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Navajo Uranium Workers and the Effects of Occupational Illnesses: A Case Study

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Fifty-five Navajo uranium workers and residents from the Navajo Reservation in Arizona and New Mexico were interviewed in a community study to determine the psychosocial effects of uncompensated occupational illnesses. Summary findings indicate that psychological trauma, resulting from long-term occupational illnesses and environmental degradation, was as serious a repercussion as physical trauma from work-related exposures. The perceptions of Navajo workers, their families, and residents are presented with regard to the uranium mining and milling processes which occurred on the reservation between the 1940s and the 1980s. Because the workers and residents were never informed about the dangers of radiation, they were not able to make rational decisions regarding their health and employment; consequently, they felt a sense of betrayal by both the government and their employers. A reduction in the incidence of occupational illnesses and death among the Navajo may have occurred had prevention and detection been provided. Moreover, unique Navajo cultural beliefs and economic factors also impacted whether or not workers and families accessed health, legal, and social services.

Key words: Navajo, uranium, occupational disease/illness, miners, millworkers

THIS STUDY is a report on field research conducted on the Navajo Reservation involving Navajo uranium workers, their families, and residents living near uranium sources with uncompensated occupational illnesses. The research is based on field research methods that included participant observation and in-depth interviews with 55 Navajo households and 33 key informants conducted over a four-month period during 1989 in the areas of Tuba City and Blue Gap, Arizona, and Shiprock, New Mexico. The Navajo workers and their families, for the most part, lived in rural areas on the Navajo Reservation. Given high unemployment, limited incomes, lack of transportation and telephones, and limited other resources, the Navajo experience may be characterized as one of abject poverty, not unlike that of developing Third World nations. Underlying these difficulties is the potential for psychological trauma, resulting from long-term occupational illnesses and environmental degradation, considered as serious a repercussion as physical trauma from work-related exposures.

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The objectives of the research included determining the psychosocial and financial needs of the Navajo families with uncompensated occupational illnesses; identifying whether or not the families applied for workers' compensation and/or filed lawsuits; documenting whether or not the families had applied to entitlement programs; determining the extent to which the families' needs were met through entitlement programs other than workers' compensation; and understanding the day-to-day lifestyle of a Navajo family that had experienced occupational illness. The paper provides an overview of the research project, including the Navajo respondents' points of view and the researcher's participant observation perceptions.

The results of the study were to provide information to legislators and policymakers to address the compensation needs of occupational disease victims and their families. At the time the data were gathered, governmental response to compensation of radiation victims was negligible,[1] and public policy reform based on objective data was greatly needed (Kutchins 1981). The denied claims and cases of the Navajo uranium miners pose serious social policy questions for future claimants with radiation-induced occupational illnesses. The majority of these workers and their families were believed not to have been receiving workers' compensation, and because of their scant resources it was especially important to assess how their needs were being addressed. This study, then, was designed to help identify the utilization of entitlement programs, employment, and other supports by Navajo uranium workers and to assess the families' needs. In doing so, it was hoped that the findings would contribute to formulating a public social policy addressing this growing social problem.

Literature Review

The population of the Navajo Nation, numbering 165,065 in 1988, lives on a reservation rich in natural resources. In 1950 when the uranium boom began both on and off the reservation, there were 69,167 Navajo living on the reservation (Navajo Nation 1988). The Navajo lived in relative poverty and experienced high unemployment during the 1950s, and the opportunity for well paying jobs was an incentive to work in uranium mines and mills. Lack of employment then and today negatively impacts Navajo self-determination and leads them into poverty. Unemployment has resulted in 51,904 persons (49.7%) and 9,348 families (47.3%) in 1979 (the latest statistics available) living below the poverty level (Navajo Nation 1988). Of that group, 25.8% received food stamps, 38% of persons 15 and older received financial assistance, and 41.7% of those 16 and older were not in the labor force in 1979 (Navajo Nation 1988). Exact statistics on Navajo welfare recipients are unavailable, although an estimate derived from the sum of those receiving welfare from Arizona, New Mexico, and Utah in 1972 was 23,000 (Aberle 1983). Aberle (1983) also notes that the Bureau of Indian Affairs (BIA) issued assistance to approximately 30,000 people and that the tribe's emergency relief fund serviced 21,000 people.

With the recent increase in natural resource (especially energy-related) development on American Indian lands, the status of Indians is under renegotiation from "captive nations" to "internal colonies" (Snipp 1986a). Aberle defines the Navajo status as an internal colony stating:

> Since the Navajo Nation is not an overseas colony but is in the heart of the United States, it may be called an internal colony. Like many non-Indian populations, it is a dependent satellite of the centers of economic and political power in the country, and like other satellite populations, Navajos can vote in state and federal elections (and, as Navajos, in tribal elections). But it resembles other Indian satellite groups more than it does non-Indian satellites, in the degree of control the federal government maintains over the lives of the Navajos (1983:641).

Snipp (1986a) notes that research needs to be conducted to determine the extent of uneven development across reservations. It is also necessary to determine why some tribes choose to exploit their natural resource assets while other tribes do not. For the tribes who have chosen development, the conflict over developing their energy resources, particularly among the Navajo, is a serious one in which jobs are often pitted against the health of workers.

According to Ambler (1990), despite the fact that Indians own 30% of the coal west of the Mississippi, 37% of potential uranium resources, and 3% of the nation's known oil and gas reserves, these resources remained almost untouched in the late 1980s, even though resources owned by non-Indians in the same areas were extensively developed. During the 1970s, energy development failed to provide many jobs or income, resulting in 1975 in less than 5% of mineral development jobs for Navajo laborers (Ambler 1990).

All extraction of energy resources in Navajo country is operated by major US corporations through leases with the Navajo Tribe and approved by the Secretary of the Interior. Royalties to the Navajo Nation have fluctuated widely since the 1950s, and most of the income and benefits of energy development and consumption flow to the owners of the resources (Aberle 1983). Aberle (1983:651) notes:

> In sum, Navajos have no control over their nonrenewable energy resources; profits from extracting and processing them flow elsewhere and Tribal income from these resources goes to operate government and to supply welfare but not to develop the Navajo economy.

The Navajo were involved in uranium mining and milling during the uranium boom of the late 1940s through the 1970s when the United States government contracted with private industry to mine uranium for atomic bombs. There were approximately 2,500 mines opened throughout the Four Corners area (a region including Arizona, Colorado, New Mexico, and Utah), and Navajo men provided a ready source of labor for the industry (NIOSH 1971). One miner explained that this was the first time the Navajo could earn high salaries and, that as a result, jobs were in great demand. The exact number of Navajo men participating in the uranium industry is not known or available. A study by the National Institute for Occupational Safety and Health and the National Institute of Environmental Health Sciences studied 772 Native American uranium miners who had worked prior to 1964 (NIOSH 1971). A key informant, however, suggested that as many as 3,000 Navajo may have worked during this period.

Even though Navajo uranium workers received higher wages, there were significant health risks associated with the uranium industry. These workers often developed occupational illnesses. Studies indicate that there is a high correlation between exposure to uranium and lung cancer among Navajo uranium miners (Butler et al. 1986, Gottlieb and Husen 1982, NIOSH 1971, Roscoe and Mason 1984, Samet et al. 1984). Dr. Leon Gottlieb, a pulmonary specialist with the Santa Cruz County Health Services Agency, was the first physician to note an increase in lung disorders among Navajo uranium miners when he was a physician working at the Shiprock, New Mexico, Indian Health Service. He reported:

> Our studies in 1982 show that out of 17 Navajos that were being checked out for lung cancer, that 16 were uranium miners, and then in 1984, our study was supplemented by Dr. Samet of the University of New Mexico Medical School, who showed a study of 32 Navajos, that 23 had developed lung cancer. These were 32 Navajo miners, and 23 had developed lung cancer (United States Congress. Senate. 1990:146-147).

Miscarriages, birth defects, bone, reproductive and gastric cancers, and heart disease deaths have also been identified as related health effects of uranium mining (Churchill 1986, Gofman 1981, McLeod 1985). Dr. Joseph Wagoner, a health expert who followed health data on uranium miners since 1960 for the US Public Health Service, reported that from 1960 to 1974 there were 144 cancer deaths among 3,500 miners, 700 to 800 of whom were Navajo. Statistically, approximately 30 deaths would have been expected instead of the 144 which were discovered (Bergman 1982).

Workers' compensation and lawsuits have not proven to be sufficient mechanisms to address occupational health problems. Levy and Wegman (1988) reported that approximately 20,000,000 work-related injuries and 390,000 new work-related illnesses occur yearly in the United States. Moreover, approximately 100,000 work-related deaths occur per year, making occupational health a serious concern. According to a US Department of Labor study, only 3% of severely disabled workers of occupational diseases received workers' compensation. Because the United States workers' compensation system imposes medico-legal bar-

riers for the majority of occupational disease victims, (e.g., proof of causality of work-relatedness), a large percentage of workers rely on other federal or state programs for benefits (Shanker 1983). Ten times as many of these workers receive Social Security Disability Insurance (SSDI) or Early Retirement (ER) than workers' compensation (Shor 1980). It has not been determined whether reliance on SSDI and ER alone provides adequate coverage.

Lawsuits have also proven unsuccessful for Navajo uranium miners despite tremendously high death rates.[2] Their losses have been based on the inability to prove a causal relationship between exposure to uranium and disease, often involving a 20- to 30-year latency period. Moreover, workers need to file their compensation claims within one year of injury; consequently, many miners and their families have unknowingly waived filing both compensation claims and lawsuits, thereby relinquishing compensation and death benefits.

In addition to uranium mining hazards, seven uranium processing mills have operated on the reservation, and the Navajo people have been exposed to mine tailings, which are piles of debris leftover from the mining process. It has been estimated that the US government has left 22,000,000 tons of tailings at 24 locations in nine western states since the 1950s, and that 220 acres of tailings have contaminated the Four Corners region (McLeod 1985). It is likely that large portions of Navajo nonminers have had a significant amount of exposure to uranium ore and may be at an increased risk of disease.

Methodology

An in-depth community study was conducted in which participant observation and interviews were combined. The observations and interviews were made of 55 Navajo families and 33 key informants on the Navajo Reservation. Each household had at least one family member with an occupational illness related to the uranium mining and/or milling processes.

Participant observation provided the researcher with the opportunity to observe both the respondents' living situations and the community at large. The project was designed to enable the researcher the flexibility of pursuing "leads" that emerged during the course of the research. Interviews were considered important in that information derived from open-ended questions provided the researcher with more detailed and extensive information than a questionnaire alone would provide.

The study was qualitative and a random sample was not employed because no exhaustive sampling frame exists of Navajo uranium workers. Since 79.4% of all Navajo do not have telephones, a tremendous effort would have been required to gather this information (Navajo Nation 1988).

The principal investigator lived on the Navajo Reservation during 1989 for three months in Tuba City, AZ, and one month in Beclabito, NM. Contacts were established throughout the Tuba City, Blue Gap, and Shiprock areas with individuals and families. Interviews were conducted with uranium workers and residents of environmentally contaminated areas. Two Navajo interpreters were hired for the project because the cohort of Navajo uranium workers, for the most part, spoke little or no English. The researcher lived with the interpreters' families, which facilitated access and acceptance. A father of one of the interpreters had died of uranium-related respiratory illness and had been a uranium miner. Workers in the area knew and respected the family, which also eased acceptance of the researcher by the community. The establishment of these contacts was appropriate for this type of research where a major objective was to gain in-depth insights into the views of the study population toward aspects of uranium mining and milling.

In Tuba City and Blue Gap, the purposive sample was drawn from key informants in the area. A snowball effect was created when respondents provided the researcher with additional names of uranium workers. Among these key informants were Navajo environmental activists, physicians, attorneys, politicians, and community leaders. A purposive sample was also drawn from a list obtained by a Navajo key informant in the Shiprock area who had assisted Stewart Udall, the Secretary of the Interior during the Kennedy and Johnson administrations. Udall had filed lawsuits on behalf of uranium miners and downwind residents of atomic testing during the 1970s and 1980s. This purposive sample was then expanded by asking respondents if they could provide additional uranium workers' names, thus producing a snowball sample.

Fifty-five families were contacted eventually from the sampling frame—with eight families from Tuba City, nine families from Blue Gap, and 38 families from the Shiprock area. The latter area included households within a 30–50 mile radius of Shiprock. Interviewing the families required significant effort for a number of reasons. Of the 55 households contacted, only five had telephones, so that the researcher drove to the family's home to make an initial contact, and then made repeated efforts to finalize an interview. Moreover, addresses were often for the sheepherding families' winter homes or summer sheepcamps. Therefore, the researcher needed to locate the family at their several homes, which were often at great distances from each other via dirt roads.

During the design phase of the project, the researcher intended to interview only those workers who had documented occupational diseases. However, reservation residents indicated that there might be uranium workers who had illnesses that had not been reported because they did not understand their illnesses to be work-related, and therefore did not apply for benefits or engage in lawsuits. Therefore, it was decided to interview both groups. Respondents included miners, millworkers, and uranium workers' widows. Because the cohort of uranium workers was composed largely of traditional Navajo, it was possible that some of the workers believed their illnesses to be caused either by natural phenomena or witchcraft. In addition, it was explained to the researcher that, due to rural isolation, there were possibly hundreds of Navajo uranium workers on the reservation who were unaware of the litigation process involving the miners.

Because of a lack of record-keeping and sporadic and/or transient employment, many of the household members did not have information related to financial issues. They did not remember specific dates and names in terms of working periods, uranium companies, social service benefits, and other significant health and legal information which, in some cases, went back to the 1940s. An attempt, however, was made to construct an accurate occupational and social information history within the constraints of the interview format.

The one- to two-hour interview schedule was administered in person with both the translator and the researcher. It included

both closed- and open-ended questions related to occupational history, environmental history, entitlement programs contacted, benefits received, financial data, and personal background information. The interview schedule also identified families who had filed claims with the workers' compensation system, families who decided against filing claims, and families who were unaware of the claims process in addition to those families who had filed lawsuits. Key informant interviews were unstandardized so that the topic area could be explored with the respondent. A participant observation journal also was kept.

Findings

Overall, the mean age of the respondents was 60 years, ranging from 47 to 89 years. Thirty respondents were married, 24 were widowed, and one was single. The mean number of 321 children was six for each household. The average educational level was fifth grade, with 24 respondents having no formal education and two respondents having attained a tenth grade education, the highest reported.

WORK HISTORIES. All the miners and millworkers worked in the uranium mines and mills from the mid-1940s through the early 1980s. The respondents indicated that the workers worked full time, working regular hours and often overtime to supplement their salaries. There were 41 miners, five millworkers, and two workers who had worked in both the mines and the mills, primarily in drilling and manual labor positions. The workers worked an average of 12 years at the sites, ranging from four months to 40 years. The average miner worked at four sites during his career; however, some workers worked at more sites than others, with three miners reporting that they had worked at over 20 different sites. Forty-six (83.6%) households had lived in the area all their lives, although many of the workers were transient during their working years at the mines. The companies would employ the workers until the particular job was finished and then the workers would travel to the next job site. One mineworker indicated that he had probably worked at over 25 sites during his career. Many respondents reported that they took pride in their labor because they believed they were contributing to the security of the United States.

WORKPLACE CONDITIONS. The respondents agreed in their descriptions of the working conditions of the era from the 1940s through the 1970s, prior to the creation of the Mine, Safety, and Health Administration in 1969. Several problems were identified, including the lack of engineering controls (e.g., mine ventilation), personal protective equipment, and worker safety education and training. All the workers reported that at no time during their employment were they informed of the dangers of radiation, nor were they informed of their rights under state workers' compensation laws when they became ill. The respondents also indicated that the workers were not even aware that radiation existed because there was no word in the Navajo vocabulary for it. The workers spoke little or no English, and believed the uranium companies had their best interest in mind. They therefore did not question health and safety practices related to uranium. One Navajo work supervisor, who spoke at a reservation chapter meeting, said he had been trained for his role of foreman at one of the mining companies. He was informed explicitly about the dangers of radiation, but was told specifically not to inform the workers under his supervision that they were in danger.

In terms of general safety instruction and training, only eight workers reported they were provided with some form of safety instruction. But typically there were no safety signs and little formal instruction in general safety, such as how to handle dynamite. In fact, unsafe practices, such as caching or storing dynamite, were common. None of the workers wore dosimeters (radiation measuring badges) or safety equipment until 1969. They also wore their uranium dust-covered clothing home to be washed with the family laundry. After 1969, two workers reported an increase in worker safety and health practices, including the wearing of face masks and earplugs. They also reported that for the first time they were required to leave their workclothes at the worksite.

Fifteen workers (34.8%) indicated that they were given physical examinations while on the job, although 27 were not. During the 1950s the US Public Health Service (USPHS) regularly monitored the uranium miners in an epidemiological study to determine the health effects of radiation. In exchange for the mining company's list of miners' names, however, the USPHS agreed not to divulge the potential health hazards to the workers while they were monitoring their health, nor to inform those who became ill that their illnesses were radiation-related.[3] These workers indicated that they are now aware of the USPHS study and feel betrayed by the cover-up by the Atomic Energy Commission (AEC) and the USPHS. They also felt betrayed by their employers and indicated that, had they known about the dangers in the workplace, they would have chosen either not to work there or to have taken safety precautions. When asked if they would support a uranium mine in their area today, 41 (95.3%) responded they would not support it; three said they would do so if it were safe; two were unsure; and one said he would support it if people were compensated.

Ultimate responsibility for the health and safety of the Navajo uranium miners belonged to the United States government, particularly the AEC and the USPHS. Today various agencies maintain responsibilities toward the health of the Navajo people, including the Bureau of Indian Affairs, the Indian Health Service of the United States Public Health Service, the Navajo Environmental Protection Administration, and state agencies from Arizona, Colorado, New Mexico, and Utah, including the departments of health and workers' compensation. The government has claimed that insufficient knowledge was available to guard the health of workers. Dr. Gottlieb stated:

> . . . and I want to refute the statement that the state of the art in the forties and fifties was such that there was not sufficient knowledge to implement mechanical ventilation and the knowledge of radiation hazards.
>
> Well, this was certainly proven to be false, because we know that in the 15th century and in the 17th century, books were written about mining, and even ex-President Herbert Hoover translated a book on mining, which was written in the 16th century.
>
> So we have all these experiences, and then the European experience, in which miners in the central European part of the country were exposed to uranium ores during the process of mining, and many of them became sick. In fact, it was called a German word, known as "bergkrankheit," which meant mountain sickness, and many of them came down with it, which was later proven, in 1897, to be cancer of the lung (United States Congress. Senate. 1990:146).

Several miners explained that they were forced to enter the

mines directly after blasting, when the mine was filled with smoke and dust. White workers were not forced to do so according to the respondents. All the workers said the mines were largely unventilated, that drinking water was collected from inside the mines, and that they often ate their lunches with unwashed hands inside the mines. Air and water testing results, when collected, were never reported to the workers, and so they believed the workplaces to be safe. Forty-two of the workers (97.6%) wore their dirty workclothes home for their spouses to wash with the family laundry. Some of the spouses who washed the family clothing said that they had rashes after finishing the laundry.

Prior to the uranium boom, the respondents were largely agricultural workers and either earned subsistence wages or bartered within the local economy. During their mining employment, they were largely transient in terms of work histories, working a range of three to 25 different worksites located in the Four Corners area. They worked until the mines closed or their health failed. Many reported that, when the company learned that they were ill following a health examination, they were fired without notice, severance pay, or sick pay benefits. They were not encouraged to apply for unemployment compensation or workers' compensation. None of the workers were union members.

The miners' families often traveled with them and lived in housing established for them directly on the sites. Both the miners and millworkers reported that they used water from the area for drinking, bathing, washing, and household uses. They mentioned repeatedly that their children played on the tailings and minewastes from the worksites, even using the mines as their play areas. The workers either lived in tents, makeshift homes, or company-built housing. Their livestock grazed in these areas, drinking the water and huddling in abandoned mines during the winter months for warmth.

The seven millworkers lived in the Tuba City area and worked in the plant for an average of three years. Unlike the uranium miners who traveled to various mines to remove the uranium ore, the millworkers worked primarily at the milling plant where they barehandedly milled unprocessed uranium ore into uranium oxides, or yellowcake. They wore the same workclothes repeatedly, often yellow with yellowcake, until taken home to be washed. In Tuba City, the millworkers' homes at the site were recently demolished because the foundations had been built with radioactive mill tailings. No lawsuits were filed on behalf of the millworkers because of a lack of conclusive studies relating the millworking process to health related problems. Respondents, however, believe rates for cancer and other illnesses (e.g., kidney problems) to be high and that they are work-related.

In addition to the 35 miners and millworkers who were interviewed about their working conditions, an additional 15 widows (of 13 miners and two millworkers) were interviewed. They were asked identical questions about their spouses' working conditions. Table 1 summarizes some of the working conditions experienced by the miners and millworkers.

Thus far the discussion has centered around work risks and hazards. There are also larger environmental problems related to such things as mine tailings and contaminated homes. For example, the Blue Gap area is located next to open-pit uranium mines which currently are not being reclaimed under the DOE abatement plans. Residents reported that their children played in the tailings and ponds, and that the ponds and open mines were considered a constant threat to the residents and their families. Residents reported what they believed to be a high rate

TABLE 1. Uranium Workers' Workplace Conditions

Conditions	Miners $n = 43$ n (%)	Millers $n = 7$ n (%)	Total $n = 50$ n (%)
Never informed of radiation hazards	43 (100.0)	7 (100.0)	50 (100.0)
Never informed of rights to benefits	43 (100.0)	7 (100.0)	50 (100.0)
No personal knowledge about radiation	43 (100.0)	7 (100.0)	50 (100.0)
Provided safety instruction	8 (18.6)	4 (57.1)	12 (24.0)
No personal protective equipment provided before 1970	43 (100.0)	7 (100.0)	50 (100.0)
Laundered dust-covered clothing at home	42 (97.6)	6 (85.7)	48 (96.0)
Provided physicals	15 (34.8)	5 (71.4)	20 (40.0)
Worked in unventilated mines	43 (100.0)	Not applicable	43 (100.0)
Handled yellowcake without personal protective equipment	Not applicable	7 (100.0)	7 (100.0)

of birth defects, cancers, and other illnesses in their communities. When the researcher spoke with a DOE official about the residents' concerns, he said there were no abatement plans because the area was not considered to be a serious threat. One woman explained, "We the Navajo People here would like for someone to assist us with the right information so we can get some help."

One Blue Gap resident reported that her husband died of blood cancer. "My husband grown up where there is now abandoned mine. There used to be a water pond up in the mountains right at the area where the abandoned [mine] is. That's where the folks used to get the water for drinking and several other places too. So I think that's how he gotten into the radiation." Another family reported birth defects stating, "My sister gave a birth to four children that were not normal—two kids died . . . and two are disabled now. One on wheelchair and the other one is on crutches. And my mother died of a blood disease." Another resident reported how she used to place carnotite uranium rocks on her windowsills because she thought they were "pretty." She also used to "bake" them in her oven to see if they would change color. She was concerned that her family and her house were contaminated as a result.

Psychosocial Responses to Illness

Traditional Navajo believe that lightning and other natural phenomena can cause illness. The traditionalists did not always clearly understand the PHS physicians' diagnoses, and frequently referred to their illnesses simply as "chest problems." They were told, in many cases, that their illnesses were caused by radiation. One worker, however, was informed by a physician that his illness was radiation-related while another physician told him that it was not, leading to anxiety for the respondent. Another worker explained, for example, that he had "radiation

around the heart." Other respondents reported that unless they were diagnosed as having a work-related illness, they could not qualify for social service benefits.

The following table identifies workers' illnesses as reported by the respondents. Seventeen workers reported hearing loss in addition to the three main categories of lung cancer, other cancers, and chronic lung diseases. All of the respondents believed the illnesses to be radiation-related.

Respondents also reported illnesses for their family members that were also believed to be radiation-related. Table 3 includes all family-identified illnesses as perceived by respondents.

The information collected does not reflect collateral relationships, but only first and second lineal relationships. Given the exploratory nature of this study, the health information collected concerning family illnesses only reflects perceived radiation-related problems. An epidemiologic study would be needed to understand the full extent and etiology of described illnesses.

Respondents repeatedly related stories concerning the relationship between the mining and milling activities, which they believed were related to family illnesses and deaths. One worker's wife explained that her daughter had a spongelike material on her body before her death. The woman believed it was related to the daughter's playing on the mine tailings near their home when she was a child. Another daughter "got some stuff, boards, things that they hauled from down below [at the millsite]. She was diagnosed with cancer inside of her but we had a ceremony on her. After that she's not really complaining. I don't know if she got all right or not." A recurring theme among respondents was that they were fearful the radiation could result in illness at any time. This factor led to stress and fear among the respondents as well as a sense of a loss of control.

In general, all health services for the Navajo respondents were paid for by the Public Health Service (PHS). Fifty-three of the respondents believed their illnesses and their families' illnesses were radiation-related after seeking health care, and 43 initially believed that their illnesses were work-related. Families reported they were responsible financially only for funeral expenses and visits to medicine men and women on the reservation. Forty-seven respondents reported that they went to the PHS for treatment and that all of their expenses were paid. Twenty-nine of these people indicated they also contacted medicine men or women for their illnesses. Those who did seek traditional treatment were treated with herbs and ceremonies and were responsible solely for payment. One miner/millworker reported that he had been diagnosed with lung cancer from uranium mining 12 years ago by the PHS and had been given six months to live. He refused to return to the hospital and was treated by a Navajo medicine woman, who is acknowledged for her successful treatment of cancer patients; today he is free from any cancer. When he returned to the PHS 12 years later, the physicians were shocked that he had not succumbed to the illness.

TABLE 2. Worker-Identified Illnesses*

Illnesses	$n = 50$ n (%)
Lung cancer	12 (24)
Other cancers	5 (10)
Chronic lung diseases (pulmonary fibrosis, bronchitis, obstructive lung disease, silicosis)	33 (66)

* In addition to the major illnesses listed above, 17 workers (34%) also indicated that they had hearing loss resulting from dynamite blasting at the worksite.

TABLE 3. Family-Identified* Illnesses as Perceived by Respondents

Illnesses	$n = 55$ n (%)
Birth defects	13 (23.6)
Lung cancer	3 (5.4)
Other cancers	19 (34.5)
Eye disorders	4 (7.2)
Miscarriages	2 (3.6)
Other diseases	25 (45.4)

* Family members include 53 spouses and 321 children.

Throughout the interviews, the lack of basic social service benefits and knowledge of how to gain access to social and legal services were evident. Only 12 of the respondents had filed lawsuits, and only 11 had filed workers' compensation claims. Because the Radiation Exposure Compensation Act was pending, many of the workers wanted to be interviewed by the researcher to determine if they would be eligible for compensation. Forty-five respondents believed the company was responsible for compensating the family, while ten either were unsure or did not know who was responsible. Prior to their illnesses, 41 families reported that at no time had they received government assistance and/or social services. After their health problems were diagnosed, 27 reported receiving some form of governmental or social assistance.

Most of the families interviewed live in rural, remote areas, and often lacked transportation or the financial means to buy gasoline; they relied on relatives to assist them. Many respondents found the social service and legal systems too complicated with bureaucratic entanglements, and so did not access them at all, or gave up on them during the process. One respondent could not keep up with ongoing appointments to qualify for disability because she did not have transportation; she consequently discontinued her visits. One widow, whose husband had been deceased for a year, received no Social Security benefits. Having no income at all, she was asked how she survives. She said that she depends on her children. For the families who had received social service benefits, the payment was often sporadic. Either respondents could not remember what form of benefit they received or they could not remember specific amounts and numbers of payments. Of the 22 individuals eligible for Social Security, for example, only five respondents reported receiving this entitlement, averaging $407 a month. One worker reported that he was nervous and stressed because he could not meet his monthly utility bills. Another worker reported that he is on medication for "a nervous condition" because of all that had happened to him. Many others reported having outstanding attorney fees and loan payments. Widows and wives often reported that they had their jewelry and other goods in pawn to pay for funeral expenses and other costs.

One widow, when asked why she did not file for benefits, explained that she felt intimidated by the process because of being told she had to write letters. She had no stationery or stamps

and could not write in English, and so decided against it. Thirty-nine respondents had not entered claims for workers' compensation, saying that they did not know or think they were eligible. A statute of limitation of one year exists for workers' compensation in many states, and workers often did not meet the deadline. While some respondents were dependent on their children for assistance, others relied on spouses' minimum wage employment and indicated they were barely able to survive. The average yearly income was $3,000. One woman explained she eats only enough food to live. Resources also became strained when the family took care of the sick worker in the home. Older children, for the most part, did not live in the workers' households.

The 15 widows explained repeatedly how painful it is for them to hold the family together without their husbands. Ten widows were interviewed from the Cove, AZ, area which is directly beneath many uranium mines situated at the top of the mesa/mountain. This area is well known for the high number of uranium miners' widows. The widows indicated concern about the health of their families, but were equally disturbed about their land and livestock, since their water supply originates from the springs on top of the mountain. Unlike Anglo culture in which transience is an accepted fact of life, the Navajo are a people who live in clans and who are tied to the land. It is unusual for a Navajo family to relocate to another chapter area, thereby leaving the rest of the clan. A family would not consider leaving the clan and the chapter because they provide both emotional and material support. In the case of the Navajo, relocation because of environmental contamination would be devastating and is not seen as a viable alternative.

In addition to the psychosocial impacts of death or illness, the workers also report a sense of betrayal by the government and mine owners for placing them in an unsafe workplace. Several people related to me that they now question the government's commitment to the welfare of its citizens. Many of the Navajo stated that, had they known of the potential health and environmental risks, they would not have undertaken employment that posed these risks both to themselves and to their families. One worker, who was suffering from cancer of the mouth and whose wife had already died of cancer, was relocated by the government three times because his hogan and subsequent two government-built homes were constructed from radioactive materials. A widow lived next to the rubble of her hogan and bread oven which she said were built of radioactive materials. She wondered if it was safe to have the rubble in her yard. Other people worried about the contamination of their water and air. In general, most of the people were concerned for their children, themselves, their livestock, and their buildings and land. The stress of living in a potentially unsafe environment is evident among many of the families.

Respondents reported that they were worried, concerned, and fearful of living in an area where the landscape is littered with minewaste. In many areas the minewaste flows directly into the washes surrounding peoples' homes, livestock, and land.[4] Yet open pit mines and dog holes (below the surface uranium mines) abound in the area and pose hazardous threats to residents. Children often play in the abandoned mines and livestock live in the mines during the winter. Parents also worried that their children will fall into the unprotected dog holes. The mines had been cordoned off from the public originally by the DOE with fences; however, local residents took the fencing material for their own use. Living with a constant threat of contamination was mentioned repeatedly by respondents. One Navajo elder explained:

> We, the elderlies, that resides around here don't know what was good and worst about the uranium. There were several death in this area that was affected by radiation or cancers. We need help. I lost my wife last year [to cancer] and now I am 87 years. My wife would have been 70 years old which made a lot of difference. I am lonely and can't get anywhere without her help. I was hurted and miserable.

Discussion

The purpose of this study was to document, in the tradition of social field investigation, the Navajo uranium workers' and residents' stories from their perspectives. What emerged was a unique worldview and cosmology distinctive of the Navajo and particularly of this cohort of older traditional people.

Initially, because the Navajo could not relate radiation to anything within their experiences, it was difficult for them to understand that their illnesses could be radiation and work-related. Dr. Leon Gottlieb (Gottlieb and Husen 1982) documented the Navajo's cases during the late 1970s, reporting to the medical community that the Navajo workers' lung cancers were work-related. Stewart Udall then pursued litigation in the name of 200 Navajo uranium miners in an attempt to provide redress for the workers. The Navajo also formed support groups (e.g., the Uranium Radiation Victims' Committee), and became active in organizing around the uranium issue. Despite all of this activity, not all the workers were informed.

Given that the Navajo were not notified of the inherent risks, the residents did not have the environmental clues or knowledge to deal effectively with the situation. For instance, the Navajo have a low incidence of cigarette smoking; consequently, when they did develop lung cancer or other respiratory problems, they could rule out smoking as a cause. Since they did not know of the connection between radiation exposure and lung cancer, however, they were not likely to probe for occupational and environmental causes. If the respondents had known about the health factors and causes, they could have accessed healthcare early on and made knowledgeable decisions with regard to the nuclear technology.

Levy, Neutra, and Parker (1987) reported in their study of seizure disorders of the Navajo that cultural beliefs with regard to certain illnesses associated with taboos may prevent individuals from accessing modern health care for fear of social isolation and stigma. In addition, the patient may believe that she/he has been a victim of witchcraft or natural phenomena. A knowledgeable source also explained that by talking about the illness, an individual could create a host environment for it or exacerbate an already existing condition. Moreover, the Navajo did not understand the environmental implications of uranium processes on their land. Many of the respondents said that, had they been informed fully about the likelihood of contamination, they would not have allowed it to occur.

In addition, because the Navajo are a clan-based matri-tenure culture, it is unusual for families or cluster/residence groups to relocate despite possible contamination. Other constraints, including the high Navajo birthrate, restriction of land base, and lack of access to land, water, and grazing permits have also impacted the Navajo in terms of relocation. Overall, however, the Navajo concept of relocation differs from that of Anglo culture,

even in the face of community environmental contamination because the consequences, such as losing one's birthright to the Navajo land, greatly impact the Navajo individual and clan (Scudder 1982). Scudder (1982:33) notes:

> Loss of land through relocation deprives the Navajos of their birthright, their livelihood, their proper social relationships, and their familiar and beloved surroundings. It also deprives them of significant places where they can make religious offerings to maintain the correct relationship with the supernatural. Indeed, it upsets the order of nature itself.

One respondent reported that medicine men and women have warned that the land is not to be disturbed. If it does occur, then terrible illnesses will result. It is possible that some people believe the "strange illnesses," such as lung cancer and birth defects, are caused by this disturbance and may be seen as retribution. One woman informed me that her grandfather was a medicine man who had told her he envisioned many catastrophes associated with nuclear development on the reservation. While these beliefs may seem strange to the Anglo mind, they are a recognized valid belief system for many Navajo and may affect their behavior in terms of accessing social, legal, and health services.

For the Navajo, the overall psychological impact of the uranium mining and resulting health and environmental problems has been great. They view themselves and their world as an interconnected whole involving religion, concepts of health, and their relationship to the world. A disruption in one part of their lives, be it their health or the land, therefore creates an imbalance or disharmony on the overall system. The disruption, then, causes stress not only because of the immediate problem to the individual but because it threatens the disruption of the Navajo fabric of life and wholeness.

The Navajo worked in the nuclear industry for the defense of the United States, working in good faith and believing their lives were not endangered. The government failed in its responsibility, then, to ensure the safety of their work as well as other groups, including the "downwind" residents (citizens who lived downwind from atomic testing), and Micronesians and Army GIs who witnessed atomic testing. As citizens, all their lives were put at risk in an era of government secrecy. In the case of the Navajo workers, the disregard for worker health and safety was blatant and intentional, as evidenced by the 1950s USPHS study. It is also similar to other groups of workers in terms of compensation, e.g., coal miners, asbestos workers, and radium dial painters.

Overall, the government failed to meet its legal and moral obligations to these uranium workers in three ways. First, the government was negligent by not informing the workers of the inherent health risks of uranium mining; second, the government failed to provide compensation to the workers and their families for the deaths and illnesses of the uranium workers; and third, the ecological damage created by the uranium mining and milling processes was not addressed for an extended period of time creating further health hazards. Had full disclosure been given to the Navajo workers, their families, and residents, rational decisions regarding their health and employment could have been determined by the respondents.

NOTES

[1] This study was conducted in 1989 prior to the signing of the 1990 Radiation Exposure Compensation Act, providing compassionate payment for the Navajo uranium miners and the atomic downwind residents.

[2] See Begay et al., vs. The Kerr-McGee Corporation et al. 499 F. Supp. 1325, 13 May 1980; Begay et al., vs. The Kerr-McGee Corporation et al., 499 F. Supp. 1317, 1 October 1980; UNC Resources, Inc. et al., vs. Benally et al., 518 F. Supp. 1046, 16 July 1981; Begay et al., vs. United States of America and Anderson et al., vs. United States of America, 591 F. Supp. 991 10 July 1984.

[3] See John Begay vs. US of America. 591 F. Supp. 991. District Court of Arizona. 16 May 1985. No. 84-2462 Court Document. Included within the Court Document is reference to the "Formal Request to Surgeon General by the Colorado Division of Health Advisory Board and the Colorado Bureau of Mines" prepared and formally submitted 30 August 1949. Washington, DC: USGPO. DEF.EX (Defendant's Exhibit) 482, PPI-2:TR.1894-1925:PL.EX.115, PPI00, 171, 318: DEF.EX.3306: PL.EX3:3. Trial Order, STIP.31.

[4] The Department of Energy's (DOE) Abandoned Mine Lands Reclamation program is engaged currently in mine abatement.

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