fertilized . . . I still to this day cannot explain to you - we had beautiful lawns, we had beautiful trees . . ..

On a hike up to an abandoned mine led by two of Janice Calvin's family members, her son pointed at a plant with enormous leaves that looked like it belonged in a tropical rainforest and said, "Uranium." When asked if he was kidding, he shook his head "no."

Melinda views the impact on vegetation in another way. Driving down a well-traveled highway on the western portion of the Navajo Nation, she pointed at the bare lumps of tailings piles scattered across the landscape. She said, "You see there's certain areas that just - just - there's no vegetation." After a minute she pointed to an area where some sparse grass and brush appeared and said, " But I betcha if there was pilings that took place up in those areas, all this would be no vegetation." She explained that the high level of radiation in and around these piles prevents plants from growing in this area.

The accounts of Lane, Melinda, and Janice's relatives reveal the various kinds of changes radiation can make on the environment. According to these people, radiation affects vegetation differently depending upon the conditions – perhaps upon the level of radiation. These stories demonstrate the multiple and varied ways in which residents have observed uranium affecting their land over time.

In addition to the more visible toll taken on human bodies, animals, and the environment, uranium also causes social and emotional damage in communities. Janice Calvin describes the way former miners in her community died from radiation poisoning:

> Some guys were baaaaarely getting on with the good life and then they had to go. They suffered. The saddest part is when they suffer the last few months . . . For a long time suffer. Reeeeally suffer from from sickness.

Janice's description does not just pertain to one particular death, but to the deaths of multiple members of her community who all died in the same fashion as a result of uranium. This transcends a personal account of one family dealing with death, becoming a collective experience.

So how do these families and those around them deal with the death and suffering? Lane answers:

> The mental effects are very hard. I mean for god's sake, I'm only fifty-two years old and I'm an orphan . . . all of a sudden you wake up one day and you realize that everybody you knew - is dead. I mean, yeah sure, maybe radiation don't kill people, and maybe it'd kill one or two. But for god's sakes everybody that you've known you're entire life? I mean that's a little hard to deal with.

The suffering can not be restricted to those who have lost their lives to radiation poisoning. The entire community bears a large part of that burden as well. The narrators' testimonies exemplify the way in which uranium distresses communities socially and psychologically as well as physically.

Perception of Self as Contaminated

While informants carefully articulate the causes and effects of the uranium cycle, their stories also reveal a deeper relationship between uranium and their communities. In their histories of the effects of uranium, they describe the way in which radiation becomes a part of people. They manifest a belief in themselves as having been contaminated. This impression emerges in the terms people use in their everyday speech.

Janice Calvin describes her experience:

> I thought we were just like everybody else, people in Pinon, Chinle, Gallup . . . and then when they um heard that they said, "You guys are - something's wrong with you guys. Those waters are coming down with uranium. You guys are drinking it. One of these days you're gonna get sick from it.

Janice thought that the people in her community were just like everybody else, but because of the "water coming down with uranium," they are, in fact, not. "Something's wrong" with them according to the residents of surrounding communities. The radioactivity not only poisons the water, but also marks the people living in that area with a geographic scarlet letter. She says, "And I ask myself, Why me? Why am I . . .?" Local residents like Janice become stigmatized because they depend upon a contaminated resource.

Individuals also bear the badge of uranium. Lane uses his whole body as a map to demonstrate the damage uranium can leave on a human body. He first showed me a small, pitch-black mark under his thumbnail. He says, "As the nail goes out, the hole still stays there and that's been since the sixties." His father had two such burns on his fingers and "'til he died in the nineties, he still carried it." Lane refers to the hole on his finger that stays there while the rest of his nail grows, and to the spots on his father's "marred" fingers as something which he "carried" with him. His use of the metaphor "carrying" reveals a sense of feeling disfigured and tainted by uranium. Later, he revealed radiation-caused burns and discoloration on his legs, chest, and arms.

Through constant reinforcement, people begin to accept their radioactive identities as normal, even amusing. This is evident even in the jokes that circulate through uranium industry towns:

> How do you find your kids at night? Just look for the glow. [Chuckles]. How do you know if a guy works in a uranium mill? Is if his kids glow on the dark.

The rest of the jokes follow the same pattern, featuring a contaminated individual - in this case, a uranium worker – who leaves his taint on various family members and women.

However, the real life "jokes" that Lane experienced are even more poignant. They follow in the same vein as the fictional jokes. At age seventeen, he arrived at the town doctor's office for a physical before his first marriage. He was asked to give a sperm sample.

> And I said, "Well okay," you know and I was just a dumb kid. I was only seventeen for god's sakes. And I said "Okay," and she come out with a gallon jar! And I says, "I've gotta fill that up before I can get married?" And she said "No." She said "Just do it once in there. It'll grow itself."

When asked if the nurse was kidding, Lane laughed, "They was just screwing with me because I was young and dumb." The nurse's joke about mutant sperm reflects his milling town culture's belief that residents are so contaminated that even their reproductive faculties are impure. In this instance, Lane's routine physical had become a means of simultaneously reinforcing and familiarizing him with his radioactive abnormality.

Guilt and Self Blame

In communities where people can unknowingly harm others through ordinary, even loving, acts such as hugging or having intercourse, issues of guilt and self-blame arise. Even though it is a joke, how does the miller whose kids "glow in the dark" feel about that? How do men who bragged about receiving high pay from the mills and finding steady work feel when their wives and children begin to get sick? How do wives who encouraged their husbands to work closer to home feel when they die from lung cancer at age forty? How does this situation become the victims' fault? Yet in the end, the burden of these questions lies on the shoulders of these families and communities.

There are several ways in which the outcome of uranium mining has fostered feelings of guilt and self-blame. The first is that when contaminated individuals can and do expose their loved ones; they feel responsible. Second, people's work in the uranium industry seems to linger in their minds as they explain the reasons why they did and that they were not warned of the danger. Third, some Navajo informants

blame themselves as a result of traditional beliefs about the meaning of mining and disturbing the earth.

Melinda speaks about the ways in which community members participated in the uranium industry. They discovered it, they mined it, and they contaminated each other. She characterizes her own family's involvement through the actions of her Aunt's husband:

> the husband worked and discovered the mines - the ore. He was one of the main guys that worked with the white people that came in and digged the ore out . . . They brought it home down to the Gray Valley area where they lived. Down the mountains. The exposure was so tremendous because this guy was like yellow-caked down to the foot with dust.

The workers and residents did not play a passive victim role in the sense that they were forced to work in the industry. This was a livelihood for many people who made money and supported families from their part in the uranium business. In addition, Melinda's depiction of the workers bringing uranium down from the mountain into their communities illustrates the way these men engaged in a hazardous practice and unknowingly introduced that danger into the lives of their families.

This circumstance of contamination has been difficult for residents to grapple with, as they find themselves maintaining the roles of both victim and assailant. As a way of coping with this double-sided identity, people often repeat the fact that they were not warned. Betty Ray portrays the way in which this dilemma plays out among surviving community members. She says:

> And it - it really bothers us now. If they had, if they had been warned, yeah, they wouldn't have worked in the mines. But it was - they weren't warned. They just used to go in there and did their job.

Everyone with whom I spoke mentioned that the workers were never warned and were not wearing protective gear; often several times in one conversation. People made similar disclaimers when they described workers exposing family members through contaminated clothing. For those living with uranium, the ignorance in which they participated in the industry's cultivation remains a central part of their experience even now. It is perhaps the single most important part of their story.

Another reason for self-blame in Navajo communities comes from their concept of the earth's Natural Order. In Navajo, there is a word to describe this balance of the universe. It is "Hozho," which Melinda translated as "the beauty of life" (Marquez 1999). Melinda explains the way in which mining uranium relates to this concept:

> Navajos say that, you know, for instance this uranium, you know, people go and dig in there and dig it out. You're disturbing the Natural Order of the, of Mother Earth. And so Mother Earth is gonna defend itself. You know. And by defending itself, you're gonna see health problems related from uranium because radiation is hazardous to the health. The person who's disturbing the earth is the one who's gonna be affected. This is exactly what's happening . . . And that's what Navajos believe.

According to her explanation, mining uranium has disrupted the Natural Order - or the way the world is meant to operate. The earth protects itself by lashing out and striking the perpetrator. In this scenario, even though the Navajo people may have done harm accidentally, the earth's instinctual reaction remains the same. In this vein, nothing can immediately prevent the ill affects brought about by uranium. The fact that many Navajos accept that there is no cure for the effects of radiation corresponds with this as well. Some people, like James, believe that things may improve over time:

> But if they cover it up, don't fool around digging out gold anymore, then I think in a hundred years we could do - have a better life.

Because the subject of uranium falls outside the boundaries of traditional Navajo culture, no established ceremonies exist to effectively heal victims physically or symbolically.

Entire Landscape as Contaminated

Every aspect of the landscape had been contaminated - from the earth to the plants, animals, and people living in and on it. It is not surprising that, as discussed earlier, many people view their whole environment as contaminated. Melinda says:

> It destroyed our lives because that uranium was dug out. The Natural Order was disturbed. And the environment, the plants, the vegetation, you could see that. Its also destroying our livestock. You know. Its creating cancer in the animals, uh babies are being born deformed. Its also affected the people.

James Garnet's depiction of living in a radioactive landscape resembles Melinda's description of a system that has been disrupted and completely tainted. He says:

> These people were livin' thirty feet away from the mine. Its probably hotter than a skunk in the reading of the - of the ah - what do you call radiation [makes the gesture for a geigercounter]. They lived right there. They spent twenty-four hours there with their kids, 'cause that's

> their home. They ate the food that grew off the tree of the mine, burned it in the fire and cooked with it. Had the water well from down the road were probably full of radiation. Made their little, uh, hogans out of the rocks, of the uranium, hard uranium, live in that. Had a nice smokestack, but radiation was there.

The portrait James paints of the family in their "little Hogan" with its "nice smokestack" contrasts sharply with the uranium that he describes as poisoning every aspect of daily life.

While his particular account refers to the time when mines still operated, other narrators spoke of their immediate communities with similar sentiments. Janice Calvin's husband told her he no longer wanted to live in her community because he believed it was too heavily contaminated. She remembers him saying: "I shouldn't have come to this community. You guys are - uranium's all over. I don't want to live here."

Locals also perceive the area as being so damaged that there are no "safe" places. Driving through an area that the Bureau of Abandoned Mine Lands had reclaimed, Melinda pointed out patches where soil had been transplanted over radioactive waste to diminish its toxicity. It was difficult to differentiate between waste piles and the dark banded lumps that characterized the region's unique otherworldly landscape. She spoke of the reclamation program with mild contempt:

> Melinda: They're covering it up so that when you cause the exposure, patching it up, once they patch it up they try . . . but they try to reclaim it by blending into the environment . . . They bring those dirt over - they cover it - or they'll cover it with gravel. And they try to blend it in and make vegetation re-grow in those areas.
>
> MH: Because they got - you mean on purpose they got dirt that didn't have radiation in it so that vegetation would grow?
>
> Melinda: And then they covered it over the area where they re-claimed
>
> MH: So no one would notice that there was a bald vegetation?
>
> Melinda: Yes. Right.

Melinda believes that some supposed clean-up efforts make these areas "safe" by covering them with dirt so that vegetation will grow and give them the appearance of being normal. In this case, reclaiming becomes a means of disguising. This process lowers the emission of radiation, but is not a permanent or curative way to restore the

land - especially when the region's characteristically strong winds constantly erode away the topsoil.

The most disturbing part of this treatment is that once these areas are reclaimed, they gain the appearance of being radiation-free. People living around these areas can no longer use the few available visual clues to determine where waste piles or former pit mines exist. As a result, the entire environment becomes a minefield in another sense - danger zones now lie buried in what appears to be a somewhat natural landscape. This creates a situation in which everything does not suddenly seem improved, but one in which nothing can be definitively labeled as safe. The entire system becomes tainted.

Without proper information in communities about where contaminated areas exist and where reclamation will take place, reclamation itself can camouflage dangerous areas and create confusion about where people should and should not go. This, compounded with the fact that delineating certain places as "dangerous" - or off-limits, and "safe" - or useable, poses a problem for people who depend upon being able to occupy and utilize vast areas. Such areas include remote places that outside officials may consider disposable.

Social Disruption

Uranium permeates not only physical landscapes, but social ones as well. Certain communities have come to form their identities through uranium contamination: one previous example being Lane Gerald's visit to the doctor. Other social ramifications include residents feeling that the overall quality of life has declined, continually worrying about how people will be affected in the future, and enduring the legacy of burden on families and those left behind.

Janice Calvin laughed and recounted a conversation she once had with her sisters. She said:

> One time we were talking about it at home. Ahhh it was we were saying, "Yeah different communities have their own problems. These people in the Midwest - they have tornadoes. Others have flooding - those floods. And then they've got volcanoes out here. Ours is the uranium. [Smiling] . . . Ours is the worst one.

In her comparison of disasters (uranium being the only un-natural one), lies the humor of someone resigned to a horrible fate. This is how many people living with uranium view their situation. It also reveals that uranium - "the worst one" - has become a form of identity for Janice's community. It is difficult to argue that people are minimally affected by uranium when they, their neighbors, and family define themselves by it. Lane's exclamation, "I mean we've lived around uranium and

vanadium all our lives," reinforces the fact that once someone has lived around it for his or her entire life, it eventually becomes a part of life – and of a community.

In perceiving uranium in this way, people feel that it has marred their lives and lowered their quality of life. The environmental and physical pollution have become so all-encompassing that they have caused social pollution as well. James Garnet makes an association between covering up the contaminated earth and improving the quality of living:

> But if they cover it up, don't fool around digging gold anymore, then I think in a hundred years we could do—have a better life. Its going to take many years to come out of it.

Even once the radiation has been covered up, he recognizes that it will still take a long time to recover because the damage has reached far beyond the boundaries of open mines. James continues:

> Well in time that when I was younger, before the real hit of the radiation, before any kind of environmental uh impact of coal mining or other things that are - in those younger days, we don't have any people that were limping. We didn't have any problem in alcoholism . . . and not very many people, uh, had any other um, um, defects in their lives. They didn't have retardation, mental problems.

His list goes on to include suicide and domestic violence before he says, "and I think the effects of that is from uh, the mixture of all—all the pollution and radiation." Here, James's speech powerfully links the environmental pollution with a wide array of social ills and degenerated aspects of modern society. It reveals the strong connection he and other participants maintain between their society and natural environment.

The loss of elders and care for the sick contributes to the despair of those left to pick up the pieces. Betty Ray says, "well its really sad. I mean all our parents are gone and now we're the only ones and it - it really bothers us now." During a trip with Melinda to the western part of the Navajo Nation, we visited the home of a woman whose father-in-law had been a miner. Melinda asked the woman how uranium had affected her family. The woman began by talking about her father-in-law's blindness and the fact that she becomes unexplainably ill every few months for long periods of time. Neither she nor her father-in-law knows what is wrong with them. She described dealing with his alcoholism that further incapacitates him because he has lost hope. She began to cry. She said "I sometimes ask myself 'Is a life like this worth living?'" The fallout from mining includes experiences like these. Even those who appear to live several degrees removed from uranium still find themselves intimately connected with it.

Finally, knowledge of the delayed effects of radiation, compounded with the sight of sick and dying people, fosters continual worry about who will be next. Because radiation exposure does not guarantee certain death, people are left with questions of whether they will get sick later in life, how they will be affected, and how or whether they are currently being exposed. Janice says:

> Well, we, like my family, my mom, its eeeaaaah in back of their mind. They try to think positive - positively every day. Just taking it one day at a time. Make sure we don't get wiped out one day . . . [Slightly laughs].

She also mentions that she keeps a list of symptoms from uranium-related illness in her truck that she consults when she hears that someone in her community has gotten sick. This is an effect of uranium that not many outsiders have given much attention, yet it is a significant aspect of how people live with uranium today.

Discussion of Interview Data

The narrators suggest that people living in uranium-impacted communities understand it as something that affects them in all aspects of life. While health studies have confirmed some of their physical trauma, there has not been enough information published to allow people to extensively analyze the bulk of their experiences. Works like "Memories Come to us in the Rain and the Wind," begin to form a base from which to conceptualize the impact of uranium mining in a multi dimensional way. This publication provides actual statements from victims and corresponding illustration, but leaves the interpretation of these powerful testimonies to its reader. While such work is infinitely valuable, the time has come to move one step further in this endeavor.

In many cases, people found it almost impossible to answer questions about how uranium had affected their communities in ways other than by listing health problems or talking about how things were back in the mining days. People are simply not used to thinking about uranium in terms of their own personal frame of reference. They related their experiences through anecdotes and stories, but almost never attached any broader meaning to these accounts. As Ken Silver (1996) and Valerie Kuletz (1998) note, people need to be able to legitimize and understand the collective truth in their stories.

Ethnographic interviews demonstrate the existence of a complex set of issues surrounding uranium. They raise the need to continue asking these kinds of questions, and reveal some of the main un-addressed avenues of concern for both community members and professionals. This is where anthropology and ethnographic analysis can elicit the deeper meaning and issues in the way people live with uranium.

Scientific and Local Perceptions of Uranium Impact Differ

Because radiation is invisible and its detrimental effects usually appear many years after exposure, scientists and laypeople alike have had great difficulty determining how much a person can tolerate without being harmed. Beginning in the early 1950s and continuing through the late 1960s, scientists and doctors argued before the Atomic Energy Commission about the amount of radiation a miner could safely tolerate in working conditions. Eventually a standard was agreed upon, but this still did not address the extent to which family members, people living near mines, or people using contaminated resources could be harmed. The federal government currently uses the standard formula of two hundred "Working Level Months" – a calculation based on measurements of radon gas in mines and the amount of time a worker spent in the mine - to compensate miners for lung disease. This standard only applies to situations in which people were exposed to radiation in mines whose air quality has been sampled. Second, it is only based on measurements of radon gas in the air and does not include radiation exposure from breathing or eating other radioactive elements in the mines. Working level months apply to radon's effects on the lungs, but not to the effects of other radioactive emissions on other parts of the body. They can not measure how much radiation a child in the womb was exposed to by her mother's consumption of contaminated water. Nor can they measure any other such indirect but significant exposure.

The working level month standard, upon which RECA compensation is based, is part of a larger belief that under a designated measurable limit, radiation has a negligible effect on people. On one side of the number is safety and on the other side is harm. Officials measure other potential radiation sources, such as homes or waste piles, in a similar way, using working level months as a basic guide to determine exposure.

In his book, *If You Poison Us*, Peter Eichstaedt demonstrates the inadequacies of using such methods to test for radiation exposure once it has become a part of the surrounding environment. One example he gives is from 1975, when the Environmental Protection Agency ("EPA") became aware of homes in the Cane Valley area of the Navajo Reservation that had been built with uranium ore from the mines. The EPA itself recognized the shortcomings of the ensuing study. While home radon levels measured a low .04 Working Level, the tests were conducted in the summer when doors and windows were left open often around the clock. Readings taken during the winter when ventilation is poor might have revealed much higher radon levels. In addition, samples were not taken over several days but were one-time "grab" samples (Eichstaedt 1994:142).

Two years later in the same place, the engineering firm Ford, Bacon, Davis Utah took several readings from the local mill tailings pile. They concluded that, in general, radiation from the mill tailing pile presents very little danger to local

residents. As Eichstaedt points out, however, "the study did not take into account that most of the residents spent a lot of time on the pile, not a mile or less from it." He continues stating that:

> [the study] is generally accurate as far as it goes but it is based only on short-term measurements of radiation near the pile. It does not include the potential long term effects on the children and families who live in dwellings that are contaminated with mill tailings. [Eichstaedt 1994:143]

This study exemplifies the way in which scientific testing does not comprehensively provide conclusive results for such an amorphous and long-term phenomenon as exposure from radiation and its subsequent effects. "Prolonged exposure to gamma radiation can result in genetic defects that can be as subtle as general ill health . . ." (Eichstaedt 1994: 136). Health studies have no way of relating radiation exposure to "general ill health" in a direct enough causal relationship to convince any one except the people who live with it. In addition, there has been no analysis of the long-term effects of exposure to waste piles on humans or animals. Waste piles pose one, if not the single most important source of contamination, according to local residents.

Another reason that scientific research does not accurately convey the effects of radiation in communities is that it relies upon large numbers of people in order to produce statistically significant results. In groups with low populations, like most Indian or rural communities, studies showing a strong correlation between radiation and a particular health problem may not convince experts for the simple reason that their sample size is too small. The one well-known health study demonstrated the correlation between fetal birth defects and uranium but proved inconclusive for this reason. The paper's conclusion states:

> It was unlikely that our small study population would have demonstrated a real effect in terms of statistical significance. [Shields, et al. 1992:550]

While Navajo people today still speak the name of Dr. Laura Shields with admiration for her help in establishing the danger of uranium, her study does not statistically prove anything. Because of their size, small communities like reservation chapters and rural towns do not show up well in surveys or research on the effects of radiation. This means that scientific tests in the most impacted areas are deeply flawed:

> Thus inadequate funding and the shortcomings of statistical analyses for small populations can result not only in a lack of 'official' documentation to support the 'preliminary' and 'anecdotal'

> knowledge of health risks, but in the production of official documentation that is contrary to the preliminary studies. [Kuletz 1998:29]

Such research typifies the fundamental philosophies upon which uranium industry practices are conducted. Industrial safety standards and compensation laws are based upon similar studies. In *Naked Science*, Dr. Laura Nader questions, "whether a narrowly demarcated science - one restricted to contemporary Western ways of knowing - provides us with the greatest source of truth" (Nader 1996:3). Local residents' different observations of radiation indicate the potential harm in basing decisions upon a single infallible kind of information. Residents do not experience the effects of radiation in terms of doses, picocuries, or milliroentgens. While scientific rhetoric demands mathematical addition of hours and doses of exposure to determine whether a person will be affected, local residents believe any radiation exposure accumulates and incurs some kind of effect, no matter how mild.

Melinda Marquez, a Navajo uranium educator, describes a conversation she had with her friend, a doctor at the University of New Mexico. Melinda's recollection of their exchange represents the gap in perception of radiation's impact between local health workers and outside medical professionals:

> And I says "Look, Cynthia." I said, "You know you go on and say Yeah, radiation will kill you of the exposure depending on the potency of it," you know. "It don't make any difference," I said, "how long of an exposure you had of radiation. You're exposed. I don't know what level of exposure was given but you're exposed. But through your - your life span, somewhere along that life span, you are gonna be affected in some way.

Here, Marquez disagrees with Dr. Cynthia's assertion that radiation only kills or harms people above certain doses. Marquez continued to explain that she, herself, believes that radiation affects people irrespective of dosage.

The tension between these beliefs plays out between local and outside officials in other arenas. In regards to cleaning up damaged sites, local organizations - including the Navajo EPA – often hold different ideas than federal agencies such as the federal EPA. A 1983 study by the federal EPA pronounced that there were almost 1,000 nuclear waste piles scattered across the Navajo Nation. They were pronounced "too remote" to produce "sufficient national concern" (EPA 1983). As Ward Churchill points out in *Struggle for the Land*, no law today requires the clean up of these piles, though the Navajo EPA sees them as a significant enough concern to divert funds designated for coal mining clean-up to reclaim the worst of these uranium piles (Churchill 1993: 271). Eichstaedt confirms the Navajo position towards these

tailing piles in his interviews with Perry Charley and Ray Tsingine, two Navajo Uranium Mine Reclamation Managers. He writes:

> Even though the precise health effects of exposure to these piles have never been determined and most likely never will be determined, concerned people like Charley and Tsingine operate largely on instinct and common sense that tell them that prolonged exposure is not good for anyone or anything. [Eichstaedt 1994: 136]

These examples do not simply portray a conflict between superficial dichotomies like local and outsider, native and Euro-American, scientific and holistic, but reveal a deeper rift between local residential sense of exposure and its public scientific depiction.

Giovanna Di Chiro acknowledges this division in her work on women's grassroots environmentalism. "The different valuation and knowledge possessed by local communities versus those held by environmental scientists," (Di Chiro 1997:203), applies to her work among women environmentalists in the same way that it does local Navajos. Both groups possess knowledge and perspective that have been cast away as being overly subjective, non-technical, and irrelevant, by a more powerful science.

Scientific and local perspectives represent culturally constructed and politically situated belief systems, each with their particular logic, flaws, and discrepancies. Proponents of scientific superiority dismiss local ethnographic accounts as being biased. They attack ethnographers for attempting and feigning unattainable objectivity. Anthropologist James Clifford responds by agreeing that, "even the best ethnographic texts -serious, true fictions- are systems, or economies, of truth" (Clifford 1986:7). However, implicit in his essay, is the understanding that no kind of truth can escape being "inherently partial – committed and incomplete" (Ibid 1986:7).

"There is no picture that can be 'filled in,' since the perception and filling of a gap leads to the awareness of other gaps," (Ibid 1986:25), and Clifford argues that the "truest" accounts are those that claim the particular viewpoints from which they emerge. Laura Nader notes, "we live at a time when science proponents consider it outrageous to allow that there are different science traditions" (Nader 1996:11). Because many powerful institutions subscribe to and support the idea of infallible scientific truth, its essential shortcomings remain unchallenged, while other forms of knowledge remain at the wayside because they are "biased."

In uranium's case, the scientific depiction of its impact greatly pales in comparison with the vivid depiction of those who live with it. The scientific method of research does not clarify the means and extent of exposure. It leaves many aspects

of how radiation acts on the body and land unanswered. Because the results of scientific research studies are considered fact—as opposed to "instinct and common sense"—local claims of radiation as definitively more harmful have no audience besides amongst the residents themselves.

Need for Legitimization of Anecdotal Evidence

> A new species of expert has emerged – one that is constructed from the everyday struggles of people striving to understand and negotiate their needs and desires in efforts to live a decent life. [Di Chiro 1997:210]

Individual case studies and personal experiences of suffering provide the strongest case for the cessation of mining and production of nuclear material. Unfortunately, such accounts have yet to be legitimized in any type of official arena. Scientific evidence holds the only true weight in congressional hearings and court cases, while its shortcomings in producing clear results within small communities (particularly regarding uranium) have not been recognized. Anecdotal evidence and ethnographic research will have to be accepted as valid evidence of the nuclear industry's impact if meaningful debate is to occur.

> If knowledge is born of experience and reason, as Malinowski argues, and if science is a phenomenon universally characterized (after insight) by rationality, then are not indigenous systems of knowledge part of the scientific knowledge of mankind? [Nader 1996:7]

Eyewitness accounts of suffering and damage illuminate areas in need of further investigation. The act of recounting, of bearing witness, also empowers victims to believe in their own observations and voice their suffering.

Due to the many venues of exposure that develop in a contaminated area, it is impossible to measure quantitatively how much people are exposed to and affected by radiation. Courts of law and expert panels recognize statistics as the strongest testimony, but they do not effectively convey the impact of radiation in a community. In regards to nuclear waste negotiations, Jay Ou notes the "significant implications of the storage process such as public health and safety are not examined in the discussions. They are simply mentioned in relation to the word 'standards'" (Ou 1996:40). He confirms the way that technical scientific language can obscure the danger and risk involved with nuclear waste. The colloquial language of laypeoples' accounts returns these factors to the debate.

Anecdotal evidence consists of the observations people make about their condition and their environment. Observation is the first step in the scientific method. However, anecdotal statements

> about the health risks associated with un-reclaimed uranium mines and tailings piles are gathered in preliminary studies or as testimony in open-hearings . . . but do not constitute scientific evidence. They are simply reported . . . diminished by the overwhelming weight of contrary 'scientific' evidence. [Kuletz 1998:28]

The use of anecdotal evidence as part of scientific research has been ignored and underrated. While it is accepted in initial reports as indication of a problem, it is not then allowed to prove that the problem actually exists. Di Chiro argues that "common sense," or lay, constructions of environmental damage maintain the authority of having been created by "the experiential realities of those communities most directly affected." She uses the term "popular epidemiology" to refer to local knowledge "about the physical, bodily effects of toxins in their lives," which "develops a form of popular science" (Di Chiro 1997:213). While this "popular science" constitutes fact enough to justify spending money and time researching a problem; in comparison with "real science," it is not objective enough to become part of the evidence.

This pattern appears in other toxic waste issues as well. In the Love Canal neighborhood of Niagara Falls, New York, homes and a school were built over the site of a 1940s toxic waste dump. When residents complained of miscarriage and problems with their older children and pets, researchers began to study the area. Later studies also revealed that the children from the area were significantly shorter than children in a control group (Levine 1982). Without the observations of the residents, no action may have been taken. However the physical elements of such cases - like radioactive isotopes or harmful chemicals – ultimately become the focus of attention. This is because measurable, quantitative scientific calculations reign as the dominant method of data collection. However, what officials fail to recognize is the intensely qualitative and un-measurable nature of these environmental waste cases.

Besides the fact that local residents constitute the only first-hand accounts of the effects of radiation in their community, they also need to voice their suffering for their own sakes. In 1984 toxic gasses leaked from a Union Carbide plant in Bhopal, India. By the time the case reached the courts five years later, the toll of injuries had reached 300,000 people. Incomplete medical tests were administered and a hasty settlement was reached. Anthropologist Veena Das showed that the court case silenced victims and enhanced their suffering by giving sole authority to medical and legal professionals while ignoring their experiential testimonies (Das 1995).

Anecdotal evidence is often ignored precisely because of its potency. In the case of the Navajo, while cultural and educational factors contribute to the hesitancy to discuss uranium, so do the power of their stories. As Janice Calvin says:

> And then other people say 'don't mention that. Don't say it. Don't say the name 'uranium,' or its gone come back on, its gone come on

> us. So they – they don't want to talk about it . . . In some areas, like different families, they all have different stories [about uranium].

For the people to whom Janice refers, voicing their experiences brings them to life so completely that people in her community prefer not to talk about them.

Because their stories hold no official weight, those who live them begin to doubt the legitimacy of their experience. The disempowerment that comes from not being able to validate one's own senses emerges in conversations with Navajo participants. Many informants expressed a desire for someone from a foreign place to come to the reservation to conduct a study of the effects of radiation. This wish reveals the understanding that their stories do not count in the eyes of the law, and as a result, they feel incapable of proving their experience by any means. For example, James Garnet mentions wanting someone to study the long-term effects of radiation in the atmosphere. He says, "Which should we credit to do this? You know, Japanese, or Hawaiian, or Navajo, or Englishman, or somebody" (Garnet 1999). Even though the Navajo people alone experienced the firsthand effects of uranium, Garnet still feels compelled to list several other possible nationalities of researcher. Janice Calvin says, "Maybe we need two or three Japanese that will do studies out here" (Calvin 1999). These offhand remarks reveal insecurity about the validity of their own anecdotes and subsequently, about their ability to solve the problem. Kuletz correctly labeled scientific discourse as a "mechanism of exclusion" (Kuletz 1998:28), in that it excludes plaintiffs from their own cases, but it also encourages residents to exclude themselves from activism or problem-solving .

Particular Navajo Issues Concerning Uranium

The politics of a situation can not be isolated from the cultural elements of the community in which they occur. The same applies to the policies regarding uranium mining and clean-up in the Four Corners area. Communities of Euro-American uranium workers possess their own particular characteristics, as do those on the Navajo Nation. They share many attributes like their rural locations, lifestyles, and greater dependence on local resources. However, since this study focuses predominantly on members of the Navajo Nation, it will address some of the Navajo-specific aftereffects of uranium mining. Again, the issue of land use pertains also to rural Euro-American populations, but for the purposes of this paper, it will be presented in reference to the Navajo communities.

Two of the greatest problems in the aftermath of uranium mining on the Navajo reservation concern cultural land-use patterns and language. As a large, geographically dispersed rural population, Navajo people use their land differently than people in urban areas. They frequent remote areas and still practice elements of a transhumance adaptive strategy in which they obtain resources from a wide vicinity.

The second problem – of language – stems from the fact that Navajo people maintain their native language to such an extent that elder members generally speak little or no English, while middle-aged people in their 30's through 50's are mostly completely bilingual. Younger Navajo in their twenties and younger usually speak English, but use a version that anthropologist Leighton Peterson (personal communication, June 20, 1999) described as "Navajo English," because of its use of Navajo words and unique adaptations of English words. In other words, older Navajo do not tend to speak English well, if at all. Those who do speak English, do not necessarily speak the same version being taught in off-reservation schools and universities. This has meant that explaining the dangers and implications of all aspects of uranium have been difficult to relay to communities who lack a functional vocabulary for such concepts as radon, uranium, and radiation.

When driving through the Navajo Nation, one often sees signs with names on them pointing to what appears to be an empty stretch of desert or a mountain. On the smaller highways, an intersection may point to three different community names while the only visible landmarks are sagebrush and perhaps a grazing horse. It can give the illusion that nobody inhabits the land for miles around. However, by turning onto a dirt road and driving for several miles, it is likely that a cluster of hogans and houses will appear, followed by another, and another one past that. While the federal government has installed a small housing development somewhere in almost every community, the majority of people on the reservation live in small groups of homes some distance from the designated housing complex. Extended families not only live together; they also use the same camping spots, sheep-herding areas, and hiking trails. Several other families usually share the same ones. These areas include mountains, canyons, and arroyos that are often impassible to vehicles.

Caves that lie at the bottom of an empty canyon, an hour's climb away from the roadside, often contain candy wrappers and soda cans from frequent visits and stays. The tiny weed-like yellow flowers that grow on the side of the road provide attractive scenery—a splash of color in an otherwise insignificant stretch of highway for the tourist passing by. However, the pick-up truck behind that car is likely to pull over and release three passengers with bags to collect the plants which make a common drink called Navajo tea. These sketches attempt to convey the fact that life on the reservation prescribes a very different knowledge of and use of the surrounding environment.

The Navajos still use local resources from a relatively large land base, practicing a modernized version of their traditional transhumance lifestyle. Livestock grazing provides a large portion of the Navajo population with food and money. People hunt deer in the winter, occasionally kill and eat prairie dog in the summer, and collect local plants for use as food and medicine. Anthropologist Richard Stoffle observed the same types of hunting and gathering activities practiced by the Indians living around Yucca Mountain, Nevada (Stoffle 1984). Before the military took over

the region for nuclear testing, Indians "made full use of this wasteland region" (Kuletz 1998:199), gathering pinon nuts, rye grass, and hunting rabbits (Stoffle 1984). The Oasis Valley people, like the Navajo today, used these resources to supplement the low wages they received as laborers for Euro-Americans.

On the Navajo Nation, these "wasteland" areas have not been declared off-limits, meaning that Navajos gather and use contaminated resources. Because of this, the Navajo people have been exposed to greater amounts of radioactivity than people who consume resources imported from other areas. This basic equation was recognized in the late 1950s by scientist Eugene Odum, who studied concentrations of radioactive elements in ecosystems. He writes,

> we see that if man were forced to obtain all his food from a restricted contaminated area, he might easily be obtaining at least temporary levels which he would not want to risk . . . Thus, we see that while there seems to be little to worry about radiation in the average worldwide levels, local situations could change the picture drastically. [Odum 1959:479-480]

Odum's observation highlights the need to emphasize cultural practices, like land use, as well as local knowledge of contamination into the dialogue of radiation. His own scientific research reveals the discrepancies between large scale and local concentrations of radioactivity.

Peter Eichstaedt ties the Navajo use of the terrain to the uranium waste problem by describing the situations encountered by Navajo Mine Reclamation managers. According to Perry Charley, Navajo Mine Reclamation Manager - out of 867 mines discovered by his crew, 467 were being used by animals for "temporary or semi-permanent shelters" and 43 "were found to have been used by people for shelter during bad weather, perhaps on a regular basis" (Eichstaedt 1994:132-133). The list of dangers resulting from the casual, but regular, use of such places continues. Concerning sheltering animals in abandoned mines:

> Cows and sheep kept in such places become contaminated by breathing the residual radon, drinking some of the water that occasionally flows from or puddles in the mines, and eating the forage growing in earth that is contaminated with uranium waste and toxic metals. The contamination permeates the animals' flesh and bones, including the cows' and goats' milk, and then is consumed by local ranchers. [Eichstaedt 1994:133]

Human risk from using mines as shelter, hunting camps, and party spots include the good possibility that "clothes and sleeping bags, food and water become impregnated with uranium dust and dirt" (Eichstaedt 1994:133). Many of these places appear to

the outside observer to be too remote to cause concern. No one would think that a small mine several rough miles into the mountains of Little Valley would pose much of a health threat to the community below. Yet Janice's son explained that he and his relatives use the barely perceptible trails for hiking and herding sheep, as do other nearby residents. On the western side of the Navajo Nation, at the location of a covered open pit mine beer and soda cans lie in the dirt next to yellow chunks of uranium ore.

These areas still pose health hazards today because outsiders like EPA and other government officials do not realize that people regularly utilize these areas. They would likely be surprised by the existence of trails in the remote mountains, or beer cans in a completely bare patch of desert. The unawareness of different land-use system among modern Navajo people, has meant that many of the sites that pose great radioactive threats to their communities have been left unattended.

As stated earlier, a report made by the EPA in 1983 stated that over 1,000 nuclear waste piles exist on the Navajo reservation. However, these sites do not need to be cleaned up by law because the EPA designated them "too remote" and not enough of a "sufficient national concern" to be rehabilitated (EPA 1983). This is also because statistically few numbers of people are affected; therefore the EPA sees no reason to do anything. A previous section notes that Navajo EPA officials diverted federal funds to clean up the worst of these areas, which demonstrates the discrepancy between what outside federal officials perceive as a potential threat, and what is actually causing harm in these communities.

When they discuss uranium, some Navajo people mention the lack of adequate vocabulary for engaging in detailed discussion of radiation. The Navajo Mine Reclamation manager Perry Charley describes his difficulty in explaining to local people why they can not keep their animals in abandoned mines. He says: "how do you explain to them about alpha and beta particles, about gamma radiation or radon gas? There is no word for it." Charley likes to use the analogy of steam to describe radiation, but it is inadequate. "I call it steam but they associate that with the ceremonial sweat baths which are good" (Eichstaedt 1994:133).

Janice Calvin mentioned the same dilemma. She said:

> There's really no words, um, no real good definition for the word "uranium." Either in Navajo or English. Sounds good . . . I mean the way it looks – the word "uranium." But when you think like beyond that – like sick people – uuuuuuhhhhh . . . you don't want to think about it.

Calvin takes the language problem a step further, suggesting that even translating English words into Navajo does not convey enough information. The translation of

uranium used most often, "Leetso" or "Yellow dirt," describes the appearance of the substance, but omits the invisible danger and sickness that accompany it. Her comment reveals the inadequacy of current vocabulary for accurately conveying the destructive nature of radioactivity.

Perry Charley's use of steam as a metaphor for radon gas also reflects this situation. He bases his steam metaphor around the English or scientific definition of the gas, which includes the fact that it is an odorless, tasteless and colorless gas – as a way of translating it into Navajo. However, as he explains, it does not convey the danger of radon. In fact, he says this translation associates radon with the traditional healing activity of sweat baths.

The danger of lacking the vocabulary and concepts of uranium mining is that it leaves local residents handicapped to fight against it. If people do not know how to describe something or explain it, winning a legal argument, for instance, becomes quite difficult. They may not understand how it affects the body or be able to explain their symptoms well to a doctor. Without the collectivizing power of a common vocabulary, people can not organize themselves against future persuasion by mining companies. Without adequate words to describe what is happening and why, people lack basic understanding of uranium and radiation. Lack of knowledge, in turn, breeds fear and avoidance of the topic. Janice Calvin says:

> Like when I was growing up, I used to see them one day they just started dying off. It didn't happen before. I don't think it happened before. It was only about – mmm, I don't know, maybe ten years ago. Mhmm. And then other people say "don't mention that. Don't say it. Don't say the name "uranium" or its gone come back on, its gone come on us." So they they don't want to talk about it. They say that if you talk about it it'll affect the people.

Calvin describes this belief as a traditional Navajo understanding that talking about bad or taboo things will make them come true, like saying the names of the deceased. She explains that the people who say this are, "Traditional. People that don't read, had never been to school." While it is hard to say how much of the avoidance of uranium conversation comes from this cultural belief and how much comes from lack of vocabulary and subsequent education, the latter enhances and reinforces any pre-existing apprehension of discussing the topic.

Lane Gerald recognizes that lack of knowledge about radiation concepts also ensures a pool of eager workers. He says:

> I mean education was not a big deal. If you're gonna take somebody and stick 'em down into a a highly dangerous situation, you think the son-of-a-bitch with the Ph.D.'s gonna go down there and – you know

> – do what they was asking them to do? I mean stop and think about it.

Lack of understanding about the concept of radiation creates fear and avoidance of its harmful aspects as well as an ignorance of the potential harm of working in or living near the industry. The Navajo case is enhanced by the fact that speaking a different language establishes yet one more barrier in attempting to convey the danger of radiation.

These people's testimonies have revealed the need for adequate educational materials like culturally appropriate scientific dictionaries and picture books. Some of these materials have already begun to emerge. At a teachers' seminar hosted by Dine College in the summer of 1999, EPA officials passed out copies of "Gamma Goat." This cartoon coloring book features a superhero goat that teaches Navajo sheep on the reservation how to avoid possibly contaminated areas. The book was extremely well received by both professionals and Navajo teachers.

While communities need this type of education, it reflects a larger social trend of placing the burden of rehabilitation on the victim. While essential, trying to solve the uranium problem with culturally appropriate "Do Not Enter" signs is in some ways analogous to solving the date rape problem by asking women to carry pepper spray. Both solutions stem from the assumption that the perpetrator - or the corporation, or the government - is beyond retribution. Simultaneous efforts to address the larger system that allows dangerous uranium to enter communities must be made.

Environmental Racism and Nuclear Colonialism

Sixty percent of the uranium deposits in the United States lie on Native-owned lands, but ninety percent of all American mining and milling have taken place on or adjacent to Indian lands (Churchill 1993:264). This indicates that decisions about where to extract resources do not depend solely on their availability or location. In another context, Jay Ou argues that, "the ideal medium of negotiation was actually characterized by a coercive, incremental process of consensus building" (Ou 1996:32). Uranium mining companies, in conjunction with the government, practice what has been described as "environmental racism" (Kuletz 1998:110). This can best be described as using disenfranchised communities, usually of color, as the location for environmentally unsound activities, such as toxic waste storage or mining. The history of the development of the nuclear industry reflects an even more extreme version of this, moving beyond the boundaries of taking advantage, to specifically targeting these communities because of their socio-economic status. Kuletz suggests that the nuclear industry has attempted to transform certain Native communities into raw materials colonies (Kuletz 1998:36).

Kuletz's definition of environmental racism provides a good basis for understanding the relationship between the U.S. nuclear industry and several of the Native American tribes. She describes it as, "the inequitable burden of environmental degradation placed on poor communities and communities of color" (Kuletz 1998:110). While such a phenomenon does not appear visible to the naked eye, those who visit these Indian lands become painfully aware of its existence.

While traveling between several western Navajo communities, I stopped at the home of a family living just off of the major highway. The families lived approximately a quarter of a mile across the road from a large reclaimed pit mine and surrounding waste piles. The giant power lines drooped with their own weight, hanging between equally massive electrical towers over nearby homes. These lines and piles sit literally in the Navajos' backyards because industries prey on their lack of funds and offer them money to accept what no one who had enough of a choice would accept. Kuletz recalls a conversation with a pronuclear Department of Energy contractor who shared his opinion about housing nuclear storage facilities on the Fort McDermott Paiute-Shoshone reservation at the border of Oregon and Nevada. According to Kuletz, the contractor suggested that "making an offer to such an impoverished tribe was tantamount to environmental racism" (Kuletz 1998:109). One could argue that if the tribes really valued their land and people they would decline such an offer no matter what price tag was attached to it. However such a position relies on the assumption that they have that choice. The underlying reality is that these offers force people to chose between two life-threatening options – debilitating poverty or hazardous development.

As representatives of the nuclear industry consistently approach Indian communities to store its waste and testing sites, opponents have accused them of practicing internal nuclear colonialism. The United Nations defines colonialism as occurring only when the colonizer crosses an ocean to reach their subjects. However, industrial nations like the United States have exhibited colonizing behavior towards some of their own citizens. As Kuletz writes:

> For many indigenous communities historically, as well as in many cases today, uranium mining is only a form of resource extraction for export. Because of this, native communities become "raw materials" colonies for the uranium companies and their home nation states. [Kuletz 1998:36]

The case of uranium mining on the Navajo reservation demonstrates this principle. All of the uranium mined on the reservation became either nuclear weapons or plutonium for use in another region's power supply. The Navajo people did not benefit from the extraction of the uranium besides the meager wages they received for mining and the compensation payments they received for being harmed by the related

radiation. As of 1984, the royalties that the Navajo people receive for uranium, averaged only 3.4 percent of marketable value (Churchill 1993:262).

Sacrificed Lands and People

Certain rhetoric derived from early American philosophy still contributes to nuclear policy today. Ideas about property derived from John Locke and the notion of Manifest Destiny have enabled the U.S. to secure Indian lands even in recent decades in the interest of national security. In addition, adherence to an economically-based model of ecology has allowed scientists and the government alike to view deserts as useless for anything except mineral extraction, waste sites, and war games. The cultural construction of these paradigms emerges when comparing this desert wasteland rhetoric with the native inhabitants' view of the desert as a sacred landscape. This comparison shows how certain landscapes and the people who live on them become non-places and non-persons in the eyes of the government and industry.

Proving that no one else owns an area of land is the easiest way to claim its ownership. When the United States government was still in its infancy, leaders developed a philosophy to enable them to take control of lands further and further west. The ideology that emerged stems from John Locke's influential *Treatise on Property*. Locke argued that a person could claim land as his own only if he worked and improved it. To proponents of such a belief, early native peoples did not own most of their territory because they had apparently left it untouched. Manifest Destiny, a nineteenth-century American philosophy, was based on this principle. According to Manifest Destiny, man had a God-given duty to make these empty lands productive.

Today, this concept still resides in the attitude that the U.S. government and industry hold towards what they perceive as empty or barren lands. Even now, with respect to native property:

> the lust for their territories and resources within them, is typically hidden behind a rhetoric extolling the settlement of essentially vacant and undiscovered lands. [Churchill 1993: 7]

Native people often reside in these "unclaimed" areas as their ancestors did two hundred years ago. The "barren" lands of today still belong largely to native people because the government viewed the property as expendable when it outlined reservation boundaries. Once the government discovered valuable minerals like uranium in these formerly useless areas, the age-old conflict re-emerged.

> Now that mostly non-Indians want these lands . . . the United States once again asserts its God-given right, (its manifest destiny) to

> territories formerly designated 'wilderness' or 'Indian Country' on early maps of the region. [Kuletz 1998:114]

Because most Indians currently living on these lands want to leave them as they are, the government persuades them by extolling the virtues of development. Rather than bribing the Indians with land allotments to farm and improve the land, the government now "negotiates" with the promise of jobs and money in exchange for housing nuclear waste or allowing uranium mining. Though the playing pieces have changed, the rules of the land-tenure game have not.

While manifest destiny rhetoric supports the take over of these regions from one angle, the use of an economic model of ecology supports it from another. Valerie Kuletz reveals a socio-economic rendition of nature that defines ecosystems according to their productivity. In one environmental science textbook published in 1991, deserts are described as being the second lowest contributors to the "primary productivity to the biosphere" (Chiras 1991). Organizing ecosystems according to the goods they produce or their productivity enables them to be ranked according to their relative economic benefit. This by no means represents an objective or real construction of nature, yet it is the one used to justify the U.S. politic of landscapes of nothingness.

Kuletz writes about the history of such rhetoric in relation to the nuclear industry, remarking that:

> the wasteland narrative, the narrative that describes this land as alien to human life, was and is too powerful to ignore. It has played too great a role in the depiction of this land as one only fit for bombs and waste. [Kuletz 1998:187]

She quotes a 1963 publication commemorating the China Lake Naval Weapons center which begins, "To those who first squinted their eyes at the vast nothingness which prevailed in 1943, it must have seemed an impossible task . . ." (Kuletz 1998:186). In the same vein as early American settlers who relied upon the belief that no one really lived in the wilderness that lay before them, the nuclear industry assures itself that no one really uses the land, nor can it be used for anything but nuclear purposes.

In opposition to the portrayal of these desert regions as wastelands, native versions of the landscape reveal an understanding of the land as sacred, life giving and sustaining. One Navajo woman pointed to some nearby mountains and said that the companies wanted to dig for uranium there in the 1940s. Eventually local residents raised such a fuss that the company backed out. The cause for such turmoil stemmed from the fact that the mountains were a source of colored rocks that local medicine men used for sand painting in their ceremonies.

In Nevada, the nuclear industry took over one of the medicinal hot springs for use as a testing site. One Moapa Paiute elder recalls:

> I remember when my dad took me over there to show me the hot springs when I had got sick for a whole week . . . I had to go in there and talk [with the springs] so I could get well . . . But like I say, they've taken them all away. [Kuletz 1998:223]

The Navy denies access to these springs to local Native Americans. In both the Navajo and Paiute cases, the nuclear industry classifies as desert wastelands places that local residents use for medicine and healing. Some of these locations might be the very places sought for relief from radiation-related illness.

The sectioning off of these lands for nuclear activity has demonstrated the process of "deterritoriality" or the loss of commitment by modern nation states to particular lands or regions (Kuletz 1998:7) that has been occurring in this country. Once the government and nuclear industry has relinquished responsibility for these places, the lands themselves and the people on them become subject to limitless damage without much hope for retribution.

The nuclear spill into the Rio Puerco River near Church Rock, New Mexico in 1979 exemplifies the results of deterritoriality. The river fed thousands of Navajo people and their livestock, and irrigated the land along its banks. As a result of the spill, the land has been rendered unusable for agriculture for at least the next few thousand years. People and animals continue to show signs of radiation contamination from the water. Officially the accident caused "little or no damage" (Nuclear Fuel 1983). Such a result can only be determined by a study that has already excluded the people and land of the region in its assessment of the damage. Peter Eichstaedt describes the way non-wasteland areas are treated, compared to those that have been discarded. He compares the frenzy at Three Mile Island to the relative disregard for Navajo people living in contaminated communities. He writes:

> In Red Valley, the Navajos were left to watch their friends and neighbors die as the rest of the nation panicked over a cloud of radioactivity drifting high over Pennsylvania. (Eichstaedt 1994:105)

The respective reactions to the ongoing destruction in the Southwest and the accident at Three Mile Island symbolize the presence of separate, carefully constructed nuclear zones – some are visible and carefully guarded from nuclear disaster, while others are hidden and left to decay.

Removal from Time and Space: An Alternate Reality for the Nuclear Industry

Brilliant colors, rocks that glow in the dark, elements that take millions of years to decay—such is the stuff that science fiction stories are made of. These fantastic images come not from a paperback book, but from the radioactive world of the nuclear industry. While they make interesting bedside reading, these otherworldly elements allow those working with them to detach from ordinary time and space, and experiment with dangerous ideas that do not have roots in reality.

Because radioactive isotopes have one hundred to several hundred thousand year half-lives, deciding how to manage them requires a certain way of thinking. It is impossible to comprehend the consequences of human actions that far in the future, yet decision-making about radioactive waste demands that we do so. The waste from uranium mill tailings contains many radioactive elements that have very long half-lives. These include the highly toxic, water-soluble radium-226, which has a 1,630 year half-life, and thorium-230. If the half-life of radium-226, at sixteen hundred years does not seem impressive, it must be understood that only after 77,000 years does half of the thorium become radium-226 (Eichstaedt 1994:128). Any possible guard against these elements leaching into groundwater can not prevent this from happening over the next millennia. Supporting this lack of futuristic perspective is the recent Y2K situation, which was caused by the oversight of an event only several decades away.

These problems also emerge in the results of a "blue-ribbon" panel assembled by the Environmental Protection Agency to warn inhabitants 240,000 years into the future about the largest accumulation of lethal nuclear waste stored at Yucca Mountain, Nevada. Two anthropologists, an archaeologist, two astronomers, two materials scientists, a geologist, a linguist, an artist, and a cognitive psychologist were hired to come up with an identifiable permanent marker that would warn future humans of the danger once any currently existing language would be extinct. Their proposals included:

> The Landscape of Thorns—One square mile of randomly spaced basalt spikes, 80 feet high erupting from the ground at all angles
>
> The Black Hole—A boundless pad of black concrete that would absorb so much heat it would be impossible to approach
>
> The Menacing Earthworks—An expansive empty square, surrounded by 50-foot-high earthen berms jolting outward like jagged bolts of lightning. And at the center of the square, a 2,000 foot long, walk-on, global map displaying all the world's nuclear dumps, including this one . . .. [Kuletz 1998:289]

The Black Hole bears particular irony because its key ingredient—concrete—disintegrates in residential driveways after just a few decades. The proposals read like video game or movie titles, which reveals their basis in fantasy. In reality, nothing can convey the presence of dangerous radioactive material even fifty years into the future, as evidenced by the conditions on the Navajo reservation. Finding a way to warn people who don't even share a common language of danger more than 200,000 years from now is exactly what it sounds like—impossible.

Just as the vast stretches of time characterize the nuclear world, so do the strange hidden settings of its activity. Miners and millers often mention the beauty of certain aspects of their workplaces. Lane Gerald described the clear brilliant turquoise acid slurry as it made its way to the ore mixture. He likened it to the most amazingly beautiful river one had ever seen, aside from the fact that it was lethal. Growing up around the mill, Lane collected ore rocks from the back of his uncles' trucks. He says:

> I'd go out and some of the rocks'd be purple, some would be green. Some would be this, some would be that. I was totally amazed by them. And I'd go pick the pretty rocks out and I'd go put 'em in my closet. Sometimes my mom'd get really pissed because she would go in there and I'd have three hundred pounds of rocks in my closet. Which I now know that was radioactive rocks . . ..

Navajo miners recall the beauty of the dark underground mine in what one writer describes as "surreal, almost mythological, in that there were mentions of yellow, glowing monsters in the deep dark caves" (Crank 1998:1). The remote geography and otherworldly landscapes of places like the Pacific Islands or Monument Valley, Utah enhance their appeal to members of the nuclear industry as good places for test sites, mines, or waste dumps. Officials allow the exotic appearance of such places to charm them in to pretending that everyday rules about danger and pollution do not apply.

In this alternate reality people convince themselves that myths like the nuclear fuel cycle really exist. "This story promised us that we could recycle nuclear waste back into the system" (Kuletz 1998:281). This principle still operates without much opposition, as evidenced by the EPA's desperate attempts to keep people away from Yucca Valley for 240,000 years while the waste becomes a harmless part of the earth once again. The truth of the matter remains that while the radioactive domain is a mysterious part of nature, full of special effects and magic, its destructive power inflicts very real damage on ordinary life.

The Political Economy of Uranium Mining

Several authors, such as Elliott Leyton, Barbara Kingsolver, and Ann McElroy and Patricia Townsend, have discussed mining in terms of the political economy. They have argued that the past and present political economy of industrial nations emphasizes production of goods as quickly and efficiently as possible. The one factor these nations have left out of the equation is the expenditure of human lives in the process. When measured by its human and environmental toll, mining becomes a highly inefficient practice. Between 1961 and 1973, more than half a million disabling injuries happened in US mines (Kingsolver 1996:9). This excludes injury, death to family and community members, and the long-term human damage caused by radiation. Other problems with uranium mining include the facts that mining often occurs in places with little economic opportunity and once the mine opens, people become dependant on it. Mining, by nature, ravages the landscape, reducing opportunities for alternative development.

The priorities of our political economy have enabled industries, such as uranium mining and milling operations, to escape relatively free of consequence while harming the workers and their communities. Elliott Leyton recognizes this essential concept in his call for a reassessment of the current paradigm of production.

> At present, politico-economic forces dictate that resources be exploited and goods produced at minimum expense and without serious regard for the hazards encountered by labor. Now that the true social and personal costs of this system are beginning to be understood, no civilized society can seriously contemplate its maintenance. The barest humane response demands a political economy which prohibits all production which cannot be made safe. [Leyton 1975:138]

His statement calls attention to the absence of human lives in the calculations of "minimum expense." He clearly voices the need to invert our current political economy to make human safety the top priority. The concept of "sustainable development" proposed by McElroy and Towsend exemplifies this type of reorganization. It entails:

> social and economic change that meets the needs and aspirations of this generation without jeopardizing the ability of future generations to do the same. [McElroy and Townsend 1996:338].

This definition suggests a reworking of the political economy, but remains a far cry from the ways in which the uranium industry has operated. It has preyed upon human labor as a cheap, expendable, and renewable resource in the exhumation of a valuable non-renewable resource—uranium.

Once mining begins, people become dependant upon it for their livelihoods. Many mines and mills open up in rural or remote areas – meaning that there exist few other competitive job opportunities. In the first half of the century, mining companies set up small towns, or camps, for their employees that essentially became breeding grounds for new employees. Barbara Kingsolver describes this phenomenon in the small copper-mining towns of Arizona, as does Elliott Leyton, who studied the flourospar-mining town of St. Lawrence, Newfoundland. Kingsolver writes, "In these isolated towns, the company dictated virtually every physical aspect of life, housing, schooling, social life" (Kingsolver 1996:14). She goes on to describe them as "impossibly remote: far from each other and from anything else" (Kingsolver 1996:19). She could very well be describing uranium-mining towns in the fifties and sixties. Lane Gerald grew up in this type of town until he was in his early twenties. He says:

> And there was several second and third generation people there. You know, Union Carbide was your life . . . They owned the company store. They owned the drug store. They owned the liquor store. They owned the gas station. I mean if you wanted a life, and we're talking about a town of nine hundred people – nine hundred and fifty people – there was no other work opportunity. Unless you went out and ranched or farmed or, you know, whatever – you was just always taught, when you grew up, you was going to work for the company store.

Here, Gerald describes the types of isolation imposed upon people in mining towns that seriously limit their decision-making capabilities. These include a) economic isolation, of having no competing industry for whom to work – besides traditional manual labor like ranching; b) geographic isolation, of being in an area where driving to another town for work is almost impossible; c) and finally, social isolation, of living in a microcosm created by one company's financial motives. Lane says that he never heard of anything that radiation could do to a person until he enlisted in the army and "went out and got an education outside of Union Carbide" (Gerald 1999). One of the informants in *Dying Hard* describes a similar economic situation to that described by Kingsolver and Gerald. In Leyton's ethnography, Alphonse Reilly says:

> I was supposed to do light work. But there's no light work here. You either go in the mine or go fishing and I didn't have nothing to fish with. [Leyton 1975:50]

The pinholeing of opportunities for people living and working in mining communities does not stop at the arrival of the uranium industry. The physical environmental destruction caused by digging up the earth and, in the case of uranium mining, releasing large amounts of toxic elements into the environment, renders it un-

useable for many other types of economic development. Kuletz writes, "once a uranium mining wasteland is created, the options left for alternative development can be quite limited" (Kuletz 1998:35). The case of the Sami, the indigenous people of Norway and Sweden, confirms her statement. The fallout from the nuclear meltdown at Chernobyl in 1986 "dealt a serious blow to the unique reindeer herding culture and economy of the Sami" who lived many miles away from the plant (McElroy and Townsend 1996:163). The Sami can no longer use the reindeer or their products for their own consumption or for sale because the lichen on which the reindeer feed absorb fission products like Strontium 90 more efficiently than other vegetation. The Sami have already been exposed to high levels of radiation by eating meat, fish, and berries contaminated by the fallout (Stephens 1987). Although the Sami never practiced mining, their tragedy reflects the irreversible damage and socio-economic limiting power of radioactive contamination in a community.

Compensation

Awarding monetary sums to victims of governmental and industrial mistreatment not only does not prevent such deeds, but encourages them to continue. By making compensation payments, the government symbolically recognizes wrongdoing, pays for it, and closes the door to any further argument. None of the damage has really been repaired, but it effectively blocks the victims from being able to continue pleading their cases. People who have invested large amounts of time and energy in making their voices heard suddenly find themselves slapped with a lump sum and told, in effect, "You win - you were harmed and now we are paying for the damages. Case dismissed." Distributing pre-determined allotments silences any of the victim's input about the types and amount of compensation necessary to repair their communities.

In his ethnography of Newfoundland flourospar miners, Elliott Leyton writes,

> Nowhere is the moral bankruptcy of industrial society better documented than in its industries' death roll and in its governments' pitiful attempts at compensation. [Leyton 1975:136]

His statement shows that while industries inflict the harm, they usually do not bear the responsibility of compensating victims from their own profits. In St. Lawrence, the town that Leyton studied, the Canadian government compensated miners for their diseases while the company continued business as usual in the mines.

The situation in the Four Corners area mirrors that of St. Lawrence. Companies like Kerr-McGee and Union Carbide may have been required to adhere to stricter safety standards, but the United States Government issued the apology and the payments. While the mines and mining companies provided uranium "for the primary use and benefit of the nuclear weapons program of the United States Government"

(US Congress 1990), the ignorance of safety measures and infliction of damage remains in the hands of mine and mill operators. The Radiation Exposure Compensation Act ("RECA") does not mention these private corporations who played the instrumental role in mining the Four Corners. Workers who clocked in everyday with foremen at USVA, and daily inhaled deadly smoke and gas in its mine, are baffled at the absence of a company voice in the RECA apology: "The Congress apologizes on behalf of the Nation to the individuals described . . . and their families for the hardships they have endured" (US Congress 1990).

The absence of mining and milling companies from every part of the compensation process illuminates the key problem. Each time federal governments compensate individuals for harm done to them by private industry, they reinforce the understanding that an emergency exit for industries exists once they have caused undeniable damage. Even in cases where companies pay for damage out of their own pockets, compensation provides a safety net for taking unnecessary risks with people's lives. When the United Nuclear uranium mill spilled over one hundred million gallons of highly radioactive water in the Rio Puerco, at least 1,700 Navajo who relied upon the river as their single water source were immediately affected, as were the livestock which were found to be heavily contaminated from drinking the water (Churchill 1993:269). United Nuclear resisted providing any relief until five years later when they finally agreed to pay $525,000 to the victims in an out-of-court settlement (Pitman 1985). Paying compensation probably provided a cheaper solution than repairing the cracks in the dam, which were known about at least two months before the break (Churchill 1993: 269). The company decided that the possibility of having to compensate victims was easier than preventing the largest radioactive spill in U.S. history. While reparations must be made for unintentional acts of harm, the current institution of monetary compensation for industrial negligence, resembles this only superficially. In practice, the option of compensation provides industry an oftentimes cost-effective way to continue hazardous production and relinquish immediate responsibility for their actions.

Conclusion

As noted earlier, informants name dozens of ways in which they are exposed, including both direct and indirect means. All of the pathways for exposure lead many people to forgo trying to extract one strand from the tangled web of possibilities. They simply perceive their entire surroundings to be a source of contamination.

The effects of exposure pervade every aspect of each community, from individual physical bodies to collective social bodies. While medical research conducted as early as the 1950s has confirmed some physical effects, like cancer and lung problems, the more nebulous effects - such as the grief and burden resulting from suddenly losing large numbers of loved ones - has yet to be thoughtfully incorporated into official dialogue about nuclear energy. One study may find traces of radioactive

elements in a certain species of organism, and another may relate lung disease to mining. What these kinds of results lack is a larger structure that connects these estranged facts and conveys the implications of simultaneously experiencing all of these phenomena, as well as those which can not be tested.

Informants do not necessarily convey these "un-testable" effects in the same way that they might speak about having several successive miscarriages or a bout with cancer. Just as researchers have trouble concretizing the psychosocial effects, informants also often find it difficult to label invisible damage resulting from uranium. Here, the traditional anthropological role of eliciting meaning from an informant's dialogue and recounted experiences can elucidate such effects.

Several issues emerged through such analysis of the interviews. The way in which informants discuss contamination in their communities reveals that it has become a part of them literally and symbolically. Some people's bodies become maps of human terrain damaged by uranium. Others residents show no external signs of damage, but demonstrate a belief in themselves as being contaminated because of their community's radioactive stigma. As a result of this status, of contaminating loved ones, and of having participated in the mining and milling process, people also grapple with pervasive guilt and self-blame. The sense of human contamination combined with a feeling of total environmental contamination profoundly alters the way these people experience their world. People express the anxiety and heartache of watching abnormal numbers of friends and family die suffering amidst their own constant fear of sickness.

The invisibility of such experiences signifies a series of contrasts that emerge in the preceding text. The glaring power of scientific knowledge renders the testimonies, practices and experiences of locals invisible. Voices of official experts silence those that have lived with radiation all of their lives. Anthropologists must move the spotlight to illuminate those people and ideas that remain in the dark.

Uranium, as these people experience it, does not correspond in many ways to the way that "official" sources have portrayed it. Because the aforementioned effects lay outside of the realm of science, they are largely ignored. Even existing testing methods for radiation are flawed because they assume that exposure is isolated to a particular venue. The nature of radiation exposure requires compounding the results of multiple air, water, earth, and organic studies before one can even hope to accurately measure exposure. This is why local residents abandon specific measurements in their notion of risk, in lieu of the attitude that any amount of radiation presents danger.

The nature of scientific studies usually necessitates their completion in relatively short amounts of time (a few years at most) and amongst statistically large enough populations, when examining human phenomena. Under the circumstances of

uranium in the Four Corners, which involves mostly small communities and the long-term effects of radiation exposure, accurate results in such studies are difficult, if not impossible, to achieve. For this reason, as well as for the validation of victims' personal experience, firsthand anecdotal accounts must hold factual authority in political debate.

In the Navajo example, local voices also need to be heard because they reveal important information about the way in which their particular lifestyle pertains to the impact of uranium. As a rural population dispersed across a large, remote vicinity, they inhabit their space in a particular way. They frequent areas that urban dwellers would not recognize as useful. They also utilize more local natural resources because of their rural location, which puts them at increased risk for contamination. Because many people speak Navajo as either their only, or first language, accurately conveying warnings or information about radiation poses a greater challenge than in populations familiar with the scientific jargon of the English language.

Another unique aspect of the Navajos' situation is their possession of over half of the uranium deposits in the United States. The U. S. government and uranium industry has targeted Navajo land and that of other tribes, like the Laguna Pueblo and Sioux, as prime locations for mining and milling. However, these communities are also targeted because their low socioeconomic status leaves them vulnerable to offers of monetary relief, despite the inherent dangers. Because local labor forces mine uranium solely for export, while shouldering the resulting damage, the relationship between the government and native communities has been described as environmentally racist (Kuletz 1998).

Dominant ideologies in American culture have enabled this colonialist nuclear alliance to continue. The construction of a desert wasteland rhetoric supported by economic models of nature represents one such paradigm. The governmental discourse of stealing land for "national security" has its roots in the 19th century philosophy of Manifest Destiny.

The nuclear industry itself has given rise to another dogma, which centers upon a removal from ordinary time and space as a way of avoiding the impossibility of its mission. Planning thousands of years in advance, working in underground glowing caves, and storing waste on remote tropical or desert locations creates a fantastical stage upon which the activities of the nuclear industry are set. These elements, however, encourage those working with them to detach from their normal worlds and engage in dangerous practices that would seem preposterous if seen in the light of day.

Even without the backdrop of nuclear fantasia, the ordinary political economy of industrial nations disregards human lives in the race for efficiency. Cost-effectiveness refers to the goods being produced, not to the people producing the

goods. If human lives were the standard by which economists judge "minimum expense," the uranium industry would never have survived. In order to see industrial practices like uranium mining as destructive, political and economic philosophy must emphasize human and environmental costs.

A discussion of compensation concludes this paper because it represents what the government and nuclear industries have hoped will constitute the final definitive chapter of the uranium scandal – a successful remuneration to their victims. However, as shown, the individual payments serve the interests of these institutions - not the victims. In keeping with historic responses to uranium damage, the compensation process skirts around taking vital reparative measures while leaving an open door for industry and government to continue their quiet killing. As compensation perpetuates hazardous industry instead of preventing it, so the cycle of nuclear destruction turns without end and the legacy of uranium continues.

Works Cited

Bertell, Rosalie
1985 No Immediate Danger: Prognosis for Radioactive Earth. Summertown, TN: The Book Publishing Company.

Chiras, Daniel D.
1991 Environmental Science. Redwood City, California: Benjamin-Cummings.

Churchill, Ward
1993 Struggle for the Land: Indigenous Resistance to Genocide, Ecocide, and Expropriation in Contemporary North America. Monroe, ME: Common Courage Press.

Clifford, James
1986 Introduction. In Writing Culture: The Poetics and Politics of Ethnography. James Clifford and George E. Marcus, eds. Pp 1- 26. Berkeley: University of California Press.

Crank, Dan L.
1998 A Review of the Exhibit. Navajo Uranium Workers Oral History and Photography Project Newsletter. Fall: 1.

Das, Veena
1995 Critical Events: An Anthropological Perspective on Contemporary India. Dehli: Oxford University Press.

Di Chiro, Giovanna
1997 Local Actions, Global Visions: Remaking Environmental Expertise. Frontiers 18(2): 203-231.

Doyle, Henry N.
1950 Survey of Uranium Mines on Navajo Reservation, November 14-17, 1949, January 11-12, 1950. U.S. Public Health Service. Salt Lake City, memorandum.

Eichstaedt, Peter H.
1994 If You Poison Us: Uranium and Native Americans. Santa Fe: Red Crane Books.

Goffman, Erving
1963 Stigma: Notes on the Management of Spoiled Identity. Englewood Cliffs, NJ: Prentice Hall.

Heil, Donna.
1999 Concerns for Families of Uranium Miners. Navajo Uranium Workers Oral History and Photography Project Newsletter. Summer: 1.

Kingsolver, Barbara
1996 Holding the Line: Women in the Great Arizona Mine Strike of 1983. Ithaca: ILR Press.

Kuletz, Valerie
1998 The Tainted Desert: Environmental and Social Ruin in the American Southwest. New York: Routledge.

Levine, Adeline Gordon
1982 Love Canal: Science, Politics and People. Lexington, MA: Lexington Books.

Leyton, Elliot
1975 Dying Hard: The Ravages of Industrial Carnage. Toronto: McClelland and Stewart.

McElroy, Ann and Patricia Townsend
1996 Medical Anthropology in Ecological Perspective. Boulder: Westview Press.

Nader, Laura
1996 Naked Science: Anthropological Inquiry into Boundaries, Power, and Knowledge. New York: Routledge.

Navajo Uranium Miner Oral History and Photography Project
1997 Memories Come To Us In The Rain And The Wind: Oral Histories and Photographs of Navajo Uranium Miners and Their Families. Jamaica Plain, Massachusetts: Red Sun Press.

Nuclear Fuel
1983 EID Finds That Church Rock Dam Break Has Little or No Effect on Residents. Nuclear Fuel, March 14.

Odum, Eugene P.
1959 Fundamentals of Ecology. Philadelphia: W.B. Saunders.

Ou, Jay
1996 Native Americans and the Monitored Retrievable Storage Plan for Nuclear Waste: Late Capitalism, Negotiation, and Controlling Processes. Kroeber Anthropological Society Papers: Essays on Controlling Processes 80:32-107.

Pitman, Frank
1985 Navajos - UNC Settle Tailings Spill Lawsuits. Nuclear Fuel, April 22.

Ruta, Suzanne
1993 Fear and Silence in Los Alamos. The Nation, January 4 - 11.

Schrader-Frachette, K.S.
1993 Burying Uncertainty: Risk and the Case Against Geological Disposal of Nuclear Waste. Berkeley: University of California Press.

Shields, L. M., et al.
1992 Navajo Birth Outcomes in the Shiprock Uranium Mining Area. Health Physics 63(5): 542-551.

Silver, Ken
1996 The Yellowed Archives of Yellowcake. Public Health Reports 111:117.

Stephens, Sharon
1987 Chernobyl Fallout: A Hard Rain for the Sami. Cultural Survival Quarterly 11(2): 66-71.

Stoffle, Richard, et al.
1990 Native American Cultural Resource Studies at Yucca Mountain, Nevada. Ann Arbor: Institute for Social Research, University of Michigan.

Magazine of the Tufts University Medical Alumni Association
1998 Tufts Medicine. Winter 58(1).

Union Carbide Photonews
1956 Another Old Timer. Union Carbide Photonews, November/ December (29): 3.

United States Congress
1990 Radiation Exposure Compensation Act. Public Law 101-426. October 15. 101st Congress.

United States Environmental Protection Agency
1983 Potential Health and Environmental Hazards of Uranium Mine Wastes. Washington, DC: U.S. Government Printing Office.

United States Senate Subcommittee on Mineral Resources Development and Production. Committee on Energy and Natural Resources.
1990 Impacts of Past Uranium Mining Practices. Shiprock, NM, March 13. 101st Congress, 2nd Session.

Williams, Carol
1995 Nine Years Later, Chernobyl Toll Goes On. San Jose Mercury News, April 27. (Reprinted from the Los Angeles Times).

Wolf, Bernie MD. and Merril Eisenbud
1948 Medical Survey of Colorado Raw Materials Area. U.S. Atomic Energy Commission. Washington DC.