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Communication of Toxic Health Information:

Arsenic in Milltown, Montana

by

Nancy L. Heil

B.A./B.S., University of Texas, 1979

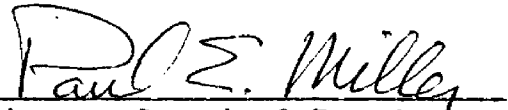
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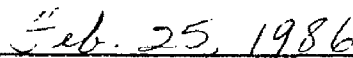
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Environmental Studies

Communication of Toxic Health Information: Arsenic in Milltown,
Montana

Director: Dr. Paul Miller

Summary

This exploratory study examines communication of health information to Milltown, Montana, a community with arsenic contaminated drinking water. In 1981 routine tests revealed the contamination of four wells serving 33 families and in 1982 the Environmental Protection Agency declared Milltown a "Superfund" site. Government agencies, the media, and citizen's groups presented information about the health effects of arsenic exposure.

To explore the effectiveness of this communication, I interviewed involved parties, surveyed the affected residents, and reviewed media coverage. Problems were observed in three areas. The first was with the nature of the health information itself. Arsenic information was hard to find, interpret, and apply to the Milltown situation. Second, communication was not always coordinated either within or between groups. Third, the varied perceptions of the arsenic hazard colored the communication. As a result, the health information presented was sometimes incomplete or conflicting.

The residents understand and perceive their possible health risks based on the clarity and credibility of information. They also weigh health risks with other personal and economic concerns. Responsive, responsible communication of toxic information depends on not only understanding technical findings, but also the perceptions of the affected public.

Montanans continue to face risks from toxic contamination, especially from heavy metals. The State can encourage effective communication with the public by clearly defining its policies, coordinating communication efforts, and compiling known data on the health effects of heavy metal exposure. A designated toxics coordinator at the Department of Health and Environmental Sciences would ensure this commitment to public health.

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I. Introduction to Toxics

Toxic chemicals pervade our environment, contaminating air, water, soil, and food. Chemicals threaten to contaminate the water supplies of half the nation's population.¹ We may have to spend 100 billion dollars over the next 50 years to clean up some 10,000 hazardous waste sites.²

An increasingly aware public has demanded action. Legislators have responded with acts controlling manufacture and disposal of hazardous chemicals (RCRA 1974 and TSCA 1976). The Comprehensive Emergency Response Compensation and Liability Act (CERCLA) of 1980 created a 1.6 billion dollar "Superfund" to clean up uncontrolled waste sites.

Montana is not immune to toxic contamination--particularly by heavy metals. Residues from 100 years of mining and smelting have polluted the state's natural resources, especially along the Clark Fork River and its tributaries.³ Montanans may be directly or indirectly exposed to heavy metals through air, water, or soil. According to a National Center for Disease Control (CDC) study, children living downwind from the Anaconda smelter have significantly elevated urinary arsenic levels.⁴ And in autumn 1984 the state warned hunters of possible arsenic contamination of deer and elk near Thompson Falls.⁵ Heavy metals are the contaminants at four of Montana's eight proposed Superfund sites-- Silver Bow Creek, East Helena, Anaconda, and Milltown.

Toxic substances pose health risks to the public. Residents of affected communities have a right and need to understand these risks.

Public health officials, responsible for communicating, try to ensure available and understandable information. However, scientific data relating to health effects may be non-existent or indeterminate. Officials, sometimes unable to make definitive statements, may remain silent or present conflicting information. Other sources such as the media also inform the public, from vantage points often different from agencies'. The same technical data can be placed in very different contexts depending on the goals and perceptions of the communicators. Conflicting information or confused communication may leave the public with only a muddled idea of the appropriate level of concern.

At Milltown, Montana, a Superfund site, arsenic contaminated four wells used for drinking water by 33 families. Health information filtered to the residents from several sources--state and local health departments, the Environmental Protection Agency (EPA), citizen's groups, the media, and the community itself. How effective was the communication? How can public agencies better respond to the public's information needs?

This professional paper examines the communication of health information about toxics to Milltown, identifies problems, and suggests some solutions. The conclusions are based on a review of media coverage, interviews with involved parties, a survey of the residents, the experience of some other communities, and background literature. My observations as community relations liaison between the Missoula City-County Health Department and Milltown also provided data.

This exploratory study gathers information, but does not test a

preconceived hypothesis. Nor is this an analysis of the entire Superfund action. I remove health issues from the larger context of communication. I also recognize that accuracy of technical information is difficult to gauge and that perception of health risk rests on more than scientific data. Given these limits, the analysis proceeds. Part II presents the Milltown site history and background on arsenic and health. Part III establishes what information was presented by whom and describes problems gathering and disseminating information. Part IV examines residents' understanding and response to this presentation. Part V analyzes the communication problems. Part VI presents some risk communication theory. Finally Part VII draws conclusions and makes recommendations.

II. Site History and Background

The first section describes the history of Milltown's arsenic problem and efforts to solve it, setting the political and social stage on which communicators had to work. The second section summarizes arsenic's effect on human health, demonstrating the problems the information caused communicators.

History of Site

Milltown, Montana, about five miles east of Missoula, lies at the junction of the Clark Fork and Blackfoot Rivers, just east of Milltown Dam. The dam, built for hydropower in 1906 and still operating today, formed Milltown Reservoir. Sediments behind the dam contain metal residues from mining activities along the Clark Fork River and its tributaries.

Milltown lies adjacent to Champion Timberlands' lumber mill. Until 1983 Champion owned all of the Milltown land. Residents of Milltown operate and maintain the community wells providing their drinking water. Four of these wells, serving 33 residences, are contaminated with arsenic. The area had water problems prior to the arsenic discovery: iron and manganese had been present for years at "nuisance" levels. Some residents, reporting foul odor and mineral deposits, had already stopped using the water prior to the arsenic discovery.

The Montana Department of Health and Environmental Sciences tests community water supplies for chemical contamination twice a year. Under state law, a public water system serves 10 or more households or

25 or more residents. Until 1981 the Department was not aware that Milltown's First Street well was considered public. On contract from the State, the Missoula City-County Health Department sampled this well; test results showed elevated arsenic levels in May 1981. Second and third samples confirmed this and in August the State Water Quality Bureau advised the resident operator to warn the other users.

In October the County sampled other Milltown wells and discovered three more to be contaminated with arsenic. In December the County advised the residents not to drink the water. Most residents began to haul their water from other sources.

In May 1982, still without safe drinking water, the affected households joined together forming the Milltown Water Users' Association. In September representatives of Montana People's Action, a local citizen's advocacy group, began organizing Milltown residents, exploring funding options and demanding action from government officials. Milltown resident Melody Fuchs emerged as a community leader. Later in the fall, the arsenic problem became a political issue. Both state house representative candidates Bob Ream and Merle Copenhaver requested meetings with the county commissioners and forums to identify resources for corrective action.

Residents and local officials also began lobbying the Environmental Protection Agency to declare Milltown a Superfund priority. After evaluating and ranking sites based on potential threats to populations and the environment, the EPA included Milltown on its National Priorities List in December 1982. In March 1983 the Montana legislature passed state legislator Bob Ream's

"mini-Superfund" bill to provide the state's required 10% matching funds. Under Superfund the clean-up process requires a series of steps--initial planning, remedial investigation, feasibility study, selection of remedy, and remedial design and construction. At Milltown EPA had to both provide safe drinking water and address the contamination source. In a cooperative agreement, EPA shares the role of lead agency with the Solid Waste Bureau of the Montana Department of Health and Environmental Sciences. An advisory committee was formed with representatives from the State and City-County Health Departments, EPA, Milltown, University of Montana, Champion, and Montana Power Company.

University of Montana geologists Drs. William Woessner and Johnnie Moore began a reconnaissance survey to look for possible arsenic sources in early 1982. Another hydrogeologic study was contracted to identify the source and propose remedial action. After analyzing sediments and groundwater for concentrations of arsenic, manganese, copper, zinc, lead, and cadmium, the study concluded that heavy metals in sediments behind Milltown Dam contaminated the groundwater.⁶ Only arsenic presented a health hazard in the drinking water. A new well was proposed on Champion land adjacent to one of its wells. An engineering firm evaluated the costs of four other alternatives including connection with Missoula's water, new surface water supply, water treatment, and buyout and relocation of residents.⁷ The advisory committee met and concurred with the recommendation that a new well be dug. The residents approved the plan in early 1984.

In July 1984 bacterial contamination of one of Champion's wells raised concerns about the new system and the entire aquifer. After repeated delays contractors drilled the new well in fall of 1984, but frozen ground prevented laying and connecting the pipes. Water finally flowed from the new system in early May 1985. The relief and celebration were short-lived however; arsenic residues remained in the houses' existing plumbing and hot water tanks. Replacement work continued through fall 1985.

The process of finding and constructing a clean water source was plagued by delays, in spite of political pressure to move rapidly. Waits for study results, release of funding, and agency approval slowed the process. The Water Users' Association also had to work out the legal requirements for ownership and maintenance of the new well. Contaminated drinking water was not the only arsenic concern. In July 1983 analyses revealed arsenic contamination of Milltown garden vegetables. The new system does not solve the arsenic problem; the EPA is currently studying what to do about the source of the contamination, the tons of sediment behind the dam.

Meanwhile concern over heavy metal contamination in Montana has continued to grow. Citizens have organized around this issue. In January 1984 Lois Gibbs, the community leader at New York's Love Canal hazardous waste site, presented a lecture and workshop in Missoula on organizing against toxic waste.

Within this miasma of legal, political, and scientific entanglements lay the issue of the residents' health. And within this context communicating the possible health risks from the arsenic

contamination was not easy.

Arsenic and Health

The following review, though not exhaustive, describes some areas where data on health effects of arsenic exposure are lacking or inconclusive. These uncertainties cause problems for both regulators and communicators. Arsenic's effects on human health are not clearly defined. Its toxicity depends on the chemical species, route, rate, and duration of exposure.⁸ Further, although acute arsenic toxicity is well documented, the long-term effects of lower exposure levels are less clear.

Arsenic occurs naturally in the environment in minerals, the soil, water, and all living organisms. Some areas have naturally high levels of arsenic in the groundwater. These can be places with thermal activity, arsenic-containing rocks, or water with high levels of dissolved salts.⁹ The drinking water of Three Forks Montana periodically contains naturally elevated arsenic levels.

Human use of arsenic compounds has greatly increased local concentrations. People have used arsenic for centuries as a medicinal agent, pesticide, and poison.¹⁰ Smelting and refining of metals, as occurred in Anaconda and East Helena, release arsenic from the ore.

Arsenic compounds vary in their toxicities, the trivalent (+3) arsenites being more toxic than the pentavalent (+5) arsenates. Trivalent forms can be oxidized biologically to the pentavalent forms, but the reverse reaction may also occur.¹¹ The chemical species of arsenic remaining in the environment has been an issue in at least one

legal suit against a hazardous waste dumper.¹²

Arsenic can be inhaled, ingested, or absorbed through the skin. Acute arsenic poisoning, usually occurring through ingestion, causes extreme gastrointestinal damage and cardiac abnormalities.¹³ Symptoms may include constriction of the throat, difficulty in swallowing, severe stomach pain, vomiting and diarrhea. Death may occur immediately or within a few days.¹⁴

Subacute poisoning may cause a variety of symptoms. Early researchers noted loss of appetite, fainting, nausea, shooting pains, nervous weakness, tingling of the hands and feet, and jaundice, with longer exposure leading to "dry falling hair; brittle loose nails; eczema; darker skin; exfoliation; and a horny condition of the palms and soles."¹⁵ Later reports of poisoning cases from contaminated beer and soy sauce described mucous membrane problems such as bronchitis. Pigment changes occurred first around scars, neck, armpits, nipples, and trunk of the body. Chronic arsenic exposure may cause peripheral neuritis, blackfoot disease (a circulatory disorder), keratoses, immune response suppression, and skin cancer.¹⁶

Several studies link cancer in humans to inorganic arsenic--from drugs, drinking water and occupational exposure. The National Academy of Sciences (NAS) reviewed medical reports, occupational studies, population studies, and experimental studies. Though the population studies have mostly been retrospective and no form of arsenic has been shown to produce cancer in animals, the NAS found enough evidence to conclude that arsenic is a skin carcinogen. It did note that "substantial doses of inorganic arsenic are required to produce an

appreciable incidence."¹⁷ Arsenic laden dust has been implicated in lung cancer in smelter workers. Though there has been little study, arsenic has also been implicated as a teratogen and mutagen.¹⁸ The EPA found enough evidence for its carcinogenicity, teratogenicity, and mutagenicity to recall its use as a pesticide in 1978.¹⁹

Studies of communities with contaminated drinking water have documented some of these effects. In Antofagasta Chile, researchers traced skin problems and some deaths of children to water contaminated with 0.8 milligrams per liter (mg/l) arsenic.²⁰ In Taiwan persons drinking well water with arsenic concentrations ranging from 0.017 to 1.097 mg/l showed increasing incidences of hyperpigmentation, keratotic lesions, blackfoot disease, and skin cancer.²¹ High incidences of skin cancer consequent to arsenic exposure were also reported in Silesia and Argentina.²²

Under the Safe Drinking Water Act, the maximum allowable concentration of arsenic in public drinking water is 0.05 mg/l. In setting this standard, regulators considered health effects but not arsenic's carcinogenicity, and also accounted for the technological and economic feasibility of arsenic removal from water. Ambient Water Quality Criteria, under the Clean Water Act, set "recommended maximal permissible concentrations consistent with the protection of aquatic organisms, human health, and recreational activities."²³ Recognizing arsenic as a human carcinogen, the EPA recommended a zero concentration. Realizing that this might not be feasible, it identified arsenic exposure levels corresponding to incremental increases in cancer, based on data from Taiwan.²⁴ An increased risk

of 10^{-5} (one additional case of cancer for every 100,000 exposed for a lifetime) corresponds to 22 ng/l, 10^{-6} to 2.2 ng/l, and 10^{-7} to 0.22 ng/l.²⁵

Recently researchers have studied arsenic exposure at levels exceeding the drinking water standards; most have noted increased arsenic storage in body tissue as evidence of chronic exposure. The relation between storage and illness is not well defined however. In Lassen County California, Goldsmith et al, found increased storage of arsenic in the hair when water levels exceeded 0.05 mg/l, but saw no evidence of specific illness.²⁶ Alaska residents exposed to up to 10 mg/l showed no clinical abnormalities. Urinary arsenic levels increased at exposure above 0.1 mg/l. Most had lived there less than ten years and the study did not consider carcinogenic potential.²⁷ Valentine et al studied arsenic in hair and urine of persons in five Nevada and California communities exposed for at least one year to water levels ranging around the 0.05 mg/l standard. They saw increased storage in those exposed to between 0.1 and 0.4 mg/l.²⁸ A recent study of Utah residents exposed from 0.18 to 0.21 mg/l found correlations with levels in hair and urine, but no adverse health effects. The researchers saw no signs of arsenic intoxication and no increase in cancer mortality.²⁹

So while acute arsenic toxicity is well established, the effects of long-term lower levels are less clear and may be difficult to discern due to the variety of symptoms. Studies have not always accounted for socioeconomic factors, nutrition, exposure to other toxics, or even the species of arsenic present. Regulators have not

used what information is available consistently to set standards scientists do not agree on the validity of standards. Some researchers conclude that the 0.05 mg/l drinking water standard is adequate and even conservative, based on the levels at which urinary arsenic increases.³⁰ The NAS concludes that the standard may not provide an adequate safety margin, based on epidemiological evidence that at 0.08 mg/l cancer incidence is reduced but still detectable.³¹ Thus communicators have to understand regulatory recommendations as well as scientific data.

At Milltown the well water levels range from 0.22 to 0.51 mg/l, clearly exceeding EPA drinking water standards. About one half the arsenic is in the more toxic, trivalent form. The levels are not high enough to cause acute poisoning; however, the possible long-term effects are not known. Since the wells were not tested before 1981, no one can say how long the residents were exposed. Though there was no doubt that no one should drink the water, officials could not precisely define the health danger to exposed Milltown residents. Health officials had to rely on their own assessments of the situation and the scientific uncertainties made the task of communicating difficult.

III. Communication of Arsenic Information

Several groups presented information about arsenic and health, including government agencies, the media, the University of Montana, Montana People's Action, and Montana Public Interest Research Group. Each had its own communication goals; each had its own problems communicating. These communicators interacted with each other as well as Milltown residents.

Communication problems and conflicts came from three areas. The first was with the information itself. Arsenic health information was hard to find, interpret, and apply to Milltown. Second, communication was not always coordinated. Third, communicators had different perceptions of the arsenic problem.

Information Presentation

Agencies The Missoula City-County Health Department served as the primary contact with Milltown and as the main information source. The State Water Quality Bureau, Solid Waste Division, and EPA offices were also involved.

After the August 1981 tests showed high arsenic levels in the First Street well, the State Water Quality Bureau sent a letter and fact sheet to the resident operator to be distributed to the other well users. The letter reported that three samples averaged 0.22 mg/l compared to the drinking water standard of 0.05 mg/l. The letter stated:

Arsenic can be toxic to humans if ingested in large amounts or in small amounts over a long period of time. Arsenic is accumulated by the human body and a single dose may take ten

days before it is excreted by the body.

The letter added that the water system would be monitored. The fact sheet noted that arsenic occurs naturally but is also introduced through pesticides, and that it is found in low levels in food, as well as air and water. It indicated that while the 0.22 mg/l concentration is four times the recommended limit, toxic effects are only likely after long term use. The fact sheet further stated that in mild, chronic arsenic poisoning the only symptoms are fatigue and loss of energy. It recommended that residents not drink the water.

After the December discovery of the other wells' contamination County sanitarians delivered warning letters door to door in Milltown.

These letters simply stated:

The well supplying your residence has higher levels of arsenic than the federal standards allow; we have not yet determined if the levels of arsenic in your water will cause adverse health effects, but we would advise that you not use the water for cooking or drinking until further information is obtained.

A letter issued the following day contained stronger warnings about possible long term effects. A few days later the County announced the possibility of hair and fingernail tests for the residents.³² In evaluating possible health risk, the Department's staffers sorted through published studies trying to determine which results to believe.³³ Since no one knew the chemical species of arsenic present at that time, this evaluation was even more difficult.

According to David Feffer, then director of the health department, the County made its arsenic announcements before it was ready because of a media announcement. He would have waited longer, noting that County officials had no experience with arsenic and were basically "starting from scratch." They turned to libraries, EPA, and

national experts, but were forced to speak without a single authoritative source of expert advice.³⁴ The letters and media coverage made this confusion apparent to the public.

In the following months little active communication revolved around health issues. The City-County Health Department did not look for possible health information needs, then address these with the residents. It did respond to rumors of arsenic spreading and questions about health effects. Meanwhile the clamor for Superfund action at Milltown grew. Designation as a Superfund site imposed a new set of guidelines and chain of agency authority on Milltown.

The EPA requires a community relations plan for Superfund sites.³⁵ Though not formally addressing health concerns, the plan is designed to respond to community concerns. The Missoula City-County Health Department carries out the community relations plan under a subcontract from the State. A local person serves as contact and liaison. I served as community relations coordinator from January through April 1984; Dan Corti at the County Health Department now serves in this capacity.

Community relations activities were limited by time and money as well as the perceived concerns and priorities of the community. Besides health issues, legal and bureaucratic matters required attention; the work could have occupied one person full-time. In responding to health concerns, I had problems both in gathering information and with finding anyone willing to assume responsibility for definitive statements. Several incidents illustrate these and other problems communicating about arsenic and health.

In spring 1984 one resident called very concerned because of the number of her child's cavities and gum problems. Her dentist had suggested that highly alkaline drinking water could cause these problems. Since the family got its water from the Champion well near the proposed well, she was extremely worried and angry. Alkalinity and heavy metal contamination both connoted "bad water." A quick water sample showed a neutral, even slightly acidic pH. Reporting this to her also required an explanation of pH.³⁶ In the meantime, no medical consultant was readily available for questions about heavy metals and tooth decay. Phil Tourangeau, at the Environmental Studies Laboratory at the University of Montana, indicated that metals were probably not the cause in this apparently isolated incident. Metals would probably kill rather than enhance bacterial growth. In this case, rumors could have spread quickly, creating alarm in other Milltown residents.

Though the local health department served as the local authority, the state and federal EPA offices retained control in other health areas. Concern over long-term health effects prompted requests for studies of Milltown residents. These studies are complicated and expensive; EPA sets priorities in its requests to the Center for Disease Control.³⁷ Because of the transient population, uncertainty of duration of exposure, and too low levels of arsenic, EPA decided not to request studies at Milltown. So although acknowledging that the problem was serious, the EPA did not consider it to be serious enough to warrant health studies. This seeming double message was difficult to explain to concerned residents.

In July 1983, the State's Solid Waste Bureau announced in a news release that relatively high levels of arsenic in vegetables from Milltown gardens "were not cause for alarm, but certainly reason for caution in consumption."³⁸ Neither the SWB nor the Food and Consumer Safety Bureau of the Department of Health and Environmental Sciences was able to find a safety standard. They checked with the U.S. Food and Drug Administration and the CDC. They compared Milltown levels in spinach (2.66 parts per million), lettuce (1.41 ppm), rhubarb (1.1 and 0.2 ppm), and radish (0.82 ppm) to background levels for spinach and lettuce (0.001 ppm), rhubarb (0.05 ppm), and root vegetables such as radishes (0.012 ppm). They also noted USDA action levels (which restrict products from consumption) in meat products ranging from 0.5 to 2.7 ppm. The news release concluded that that "small amounts might be safe to consume but continued usage could lead to accumulations of dangerous levels" and that "when it comes to public health we'd (the agencies) rather err on the safe side." The state promised further testing of vegetables.

By the following spring of 1984 residents wondered whether it was safe to plant vegetables. As community relations liaison, I began to investigate the problem. I spoke with contacts at the Environmental Studies Lab, health officials in Seattle and Tacoma,³⁹ and the CDC. The vegetable tests did not show whether the arsenic contamination came from surface contamination or from internal uptake. According to some studies, internal arsenic would have killed the plant before concentrations reached Milltown levels. No one could say for sure whether the plants were contaminated from irrigation with

arsenic-laden water or from residues in the soil.

As part of their study, University of Montana geologists had taken soil samples from several areas including some gardens. These tests were not intended for use in determining the safety of gardening, since no standards exist for soil arsenic. However this was not clear to the residents. When the samples had not been analyzed by spring, a few residents became angry and frustrated with the delays. The results finally showed that except for elevated concentrations in two locations, the garden soil levels were at or below normal background levels. As anticipated, the Health Department could not use this information in any definitive way, but did pass it along to the residents.

The Seattle and Tacoma health departments had a gardening brochure which suggested ways to minimize arsenic and cadmium contamination from smelter fallout. Based partly on these, the Missoula City-County Health Department distributed a fact sheet that noted, "Heavy metals can accumulate by absorption from soil or water. They can also occur on leaves or other plant surfaces in contact with soil, dust, or water." It recommended watering with uncontaminated water when possible, avoiding overhead spraying, not using fertilizers or pesticides containing arsenic, and peeling or washing vegetables.

At a spring advisory committee meeting, attended by two residents, Vic Andersen of the SWB presented a summary of CDC's "Assessment of health effects from heavy metal contamination of food products in Anaconda, Montana." The study found that no adverse effects were expected from Anaconda grown food. The report

summarized health effects of metal poisoning, stating that chronic arsenic poisoning can be manifested as "weight loss, nausea and diarrhea alternating with constipation, pigmentation changes and eruptions of the skin, hair loss, peripheral neuritis, chronic hepatitis and cirrhosis." It further stated that the toxic dose far exceeds levels usually found in food and that affected plants will show yellow wilted leaves and poor growth. The report of the food sampling in Anaconda is confusing. It compares metal levels to an FDA Metals in Foods Survey. But the numbers are difficult to compare since the FDA used wet weight not dry weight, and measured arsenic trioxide not total arsenic. The summary concludes that there is little risk of poisoning, but that to reduce risk of any possible ingestion, people could avoid root and leafy vegetables. It appended the Seattle gardening brochure. The SWB official commented that Milltown levels were lower than in his garden in Helena. It was not clear whether this was a formal recommendation not to worry or his personal opinion. The CDC summary could have allayed some anxieties in Milltown, if translated into understandable words and relayed to the residents. However this became less important; by summer's end no residents were interested in vegetable testing. The State did not take samples. The matter appeared closed.

The County Health Department used newsletters in 1984 to update residents and pass along new information such as gardening recommendations. Staffers answer questions on an ongoing basis, including those related to health. The number of calls decreased as the project progressed; staffer Dan Corti received about one call a

month in the spring and summer of 1985, mostly from new renters.⁴⁰ During the bacterial problem in July 1984, the Health Department received about 25 calls.⁴¹ Occasionally Health Department representatives make presentations to groups or town meetings. When they need to inform the community of a new development, staffers usually rely on two or three residents as contacts for the whole community.

Public agencies, primarily the Missoula City-County Health Department, had problems determining what and how to communicate for several reasons. The information on arsenic and health was scattered or sometimes unavailable. No single source had compiled the available information for easy reference. Local staffers had to sift through journals and studies. No one had compiled or mapped the results of water tests to answer questions quickly. Definitive statements about possible health effects were also hard to make because of lack of exposure information.

Agencies did not always coordinate information with each other. Missoula had known since August of the arsenic testing, yet had to scramble for information in December. The Water Quality Bureau's August letter was informative, placing the arsenic levels in context and citing possible health problems. The County's December letter was vague and uninformative.

After Superfund designation, state responsibility fell to the Solid Waste Bureau, unused to water quality matters. Federal and State EPA offices, the Solid Waste Bureau, and the City-County Health Department all had to stay apprised of each other's actions at

Milltown. Though this did not cause conflicting announcements to the public, it did slow the communication process. Though the State and EPA did respond to letters and phone calls from the public, the County faced most of the direct public contact. Even when the State or EPA could not make definite recommendations, as with gardening, the County still had to take a stand and make some statement to the public.

Policy questions arose throughout the clean-up process. Should tests be performed when the local department sees a need, when the state does, or when any resident requests it? Should state or local health departments announce test results? How should officials balance information needs with the time and expense of gathering information? Agencies did not formulate responses to these questions together. Not all of these related directly to communication, but failure to address them led to confusion about what to communicate and to whom. Unclear communication channels also led to failure to follow through or explain plan changes, as with hair and fingernail tests.

Communication to the residents was sometimes frustrating for agency staffers. Public concern was difficult to gauge and changed over time. Uncertainties regarding health effects were difficult to justify to a public used to the supposed certainty of science. Officials often had to say, "We just don't know."

Media While informing the public, the news media can shape as well as reflect public opinion, with the power to choose coverage, emphasis, and content of stories. Technical information and medical uncertainty such as surround arsenic can be difficult to convey. To

review media coverage, I interviewed reporters and examined Missoulian articles and available television logs and scripts. I also asked other involved parties about their perceptions of this coverage.

The Missoulian serves as the area's daily newspaper, with about 70-80% of households subscribing.⁴² Between December 1981 and July 1984 the Missoulian published 55 articles directly related to Milltown's water problem, including 7 editorials, one opinion, one portrait, and two letters to the editor. These were usually grouped around events such as the initial arsenic discovery, the release of the National Priorities List, or political discussion.

Early stories contained a good deal of numerical information noting concentrations in wells and comparing them to EPA standards. Articles reported the County's December 1981 arsenic discovery and its confusion over the significance. Reporter Kevin Miller explained some of the health studies on arsenic. He noted that one study showed cancer in persons exposed to water with arsenic levels as low as 0.08 mg/l.⁴³ Articles noted that skin pigment changes and blotching were symptoms of long-term effects. A later story related the chemical species of arsenic present to its toxicity.⁴⁴ In an opinion piece, Kevin Miller reported the problem of interpreting conflicting studies.⁴⁵

By October 1982, other reporters including Steve Woodruff had begun covering the Milltown story. Health information included statements that fatal doses were much greater than those at Milltown, but that arsenic had been linked with skin cancer, nervous disorders, and digestive tract ailments. That summer another story covered the

vegetable contamination.⁴⁶ In a letter to the editor a concerned Arlee resident described health hazards of heavy metal ingestion and the dangers of contamination to Milltown residents using their water for showering or washing dishes.⁴⁷ Another letter from Missoula said Milltown residents experienced, "headaches, rashes, and stomach ailments."⁴⁸ Other Missoulian articles said no health problems had been seen.⁴⁹ The initial reports contained specific health information. As the focus shifted to clean-up efforts, writers relegated health information to the background, where it appeared at the end of stories.

When the EPA declared Milltown a Superfund site, reports stated the arsenic health threat ranked Milltown among the EPA's top 200 sites. Local articles characterized Milltown as one of the nation's worst toxic sites and used it as referent for other sites.⁵⁰

Broadcast journalists also covered the arsenic story. Missoula has two television stations, KECI and KPAX. KECI kept no logs or old scripts. Reporter Roger Fuhrman estimated having done 12 Milltown stories between January 1982 and May 1984.⁵¹

KPAX keeps logs of its news stories. Scripts, but not transcripts of aired interviews, were available for review. The station broadcast 71 Milltown stories between December 1981 and December 1984, also usually grouped around specific events.⁵² The reports usually did not mention specific arsenic concentrations, reporting contamination as a number relative to the drinking water standard. The beginning reports did not describe specific health effects; many stories did not mention health effects at all. When the

geologic study results were released, some stories noted possible health effects, such as "skin cancer, nervous disorders, and digestive tract ailments."⁵³

In November 1982 a KPAX reporter described the health effects of manganese, lead, and zinc, as well as arsenic. She used manganese information from Love Canal studies where reported effects included central nervous system disorders and memory loss.⁵⁴ The story did not place this information in context, with no comparison to Milltown metal levels. Another story reported that sediments in the dam contained heavy metal concentrations 100 times higher than water standards allowed. Water standards, however, do not apply to sediments. Other information was accurately conveyed. Another reporter covering a MontPIRG health study did include disclaimers and notes of the tentative nature of the results.⁵⁵ Television stories were briefer and less technically detailed than those in the newspaper.

None of the six Missoula area radio stations contacted kept logs.⁵⁶ Most relied on wire services or newspapers as sources. Glen Schmidt of KGRZ followed the Milltown story closely. He did a Milltown piece about once a month until Fall 1985, checking with health agencies and the Milltown Water User's Association for information.⁵⁷

Both print and broadcast reporters relied on the Missoula City-County Health Department for health information. One newspaper reporter also researched some journal articles. Most found Health Department staffers to be generally accessible and straightforward.

Evaluation and presentation of arsenic information presented a challenge. Steve Woodruff of the Missoulian noted, "You can't get into too much technical detail or you don't get the point across".⁵⁸ Another Missoulian reporter Kevin Miller, already aware of long-term arsenic effects, found the published studies confusing and noted that a reporter cannot pretend to be a scientist.⁵⁹

Most public officials and researchers felt the media coverage was generally technically accurate. Jim Dunn at the State EPA office noted that a few key words make lots of difference in accuracy.⁶⁰ Elaine Bild of the Missoula Health Department felt that a local citizen's group, Montana People's Action, had misrepresented some information and that the media overplayed these inaccuracies.⁶¹ Jim Melstad at the Water Quality Bureau noted errors in the reporting of the chronology of testing.⁶² David Feffer, former health department director, thought that the problem was portrayed as more serious than it was.⁶³ (A later section addresses differences in perception.) Others mentioned that they saw differences in reporting ability, with newspapers tending to be most accurate.

Milltown's arsenic problem was thoroughly covered by the news media. Few stories related to health per se, with health information serving as background rather than focus. Except for the instances discussed, the media accurately portrayed the technicalities of the arsenic health information.

University of Montana University of Montana researchers performed the hydrogeologic survey at Milltown. Though not addressing

human health issues, they did gather data about arsenic sources and concentrations. Some worked directly in Milltown and had contact with the residents. They presented findings at the request of the residents or the health department. Environmental Studies Lab personnel, with previous heavy metals experience, also assisted the health department. Sometimes residents, a citizen's group, or the media misinterpreted university information. Sediment levels were compared to EPA standards for water, to demonstrate the severity of the problem. Arsenic in sediment may indicate its presence in water, but these levels have no relation to drinking water standards.⁶⁴ Geologists had to correct this at a public meeting. Even though hydrogeologist Dr. Bill Woessner explained soil sampling could not indicate gardening safety, some residents assumed that it would.⁶⁵ Researchers also had problems explaining the time that it takes to analyze samples and compile results. So university researchers had data on Milltown's arsenic, which while not specifically health-related, had implications for health. This information was sometimes misinterpreted or misused.

Montana People's Action Montana People's Action, (MPA), a local citizen's advocacy group works with neighborhoods and low income groups on issues including utility rates and toxics. Organizers began a door knocking campaign in Milltown in September 1982 to gauge concern over the arsenic issue. Through this group Milltown resident Melody Fuchs became actively involved in working for a clean water supply. Eventually the entire Milltown Water User's Association

joined MPA. MPA organized meetings and hearings. It distributed information on taxes and funding alternatives, as well as health, to Milltown residents.

Organizers distributed toxics information beginning in 1982 with a xeroxed list of health effects of arsenic, zinc, manganese, lead, and iron. Staffers later enlarged the list for use at MPA display tables. It notes the drinking water standards and occupational exposure limits and notes possible arsenic health effects: "(C)ancer of lungs, skin, and liver and birth defects. Burning, itching, inflammation of skin, loss of hair, nausea, vomiting, diarrhea, anxiety, muscle weakness, cold hands and feet (leads to gangrene). Leads to liver damage, cumulative poison."

While this information was technically correct, it was not placed in any kind of context. No one attempted to compare levels, to explain length or duration of exposure, or note the differences between long-term and short-term effects.

The MPA newsletter also contained articles about Milltown. In one, Melody Fuchs noted that the EPA had said gardening was safe, but that when resident "Mrs. Van Holt wanted to make rhubarb jam, we (Milltown residents) thought we'd better have our produce tested. The results were all abnormal. Now we have to get our soil tested to see if the arsenic has contaminated it, making our gardens unusable for years."⁶⁶ Later in that issue, a table compared Milltown vegetables' arsenic levels to EPA "danger levels," apparently the EPA background levels. The table also did not contain any units to indicate the concentration. The caption below a picture of a metal stained sink

stated that washing with the water could cause "skin irritations and possibly cancer."⁶⁷

In another educational and organizing effort, MPA sponsored a conference, "Organizing Against Toxic Waste," in January 1984. Lois Gibbs spoke about her experiences at Love Canal and moderated a panel discussion. Health concerns were very important at Love Canal. While not addressing arsenic specifically, she did question possible exposure if the sediments behind the dam were ever removed.

MPA had direct contact with many of the residents. Many have acknowledged the importance of its efforts in securing a new water supply. Its staffers had problems gathering information about health effects of arsenic and interpreting technical data. MPA researched at the University of Montana, UM's Environmental Library, CDC, Clean Water Action Group, and the County Health Department. The most valuable source to them was "We're Tired of Being Guinea Pigs: A Handbook for Citizen's on Environmental Health in Appalachia."⁶⁸ They could find no usable health packet on heavy metals for neighborhood distribution. As a result its health information was sometimes slightly inaccurate or out of context.

Montana Public Interest Research Group This group also researches consumer issues such as toxics. MontPIRG became involved with the push for the "mini-Superfund" bill in the state legislature in 1982. In June 1983 MontPIRG released a health study based on guided interviews of the residents. In designing the study the MontPIRG staffer relied on journal articles and the advice of the Health Department. The study reported skin and respiratory problems as the

primary health weaknesses in Milltown. It claimed to dispel a circulating myth of skin cancer deaths, although noted one man did have skin cancer. It also "allayed suspicions that some residents were still drinking the water."⁶⁹ C.B. Pearson, director, considered the study a success, as it drew attention to the details of people's concern.⁷⁰

MontPIRG did note flaws in the health study. No residents had been drinking the water for 15 months. Interviewer variability, lack of a control group, and a very small sample size also could have skewed some of the findings. It recommended more study and citizen action, noting that while the data may not have been statistically significant, that it could serve as an organizing tool. MontPIRG released the report to the press and the Milltown leadership.

Communicators' Perceptions

The perceptions of the communicators affected how and what health information was presented. Each had different perceptions of the health risk and what information was important to emphasize. Each also had perceptions of the residents' concerns. Differing goals also affected the style of presentation.

The consensus among health officials was that there was definitely cause for concern, but not over long-term health effects. David Feffer felt that the problem was portrayed as more serious than it was and that the arsenic had probably been in Milltown for years at low levels, with no reports of disease. He also felt that the water was "horrendous" in the first place and no one had been drinking it

anyway.⁷¹ Jim Dunn of the EPA expressed concern that residents were exposed to contaminated groundwater, but was not worried about chronic effects.⁷² Elaine Bild at the Missoula Health Department felt that the health risks were very low. Milltown may have gotten a high ranking on the Superfund list because she understood the ranking system and knew how to "play the numbers" to get assistance.⁷³ Local government had to prove to the federal government that the problem was serious enough to warrant attention and money. It then had to tell the residents that it did not perceive chronic health effects.

The Health Department was most interested in informing the residents not to drink the water and that the long term risks were uncertain but probably low. Its communication efforts were response based. It also passed along new information as it became available.

Media reporters' perceptions of the seriousness of the arsenic problem varied. Kevin Miller of the Missoulian felt that there was definitely a threat and that the range of possible effects were all negative. He also felt that if the same problem had surfaced in a more affluent area that the residents would have been better informed.⁷⁴ Steve Woodruff, also of the Missoulian, noted that people had to rely on experts to establish threshold concentrations, but that no one could say for sure what the risk was.⁷⁵ Kevin Macki of KPAX saw lots of inconvenience but "no one lying in bed holding their stomachs."⁷⁶ Glen Schmidt of KGRZ felt that the residents had "been messed around" by bureaucrats.⁷⁷ Reporters judged then not only the arsenic health risk but also the residents' perceptions.

The Missoulian's Kevin Miller saw the media's role to be that of informing the public of the situation and identifying the need for action. After the initial flurry of coverage, specific health information served as background material. However after the Superfund declaration the degree of health risk was portrayed as more serious. Broadcast journalists especially began to play up the victim angle using health as an issue.

Montana People's Action wanted to organize and establish credibility in itself.⁷⁸ It wanted citizens to realize that the arsenic contamination was not their fault and that they had the right to have it cleaned up if they wanted. Staffer Secky Fascione felt that the residents needed the opportunity to know how bad the contamination might be. She was "enflamed" by how little information got to the residents. MPA saw toxics as an organizing issue for itself and used Milltown to try to build a support base.⁷⁹ The group is now also active at other toxic sites in the state including Anaconda. The MPA staffer interviewed thought that the arsenic problem had been portrayed more in terms of environment and economics than human health. She referred to one street as "Cancer Row" where three senior citizens had lost spouses to cancer and three others have cancer. In assessing the risk, she said, "Who knows? It's probably pretty bad, but so are the mills they've worked in all their lives and so is the air in the Missoula valley."

MontPIRG designed its health study to be informative. It also wanted to test "the usefulness of health studies as an organizational

tool in assessing the impact of hazardous waste on a community."⁸⁰ So this organization also had other goals than just exploring possible health problems.

Two groups took the same information and placed it in different contexts. Government agencies saw that there was a problem, but were not overly concerned about the long-term health risks. They concentrated communication efforts on informing and responding to the public.

The other saw Milltown as the "Love Canal" of Montana. It used health issues as tools and levers for action. This action inducing approach was more confrontational in style. For instance, MPA organized "town meetings" with posted questions for officials requiring a definite yes or no response. This strategy was effective and perhaps necessary to elicit government response, but also had a polarizing effect. It implied that agencies were hiding information or not attending quickly enough to the problem. Both groups had the same overall goal--a safe drinking water supply for Milltown.

IV. Perceptions of Milltown Residents

The residents' understanding and perceptions are measures of communication effectiveness. What health information did they want? Did they get this information? What were their main sources? How did they perceive their health risk?

General Concerns

Health concerns were only part of Milltown's arsenic situation. The arsenic discovery forced residents to carry their own water for four years--a continuing inconvenience. Some lost money as rental values dropped. Many grew frustrated with the long process of obtaining a safe water supply. Young children never learned how to turn on the spigots in their own homes. Arsenic impacted all of their lives, but opinions and reactions to the health issue varied within the town.

Most of the community's action focused on the new water supply rather than on specific health concerns. Community efforts included organizing meetings, lobbying, and working on the legalities of the new system. The activity level varied; attendance at meetings dropped over time. Involvement also varied from individual to individual; some residents were more vocal than others. Milltown is a small community, with close interactions between neighbors. Some did not trust Montana People's Action; others did not like the main community leaders. One resident complained loudly when the well contractor paved one street but not hers.

Outsiders had their own perceptions of the concerns. Early media accounts noted residents' reactions to the arsenic. According to a December 1981 Missoulian article, residents were "perplexed" but due to past problems the arsenic "came as one more complication that for the most part the residents took in cautious and even good humored stride." The coverage did note health concerns; the story reported a woman's concern for her daughter's health.⁸¹ In a television interview a pregnant resident worried about her unborn child's health.⁸²

One reporter felt that the residents were numb to the possible health effects, that negative publicity concerned some of them much more. He felt their concerns were more immediate, such as dinner and the utility bill.⁸³ An MPA staffer felt that for many that the inconvenience was as of much concern as health. She thought that some did not want to believe that there was a problem and that younger families especially were more casual about the dangers. Melody Fuchs stayed closest to the health issue; others did not want to have anything to do with it.⁸⁴

During the course of my health department work, I saw concern expressed in several areas. The main health concern related to garden vegetables. After the Lois Gibbs visit, Milltown residents also raised questions about the dam sediments and possible long term health effects. The neighboring public continually worried about spreading contamination.

In spring 1985 I contacted some of the residents for first-hand accounts of their experience and concerns. One declined to be

interviewed, as they had "been studied to death." I spoke at length with two others. One woman reported just getting used to hauling water. She was frustrated with the EPA and the University for the time it took for studies and action. She felt Melody Fuchs had been her most helpful information source. Her biggest health concern had been the garden. She felt that some people had reacted with hypochondria to the arsenic, feeling sick only after the discovery.

A retired millworker also noted the slow process of "dealing with bureaucrats" and said that he could have told them where to put the new well in the first place. He used the contaminated well water for bathing, though thought it could infect cuts. Though he supposed that he had drunk lots of the water, he said that at his age (over 70) he does not worry about getting sick from it. He did note that several people on his street, including his wife had died from cancer. He thought that this occurrence was greater than normal and may have been due to the water. He also recognized that this would be hard to prove.

Questionnaire Results

The views expressed to the media or Health Department by a few do not necessarily reflect the concerns of the entire community. To better understand Milltown residents' perceptions of arsenic related health problems, I administered a questionnaire. Not a health survey or a statistical analysis, the questionnaire was designed to identify communication problems. It included questions in four general areas--water use habits, sources of health information, knowledge of

arsenic and health, and perceptions of health risk. Several demographic questions asked for information to characterize the community.

Question design required thoughtful consideration. To encourage open response, questions about perceptions of health problems could not be "leading;" the knowledge section could not sound like a quiz. I wanted respondents to be able to comfortably answer "I don't know." I also wanted the questions to be structured enough to gather specific information but open for other comment. Reviewers at the Health Department and University provided criticism and guidance in the questionnaire design. The final form had 42 questions of various styles and lengths. Some required yes/no responses; others required choosing one from among several possible responses, and a few required ranking concerns. A final open question left room for any additional responses.

Given some residents' antagonism toward the University, I tried to ensure good response through personal contact. I delivered and picked up the questionnaires in person, allowing me the opportunity to explain the work and the residents the opportunity to ask questions or comment. A cover letter also explained the study and the usefulness of their input, while assuring confidentiality and offering copies of the results.

I contacted the 28 apparently occupied Milltown households with arsenic-contaminated wells. Nineteen responded, some with extensive comments. Though one questionnaire's answers had an angry tone and one resident was sarcastic in person, the response was generally calm

and helpful. Some residents were friendlier than others and some were more curious than others, but most all were willing to help. The questionnaire, tabulated results, and comments are appended. The following discussion refers to questions by number.

The demographic questions (#35-42) asked the residents to describe their household numbers and ages, Milltown residency, education, and involvement in clean water efforts. The 19 households consisted of 57 people, ranging from retirees to young families. Twenty-two children under 18 live in these households. Length of residency ranged from 3 months to 58 years, nine had lived in Milltown 20 years or longer. Most respondents had completed high school, with five continuing beyond high school. The level of involvement in community efforts to solve the water problem varied. Nine reported themselves as moderately or very involved, eight as not at all involved. Thus the affected residents varied widely in age, residency, and level of involvement.

Four questions (#10-13) addressed water use habits. None of the responding 19 households still used the water for drinking. Eleven of the nineteen did use the water for bathing, washing dishes, and laundering. Others used the water for only one or two of these activities. Of the six respondents who gardened, 3 reported changes in gardening; one had returned the plot to grass. Of 11 respondents with children living at home, 4 restricted their activities in some way, mostly by not allowing outdoor water play. The water habits of every household were affected, but almost all still used the water for some activity.

When asked when and why they stopped drinking the water, 5 reported never having drunk it, most having moved in after the arsenic discovery. Three quit before the official warning, one citing the "terrible smell and rusty color" and another "lousy taste." The third quit after a neighbor had tests run in August 1981. No one reported continuing to drink the water after the arsenic announcement.

Residents heard about the arsenic situation from several sources. Eight (#1) indicated hearing first from friends, seven from the Health Department, 4 from the media, and two from landlords. Most (#3) kept updated through the media or friends. When asked whether they felt well-informed about progress on the new system (#2), 10 said yes, 9 said no. One noted that, "Once they got going on this (the water project), they just forgot to keep us updated." Another felt that the media always knew about progress on the water system before the residents did. Some felt that information was being hidden from them. For instance, one commenter thought that the power company knew that there was arsenic in the dam. Another felt, "the health board covered this up."

Other questions (#14-20) addressed health information more specifically. Eight residents (#14) felt as if they received enough information about precautions to take with their water, 7 would have liked more, and 6 never received any and would have liked some. They responded similarly with respect to information about health effects. Five of 19 had (#16) tried to find out more information about arsenic and human health on their own. Seven (#17) had asked doctors about arsenic and health. One resident wanted to know the results of the

MontPIRG health study and what had happened to the hair and fingernail tests planned by the Health Department. Others wanted more specific information about cumulative effects, effects on plants, the safety of bathing, and effects of other metals. If wondering about the health effects of arsenic (#18), nine would ask doctors first, 7 would ask health department officials. One, reporting little success with the Health Department, would check with an environmental specialist at the University. All said (#20) that they would follow the advice of the Health Department if it again issued warnings. Most respondents (#19) said they prefer to be informed of any new health information with written notices.

Other questions (#21-24 and 31-33) were designed to examine the residents' knowledge of arsenic information. Most knew (#21) that there was not enough arsenic in the water to make one sick right after drinking. One question (#22) asked if respondents thought any health problems could result from being exposed to small amounts of arsenic for a long time. Ten knew there could be problems but were not sure what specifically they were. Four said they knew of specific problems, but only listed death and cancer. Two did not think any health problems could result. The following question (#23) asked about signs of arsenic exposure in humans. Again eleven thought there were some, but were not sure specifically what they were. Less than half knew (#24) that even medical experts did not agree on the long term effects of drinking water containing small amounts of arsenic. All but two (#31) realized that no one knew how long the arsenic had been in the water and most knew (#32) that sediments behind the dam

were the most likely source of arsenic. Only six could name (#33) other metals in the water. So residents were fairly knowledgeable about the arsenic in the water itself and that there was not immediate danger, but did not know much about specific possible long-term effects.

The questionnaire also examined concerns and perceptions. Question 4 asked respondents to indicate the importance of four concerns--quality of neighborhood, difficulty and inconvenience of hauling water, personal health, and value of personal property. Fifteen of 19 ranked both personal health and inconvenience as very important. Eleven ranked (#5) personal health as the most important.

Most felt positive about Milltown as a community. The majority said (#7) that Milltown was still a good or excellent place to live, though eight did consider moving (#6) because of the arsenic. Though eleven felt that they could not help much as individuals to solve the arsenic problem (#8), they did feel that by acting with their neighbors they could. Twelve of 19 did not agree (#29) that arsenic makes Milltown a dangerous place to live. One respondent "knew the situation could have been worse."

Respondents were asked (#29) to compare the risk of drinking arsenic contaminated water to five other risks--smoking cigarettes, driving on the highway, breathing polluted air, working at a dangerous job, and boating. Most considered these activities to carry the same or greater risk than drinking the water.

Only one person reported (#25) of knowing of someone in Milltown who had gotten sick from arsenic in the water. Five felt that arsenic

had contributed to their own health problems; two others thought that arsenic possibly had. They cited mental disorientation, nausea "from the smell alone," loss of hair and dyed hair. A resident told me of a woman who had two miscarriages while living in Milltown; she attributed these to the water. The woman carried a third child to term after moving to town. When asked (#27) about getting sick from having drunk the water, seven said they were a little worried, four were very worried, and seven said they did not think about it much. Seven said (#34) that they would still have concerns about arsenic even after the new water supply was in. Respondents were concerned about future contamination and wanted testing to continue. One would continue to worry because of a new awareness of water problems.

The respondents to the questionnaire provided detailed information about their experiences with arsenic. The sample size, though small is representative of the population. The analysis has some limits. Some respondents did not answer all the questions. Some questions, especially regarding perceptions, may have been confusing. The questionnaire was distributed three and a half years after the arsenic discovery, which may have affected responses. Correlations were not attempted: more study could examine relations between level of involvement and arsenic knowledge, concern and knowledge, length of residency and concern, and other influences on perception.

The results of the written questionnaire, though very valuable, did not provide a total understanding of people's perceptions. People shared different information orally than they did in writing. For

instance, only one person reported in writing knowing of someone getting ill from the arsenic. Both cancer and miscarriage were reported to me orally. The people in Milltown seemed less likely to write of suspicion or rumor, though these influenced their perceptions.⁸⁵

Residents placed their arsenic perception within the broader context of health, water, and other risks. They did have definite health concerns and information needs, however. These concerns varied within the community and changed over time, as residents responded to new information. Concern will continue even after the new well is operating.

Friends and the media are key information channels within Milltown. The medical community is also an important source. The health department and other government agencies have some credibility problems, but people will follow their advice. Some residents felt that information was hidden from them. Some had problems finding arsenic information when they sought it. New renters particularly were not well informed.

Residents wanted more health information in several areas. They needed more information about specific health effects of arsenic and other metals, which also addressed both the reported Milltown incidents such as hair loss and the suspected ones such as cancer. Confusion about the difference between the health hazard from arsenic and the nuisance of other metals (such as staining) needed to be cleared up. The safety of other uses of the water was not clear. A

City-County Health Department staffer told one woman not to bathe infants. She wondered whether it was safe for adults, especially if the body absorbs bathing water. The residents received few explicit suggestions regarding houseplants, pets, or dishes. These resident needs evidence some communication problems.

V. Evaluation of Communication

The exchange of arsenic health information formed communication webs. The health department relied on residents to express their concerns and questions. The residents turned to friends, doctors, the media, and citizen's groups as well. These groups in turn sought information from the health department. Information from each affected the others; perceptions revolved around each other. As new information was added concerns and perceptions changed.

Both communicators and residents had difficulties with the uncertainty surrounding the health effects of arsenic at Milltown. Uncertain information can encourage refusal of anyone to take responsibility and coordinate efforts. It can also allow varied interpretations and perceptions of an issue. Communication evaluation is largely subjective; effectiveness is measured by response. The following ties together observations of Milltown and analyzes information content, delivery and coordination, and perception. The analysis focuses on toxic health information, but also considers general communication where appropriate.

Everyone involved had problems finding or interpreting arsenic information related to Milltown. Though the State and EPA maintain extensive data base systems, much of the compiled arsenic information is based on studies of occupational airborne exposure which would not relate to public drinking water.⁸⁶ The local health department did not have the available data in condensed form for easy reference. It also lacked some knowledge about who was drinking from which wells. A

"generic" arsenic handout was not available for public use. An EPA official indicated that the uniqueness of each arsenic exposure situation precludes this.⁸⁷

Everyone was frustrated with the uncertainty of some of the information with respect to long-term effects. The public sometimes expected more definitive answers than were possible. Agencies sometimes were reluctant to make strong statements without definitive information.

In some cases technical information was presented but misunderstood. The University and the Health Department repeatedly said that soil sampling could not be used to make gardening recommendations. Residents either did not hear or understand this. Accurate information does not always imply accurate understanding.

The level and amount of technical detail seemed sufficient for the residents. Though one did ask about specific harmful arsenic concentrations, most wanted more interpretation of the numbers, which have little meaning in and of themselves. The agencies compared standards to Milltown levels and the Missoulian usually placed numbers fairly well in context. Some residents did complain of the technical nature of the University's reports; these were, however, scientific studies.

Health information was not always accessible to the public. The Health Department's designation as an "information repository" under Superfund gave little help. Most residents and reporters did find the staffers accessible though not always able to answer questions as certainly as they would have liked. Through efforts to understand

resident concerns and questions from outside, agencies tried to respond with desired information. These efforts were not always as successful as they might have been.

They sometimes directed information to community leaders rather than individuals. Strong, organized leaders can pass new information to the rest of the residents. At Milltown, however, after the main resident organizer moved, some of the other residents felt less well informed. It was also unclear what responsibilities landlords had in informing new renters about arsenic in the water and its health implications. The agencies did not explicitly identify the channels of communication with the community.

Agencies responded to the more vocal communities. The EPA received phone calls from Anaconda residents wondering why Milltown received so much attention when its own situation seemed worse.⁸⁸ Staffers also responded to the most vocal residents within Milltown. Residents were responsible for identifying and stating their concerns. Some simply did not seem worried about their health; others were more concerned. Sometimes residents called state or federal officials to complain, without the County's awareness of a problem. In other instances state or federal officials were not aware of local concerns or their extent.

Written notices seemed effective in presenting some information such as warnings about the water. Personal contact on specific questions seemed to allow more understandable explanations. Public meetings served in correcting widespread misinformation, such as surrounded the contaminated sediments. The emotional tone of some

public meetings requires particularly forthright and clear words from agency officials. On the questionnaire residents indicated a preference for written notices of new information. For some health questions at Milltown, however, personal contact could have supplemented or followed written notices to clarify details or implications.

Sometimes state or local agencies did not follow through on reporting of health related information. The State promised vegetable tests then did not run them due to lack of resident interest. Again agencies relied on perceived resident concern. Though no one publicly explained the 1982 decision not to do hair and fingernail studies, the City-County Health Department did explain the EPA's later decision not to request health studies.

Coordination between agencies was a continuing problem. Milltown "slipped through the legal cracks" in some ways.⁸⁹ Only one of Milltown's wells was legally considered public. Champion ownership of the land also complicated the question of responsibility. The State can only issue strong warnings about drinking water from private wells. Further, though the County had known since August of the possibility of arsenic contamination, it seemed unprepared for the December 1981 announcement.

Since budgets and expertise vary, a given county's ability to gather health information also varies. The State can attempt a literature search if requested.⁹⁰ The EPA also can provide data, but cannot make formal recommendations on unregulated chemicals.⁹¹ It is unclear what sources Missoula should or can rely on for information.

The Superfund designation added another layer of responsibility and coordination requirements. The EPA does try to ensure communication with residents at Superfund sites through a community relations plan. This plan is designed to be more than a "public relations gimmick," responding to public concern.⁹² The plan is tailored to each site; in Anaconda, though not technically required to, the EPA holds monthly public meetings. As a subcontractor Missoula County carried out the community relations plan, though remained responsible to the Solid Waste Bureau. Decisions and test results still had to pass through several agencies, distracting from what the residents were waiting to be told.

Those involved with Milltown, especially at the local level, did not seem to communicate with other hazardous waste sites in the state or region. Anaconda faces serious heavy metal contamination and has addressed such issues as children's playgrounds.⁹³ Other Montana Superfund sites, E. Helena and Silver Bow Creek, as well as Three Forks deal with arsenic contamination. EPA informally keeps up with other regional sites through briefing notes but has no formal mechanism to do so.⁹⁴ (Some public groups have encouraged communities with toxics problems to share their experiences. Through Montana People's Action, Milltown residents visited Anaconda.)

Local officials also had to coordinate information gathering and release with other groups. The designated liaison eased this task. Interactions through the media were generally positive; Missoula Health Department officials and local reporters have established good working relationships. One group that perhaps does warrant more

attention is the medical community. Milltown residents did contact their doctors about arsenic. Physicians with expertise in heavy metal poisoning could inform those without this experience, as well as county officials. Medical reports can also document health effects if gathered from the various doctors treating members of the community.

Overall the communication was effective in that there was not widespread panic, residents followed the warnings, and information did pass to and from the community. There were problems leading to confusion and frustration, rumors, and lapses of credibility. These problems resulted both from the nature of the arsenic information itself and the way that it was presented. While agency officials cannot change or control some of these, they can more actively use the available resources for work in Milltown. For instance, a staffer could map recent arsenic levels in area wells for easy reference.

Milltown residents continue to worry about their water. After the installation of the new system, the Health Department received calls complaining of bubbles and a petroleum smell. The bubbles were a normal occurrence in new lines; the petroleum was soap residue.⁹⁵ Residents need reassurance about the safety of their water. Some are also unsure of the hazards posed by other metals in the water. The Health Department can provide regular test results and continue to stay in touch with the community. The EPA is currently considering ways to handle the arsenic-laden dam sediments. Clear communication will be particularly important in presenting the health risk assessment that is part of this feasibility study.

The experience of Milltown raises questions of public policy. How should agencies gauge the level of risk before communicating it? What types of studies and data should be considered? How much is enough information to make an assessment? Though beyond the scope of this paper, clear answers to these questions provide the foundation for decisions relating to toxics.

What information should be communicated to the public? What technical information is appropriate? Should agencies pass along their judgments, or make the information available for public judgment, or both? Should they judge what the public ought to know or just respond to what it wants to know?

How can information be given in a non-threatening manner? How should information be communicated-- through community leaders, the media, written notices? How can it be coordinated?

Where does government responsibility end? What if people do not want to listen or do not choose to act on the information? How can agencies understand public concerns? To whom should they respond--only the most vocal? How can limited time and money be efficiently allocated for the safety of the public? The experience of Milltown illustrates the problems Montana will continue to face with toxics and public communication.

VI. Communication of Toxic Health Information

The following background will outline some points that communicators need to be aware of. The nature and availability of toxic information may pose problems. Technical information will affect, but not necessarily determine, people's perceptions of a problem. Communicators must treat each new situation as unique, but can apply the experience of other communities.

Toxic Information

Toxics pose particular communication problems because often a health effect or hazard cannot be described with certainty. Knowledge of toxic effects depends on scientific study in laboratories or of populations. These studies often do not provide definitive conclusions with respect to human health. Results from laboratory studies on animals have to be extrapolated with respect to dose and species. Epidemiological studies often cannot account for variations in duration and degree of exposure, nutrition, and other chemical contamination. Scientists' work include value judgments and assumptions⁹⁶ using models to describe reality. Scientists may disagree among themselves on the meaning of a given study. They may differ in model choice, interpretation, or in the degree of certainty needed. For instance with chemical carcinogens, extrapolations of dose-response relationships can be used to assess risk from very low doses. In the assessment of saccharin, depending on the model used, the predicted cancer risks range all the way from 0.001 to 1200 cases

per million people exposed to 0.0001% in their diet.⁹⁷

Defining a health hazard also requires exposure information which may be unavailable for a newly discovered hazard. The transience of the population can make it difficult to identify those exposed. Even if the medical effects of a chemical are known, the extent of possible harm to the public may still not be known.

Health information can be compiled and made available to communicators. The EPA and State library can perform literature searches through computer systems such as Medline and Toxline.⁹⁸ However, interpretation and compilation of relevant articles is still required. The State Department of Health and Environmental Sciences does maintain such centrally compiled files at this time.

Other information may simply not be available. Accurate studies of a single chemical can take many years. Thousands of chemicals have never been studied. Data are particularly lacking on the long-term effects of low level exposure to certain chemicals.

For many chemicals there are no set guidelines or standards for "safe" exposure that communicators can rely on. EPA is reluctant to make recommendations for controversial chemicals such as formaldehyde. Animal studies show formaldehyde causes cancer at low doses. Though EPA first declared regulation a top priority, the head of its toxic substances office later decided that this was unwarranted. Charging submission to industry influence, an environmental group sued. The agency is now again evaluating formaldehyde and considering ways to regulate it. While this process continues local health officials have to deal with this clearly hazardous chemical now.⁹⁹

Sometimes researchers use available data to assess the health risk from a particular hazardous material or situation. Risks can be described quantitatively in several ways--lifetime or annual, individual or population, absolute or relative.¹⁰⁰ For instance a lifetime cancer risk of 10^{-6} means that one in a million may possibly get cancer after 70 years of exposure. Though expressed quantitatively, these risk estimates are also based on models and assumptions and may not be as certain as they imply.

Decision makers use these risk assessments to set "safe" standards for society.¹⁰¹ Recent policy makers have attempted to separate "risk assessment" from "risk management," distinguishing between factual information about risk and judgments about acceptable risk.¹⁰² The role of risk assessment in public policy has been described and analyzed elsewhere.¹⁰³ The point here is that officials may have to explain health risk assessments and their uses. They may have to understand not only health information, but also the regulatory and decision making structure.

Risk Perception

While information presented affects how people perceive their risk, other factors also affect perceptions. The public sometimes perceives risks differently from scientists or health officials. An understanding of public perceptions can indicate to communicators what to address.

Risk is a dynamic cultural concept.¹⁰⁴ Individuals weigh risks and choose actions accordingly every day, from wearing a seat belt to

voting on a nuclear reactor. As a society people identify the most important risks deserving active response and regulation. Environmental contamination, toxic hazards, and cancer are particular concerns now.

Perceptions of the same chemical may vary. Arsenic often brings to mind "Arsenic and Old Lace" or visions of British murder mysteries. In the early days of Butte, women sought arsenic induced pale skin color. Some saw it as causing a Love Canal at Milltown.¹⁰⁵ In Three Forks, residents with naturally high arsenic have not complained to the State, though they are concerned.¹⁰⁶ Anacondans may weigh arsenic risk still differently since their jobs depended on the smelter producing the arsenic.

Perceptions vary based on a number of factors not necessarily related to technical information. Lowrance has identified some of these:¹⁰⁷

- whether risk is voluntary or involuntary,
- whether the effect is immediate or delayed
- whether alternatives are available
- whether risks are known with certainty
- whether exposure is essential or a luxury
- whether exposure is occupational or non-occupational
- whether the risk is common or dread
- whether average people will be affected or only very sensitive ones
- whether the risky process will be used as intended or has potential for abuse
- whether the consequences are considered reversible or not.

In the growing field of risk perception, researchers have begun to examine these factors. Sagoff suggests that people are less likely to assume involuntary risks because of invasion of their autonomy; rather than fearing some risks more than others, people resent some more than others.¹⁰⁸

A recent Science article described carcinogens found naturally in common foods and the importance of diet in protecting the body against these.¹⁰⁹ Lifestyle factors may account for 35% of cancers and environmental factors only 5%, but only 38% of the public sees any connection between lifestyle and cancer prevention. According to a recent study, environmental carcinogens received more media coverage than any other single factor. A science writer asked, "Was that because the overwhelming majority of news stories about cancer were based on fast-breaking news and only two percent were background stories? And was that in turn, the cause of the public misperception? Or is it simply because all of us--including reporters and editors--tend to worry less about self-imposed risks than we do about risks imposed on us by others?"¹¹⁰

Source credibility influences how people perceive risk. As Nelkin notes, "the acceptance of the authority of scientific judgment has coexisted with mistrust and fear."¹¹¹ The level of trust in governments, organizations, and the media will affect what individuals choose to believe.

The way risks are presented affects people's perceptions. Risks can be described as increased number of cancer deaths per population. They can be compared to each other, for instance, risk of death from arsenic exposure to that from cigarette smoking or automobile accidents.¹¹² An EPA communication guide suggests, "We...simply might say, 'the amount of benzene in your drinking water is...so small that your chance of getting cancer from exposure to it compares to the chance of the earth being wiped out by a supernova.'"¹¹³ Some feel

that the public is more likely to understand risk expressed in relative terms, that "although such comparisons are crude estimates at best, the magnitude of the error is not likely to be greater than the error of determining absolute risk."¹¹⁴ The comparisons made can however be used to imply that certain risks are acceptable.

Communicators need to be aware of these influences on public perception. They also need to be aware of their own perceptions and biases which color their expression of health information. Public perception of a problem will determine the degree of outcry and demand for action. Though they cannot dictate how much to worry, communicators' understanding of these perceptions will allow them to respond effectively.

Toxic Communication

Health officials have to meet varying communication goals and needs. The public may use some information in a policy decision, for instance, fluoridation of drinking water.¹¹⁵ A health board may have to decide how much money to spend regulating a waste site. Journalists may need to report the existence and significance of any of these actions. In other cases an agency may be issuing a health warning; a staffer may have to tell a community its drinking water is contaminated. The detail and content will vary with each of these situations.

Community concerns and needs vary. When people's health is threatened, they may see a need for immediate response. A New Hampshire woman whose son was poisoned by arsenic contaminated well

water reported, "I used to drive around living my own quiet myopic life...I had no reason to be concerned...When it comes home to roost, you'd be surprised how quickly private citizens become adept...."¹¹⁶

Officials may have to describe a possible health risk then explain an evaluation which considers other factors. In North Dakota EPA decided not to include a site with naturally occurring arsenic on its Superfund list. EPA response to hazardous waste sites at Anaconda and Butte differs because of differences in population size.¹¹⁷

Health communication requires consideration of ethics. All members of the public should have equal access to information. Sometimes people can choose exposure to risks only after "informed consent."¹¹⁸ In these cases communicators are obligated to share all relevant information.

Actions are communicative.¹¹⁹ When an official visits a well to test for arsenic, he or she is indicating a possible problem. The act itself may cause alarm and require some explanation and follow-up.

The task of communicating health risks and scientific information is not new. Incidents at Three Mile Island, Love Canal, and the current furor over AIDS, challenge the communication skills of both health officials and journalists. EPA has examined risk communication at a Superfund site in Florida.¹²⁰ Two other cases illustrate some problems both in warning the public and presenting information for decisions.

EDB, a widely used grain fumigant, was found to be carcinogenic. During the 1984 controversy over its regulation, the public faced conflicting opinions as to its hazard. The Grocery Manufacturers of

America said, "At the levels we're speaking of, the food was safe. People have been eating foods with EDB in them for 40 years and nobody has dropped dead." The Natural Resources Defense Council called EDB "one of the most potent carcinogens we know of."¹²¹ The EPA wanted to convey that this was not a crisis situation and that the FDA and states would monitor levels in food.¹²² In many states, setting stricter standards than EPA, officials destroyed food products such as muffin mixes and oatmeal. A study of public communication concluded that EPA was "talking at macro risk levels--that is risk to society as a whole. The news media and the listeners, however, were struggling...(with) the micro risk--the risk the individual faces from eating a bran muffin laced with EDB."¹²³

In 1983 EPA proposed new regulations on arsenic emissions from the Tacoma, Washington smelter. In an innovative move, the agency asked for the public's opinion on the most appropriate control. The regulations would require changes in the existing "hoods" and "scrubbers" which remove arsenic. The control options, including adding hoods, scrubbers, or a whole new process, each had a different associated cost and effectiveness. For each control EPA eventually estimated arsenic emissions, health risk (expressed as increased deaths in a 2 mile radius), and cost. At first EPA was unsure of its numbers and admitted this to the public. According to the supervising EPA official, people did not want to hear about the uncertainty and were willing to accept best professional opinions. They also wanted the risk compared to other familiar hazards such as saccharine or failure to wear seatbelts.¹²⁴ Emotions ran high at the hearings, and

though some described the debate as "jobs versus health," union members, neighboring residents, and environmentalists were able to work together. The public consensus favored a control option more stringent than EPA required. The plant closed before the agency made a final decision, but the process provided valuable experience in communication. As more communities experience hazardous waste problems and choose action, information needs and effective communication styles will become more apparent. Meanwhile Montanans can begin to address the issues raised by toxics here.

VII. Recommendations for Future Sites

Montanans will continue to need health information about toxics, especially heavy metals. Each local health department should not have to begin anew to assess heavy metal impacts. The State Department of Health and Environmental Sciences should designate a toxics coordinator at the director level. This person would keep updated on toxics problems within the state, compile health information, and respond to health questions from the public and the department. Staffers at the Departments of Agriculture and Natural Resources and Conservation and County Extension offices can also use toxic information. The coordinator would maintain communication with EPA on Montana Superfund sites.

Known information about ongoing hazards such as arsenic should be compiled at this office. The Health Department's data base should be updated quarterly through the State library. Files should include acute, chronic, and long-term effects of exposure from air, water, and soil. A Telnet system could allow communication with other communities facing similar problems. A list of medical experts on heavy metals should be assembled. Summary documents on each metal should explain understandably but fully the possible effects of exposure, with comparisons to known levels in each area.

At the local level, once a problem is seen to be ongoing, one person should be designated to coordinate communication with agencies, the media, and the public. This person should be responsible for setting up communication channels with the public and identifying

concern. Site specific information should be prepared.

Some sites will be under EPA jurisdiction, others not. Coordination and support will minimize duplication of efforts. Clear policy guidelines should delineate responsibility and a flexible approach to communication spelled out. Staffers should consider whether to present health risks numerically or relatively or both. Agencies should also agree on the goals and needs of health studies and testing. Attention to these general communication guidelines can serve as a beginning:

Know the goals of the communication and how the information is to be used.

Know the audience. Respond actively.

Define agency responsibilities and liabilities and those of the public.

Define individual and department perception of the severity of the chemical problem and the bases for those perceptions.

Follow through on promised answers and test results.

Be honest and straightforward. Do not hide behind numbers. Be willing to admit uncertainty, but also be willing to use available information and experience to express judgments.

Anticipate information needs.

Have information accessible and available to the public and the media. Update it regularly.

These common sense actions can aid response and coordination.

Montana, because of its small population, has the opportunity to respond directly on a local level. Local ability to respond will vary; ultimately effectiveness depends on responsible, responsive individuals at every level. The support of the State is crucial. Its policies should reflect a commitment to addressing toxic contamination

in a coordinated thorough fashion, making health protection a priority. Its actions should support this commitment with time and money and with the appointment of a designated toxics coordinator.

Footnotes

¹"Poison wells pose threat," Missoulian, 26 November 1984, citing an Office of Technology Assessment report.

²"Report: Dangers of toxic waste underestimated," Missoulian, 10 March 1985.

³"River study finds elevated metal levels," Missoulian, 20 April 1985.

⁴"Arsenic detected in youths living near old smelter," Missoulian, 10 July 1985. ✓

⁵"Deer carcass prompts arsenic warning," Missoulian, 24 November 1984.

⁶William W. Woessner and Johnnie Moore and others, Arsenic and Water Supply Remedial Action Study: Milltown, Montana, July 31, 1984. ✓

⁷Robert Peccia and Associates, "Milltown Water Supply and Distribution System Study," December 1983. ✓

⁸For a review, see National Research Council, Drinking Water and Health, National Academy of Sciences, volume 1, 1977, pp.316-344.

⁹For a review, see National Research Council, Arsenic (Medical and Biological Effects of Environmental Pollutants), National Academy of Sciences, 1977.

¹⁰M.D. Kipling reviews human arsenic use in "Arsenic" in The Chemical Environment (Environment and Man Volume 6), ed. John Lenihan and William W. Fletcher, Academic Press, 1977.

¹¹Environmental Protection Agency, "Wood Preservatives/ Pesticides", Federal Register Part 11, 18 October 1978.

¹²Personal communication, Jane Werholtz, Attorney, Environmental Protection Agency, 11 May 1985 and 9 July 1985. She indicated that they would probably use a worst case scenario.

¹³National Research Council, (NRC), Arsenic, cited in note 9, p.176.

¹⁴Kipling, cited in note 8.

¹⁵NRC, Arsenic, cited in note 9, p.177.

¹⁶NRC, Arsenic, cited in note 9.

¹⁷NRC, Arsenic, cited in note 9, p.207.

- ¹⁸NRC. Arsenic, cited in note 9, p.193.
- ¹⁹EPA cited in note 11.
- ²⁰NRC. Drinking Water and Health, cited in note 8, p.323.
- ²¹NRC. Arsenic, cited in note 9, p.182.
- ²²NRC. Arsenic cited in note 9, p.329.
- ²³Environmental Protection Agency, "Arsenic: Ambient Water Quality Criteria Document," Washington, D.C., December 1979, p. C-58.
- ²⁴This standard assumes consumption of 2l of drinking water and 18.7g fish and shellfish. EPA, "Water Quality Criteria Document," p. C-59.
- ²⁵22ng/l is equivalent to 0.00022mg/l.
- ²⁶J.R. Goldsmith et al. "Evaluation of Health Implications of Elevated Arsenic in Well Water," Water Research, Pergamon Press, 1972, Volume 6, pp 1133-1136.
- ²⁷J. Malcom Harrington et al., "A Survey of a Population Exposed to High Concentrations of Arsenic in Fairbanks, Alaska," American Journal of Epidemiology:108(5):377-385, 1978.
- ²⁸Jane L. Valentine, Han K. Kang, and Gary Spivey, "Arsenic Levels in Human Blood, Urine, and Hair in Response to Exposure via Drinking Water," Environmental Research 20:24-32,1979.
- ²⁹J.W. Southwide et al "Community Health Associated with Arsenic in Drinking Water in Millard County Utah" Project summary EPA-600/S1-81-064, February 1982.
- ³⁰Valentine, cited in note 28.
- ³¹National Academy of Sciences, Drinking Water and Health, p.343, cited in note 8.
- ³²Kevin Miller, "Hair-fingernail tests planned in arsenic contamination probe," Missoulian, 23 December 1981, p.9. ✓
- ³³David Feffer, as quoted by Kevin Miller, "Arsenic probe is stepped up, warning issued," Missoulian, 16 December 1981, p.1. ✓
- ³⁴ Interview with David Feffer, Health Incentives, Inc., Missoula, Montana, 7 March 1985.
- ³⁵Environmental Protection Agency, "Community Relations in Superfund: A Handbook," Interim Version, September 1983.

- ³⁶ Explaining the concept of pH was not easy itself.
- ³⁷ Interview with Jim Dunn, Environmental Protection Agency, Helena, Montana, 12 March 1985.
- ³⁸ Vic Andersen, Montana Department of Health and Environmental Sciences, Helena, Montana, 22 July 1983, News release. ✓
- ³⁹ The King and Pierce County Health Departments have dealt extensively with heavy metal contamination because of fallout from the Tacoma smelter.
- ⁴⁰ Interviews with Dan Corti, Missoula City County Health Department, Missoula, Montana, 24 September 1984 and 3 September 1985.
- ⁴¹ Dan Corti, in an interview 30 October 1984, said that he found bacterial problems were much more straightforward and easier to communicate.
- ⁴² According to a survey done a year ago, 53% of subscribers get their local news primarily from the Missoulian. 47% of non-subscribers rely on television. Personal communication, Carrie Chadwell, Missoulian, 26 February 1985.
- ⁴³ Missoulian, 16 December 1981, cited in note 33.
- ⁴⁴ Kevin Miller, "Quantity and toxicity of arsenic in Milltown tops previous levels," Missoulian, 22 December 1981, p.1.
- ⁴⁵ Kevin Miller, "Choose your answer to effect of arsenic problem," Missoulian, 27 December 1981, p.9.
- ⁴⁶ Garry J. Moes, "Arsenic found in Milltown gardens," Missoulian 23 July 1983, p.1.
- ⁴⁷ Letter by Susan Rogers, "Milltown situation awful," Missoulian, 15 December 1982, p.6.
- ⁴⁸ Letter by Lisa Fleischer, "Help Milltown with pollution," Missoulian, 11 February 1983, p.4.
- ⁴⁹ Steve Woodruff, "Milltown drilling for water," Missoulian, 6 September 1983, p.9.
- ⁵⁰ For instance, Steve Woodruff, "Arsenic sought: Drillers working near Milltown," Missoulian, 6 April 1983, p.1. ✓
- ⁵¹ Interview with Roger Fuhrman, KECI-TV, 26 February 1985.
- ⁵² News director Suzanne Lagoni allowed me to review the stations old scripts.

- ⁵³Script from KPAX broadcast, 3 October 1982. Jami Harrison reporting.
- ⁵⁴Script from KPAX broadcast, 8 November 1982.
- ⁵⁵Script from KPAX broadcast, 2 June 1982, Ian Marquand reporting.
- ⁵⁶I spoke with representatives of KDXT, KGRZ, KGVO, KUFM, KYLT, KYSS, and KZOQ.
- ⁵⁷Interview with Glen Schmidt, KGRZ, 25 January 1985.
- ⁵⁸Interview with Steve Woodruff, Missoulian, 5 February 1985.
- ⁵⁹Interview with Kevin Miller, former Missoulian reporter, Oregon, 13 February 1985.
- ⁶⁰Interview with Jim Dunn, EPA, cited in note 37.
- ⁶¹Interview with Elaine Bild, Missoula City County Health Department, Missoula, Montana, 25 February 1985.
- ⁶²Interview with Jim Melstad, Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, Montana, 13 March 1985.
- ⁶³Interview with David Feffer, cited in note 34.
- ⁶⁴Interview with Johnnie Moore, Department of Geology, University of Montana, 7 March 1985.
- ⁶⁵Interview with Bill Woessner, Department of Geology, University of Montana, Missoula, 27 January 1985.
- ⁶⁶Montana People's Action, "Action Line," Volume 1, Number 1, August 1983. ✓
- ⁶⁷Ibid.
- ⁶⁸"We're Tired of Being Guinea Pigs: A Handbook for Citizens on Environmental Health in Appalachia." Highlander Institute, 1980.
- ⁶⁹Lisa Fleischer, "Health Study of Milltown, Montana," Montana Public Interest Research Group, June 1983.
- ⁷⁰Interview with C.B. Pearson.
- ⁷¹Interview with David Feffer, cited in note 34.
- ⁷²Interview with Jim Dunn, EPA, cited in note 37.
- ⁷³Interview with Elaine Bild, Missoula City-County Health

Department, 25 February 1985.

⁷⁴Interview with Kevin Miller, cited in note 59.

⁷⁵Interview with Steve Woodruff, cited in note 58.

⁷⁶Interview with Kevin Macki, KPAX, 5 February 1985.

⁷⁷Interview with Glen Schmidt, cited in note 57.

⁷⁸Interview with Secky Fascione, Montana People's Action, Missoula, Montana, 31 January 1985.

⁷⁹Ibid. Secky Fascione also commented that MPA has organized more around health issues in Anaconda. Since many residents worked for the Anaconda company, organizers could not use an attack on industry as its primary tactic. Anacondans also have more obvious physical and mental disabilities from heavy metal exposure.

⁸⁰Interview with C.B. Pearson, MontPIRG, 26 February 1985.

⁸¹David Roach, "Contamination leaves residents perplexed," Missoulian 16 December 1981, p.9.

⁸²KPAX script, 8 November 1982.

⁸³Kevin Miller, cited in note 32.

⁸⁴Secky Fascione, cited in note 78.

⁸⁵Although the Milltown situation is relatively uncomplicated by occupational conflicts, one resident still feared "badmouthing" "The Company," (referring to Anaconda and its possible responsibility for the metal sediments). Researchers should respect the sensitivity of these areas.

⁸⁶Interview with Elaine Bild, 25 February 1985.

⁸⁷Interview with Jim Dunn, cited in note 37.

⁸⁸Interview with Secky Fascione, cited in note 78.

⁸⁹Interview with Jim Dunn, cited in note 37.

⁹⁰Interview with Barb Karlsen, Solid Waste Bureau, Montana Department of Health and Environmental Sciences, 12 March 1985.

⁹¹Interview with Elaine Bild 6 March 1985.

⁹²Interview with Daphne Gimmel, EPA, Washington, D.C., 30 October 1984.

⁹³Interview with Barb Karlsen, cited in note 90.

⁹⁴Interview with Jim Dunn cited in note 37.

⁹⁵Interview with Dan Corti.

⁹⁶In study cited by Ian Barbour, members of technology assessment teams disagreed widely about value judgments in assessments. "Some insisted that professionals make great efforts to produce objective value-free reports. Others said that objectivity is impossible and the only way to obtain evenhanded reports is to be sure that a variety of different biases is represented. The study concludes that value-laden decisions are inescapable at a number of points in assessment procedures. Technology, Environment, and Human Values. Praeger Publishers, 1980, p.201.

⁹⁷Stephen L. Brown, "Quantitative Risk Assessment of Environmental Hazards," in Annual Review of Public Health Volume 6, 1985, p.255. Brown also describes other modelling problems here. Ricci and Molton also describe various cancer models and their uncertain application in "Regulating Cancer Risks," Environ. Sci. Technol. Volume 19, No. 6, 1985, pp. 473-479.

⁹⁸Other systems include MEDLARS and Enviroline, through data bases such as Dialogue and BRS.

⁹⁹Marjorie Sun, "Formaldehyde: Back to Square One," Science 224:968-69, 1 June 1984. Elaine Bild has noted the problems the health department has had telling realtors about possible formaldehyde hazards in basements of houses. Interview 6 March 1985.

¹⁰⁰Stephen Brown, as cited in note 97, suggests that assessments can be counterproductive if they "suggest too much certainty" or paralyze "action by revealing uncertainty in the data base."

¹⁰¹See Stephen Brown, cited in note 97 and Ricci and Molton, cited in note 97.

¹⁰²William Ruckelshaus described the EPA's approach in a 1984 speech at Princeton University. "Risk in a Free Society: A Reservoir of Trust." Vital Speeches of the Day, Vol. L, No. 12, April 1 1984, pp. 83-87.

¹⁰³EPA's use of risk assessment in health policy has been criticized. See for example, Bob Yuhnke, "EPA's Risk Assessment Process...A Critique," The Environmental Forum, July 1985, pp.19-24.

J.L. Regens et al review risk and policy in "Risk assessment in the policy making process: Environmental health and safety protection," Public Administration Review, 43: 137-145, Mr/Ap 1983.

Dorothy Nelkin and Michael Pollak describe the politics of risk in "Problems and Procedures in the Regulation of Technological Risk" in Making Bureaucracies Work, edited by Carol H. Weiss and Allen

H. Barton, Sage Publications, 1979, pp.259-278.

¹⁰⁴Mary Douglas and Aaron Wildavsky in "Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers," (University of California Press, 1981), explore risk from a cultural and social point of view. They note that risk is socially selected and that each culture is biased toward or away from certain risks. Risk debate, therefore, is a record of cultural change.

¹⁰⁵George Ochensky, "Love Canal on the Clark Fork--The Toxic Waste Time Bomb." Montana, November-December 1984, p.15.

¹⁰⁶Jim Melstad, Water Quality Bureau, Montana Department of Health and Environmental Sciences, Interview 13 March 1985.

¹⁰⁷William Lowrance, Of Acceptable Risk, (Los Altos, CA: W. Kaufmann), 1976.

¹⁰⁸Mark Sagoff, "On Markets for Risk," Maryland Law Reveiw 41(14):755, 1982.

¹⁰⁹Bruce N. Ames, "Dietary Carcinogens and Anticarcinogens," Science, 221:1256-1264, 23 September 1983.

¹¹⁰Howard Lewis, "Health risk coverage adds new edge to old problem," Newsletter of the National Association of Science Writers, November 1984, pp.1-4.

¹¹¹Dorothy Nelkin, editor, Controversy: The Politics of Technical Decisions, Sage Publications, 1979, p.10. This work includes 12 case studies of technological conflict and political debate.

¹¹²Cohen and Lee gathered information on various risks and expressed them in terms of loss of life expectancy. For instance for an individual loses 10 minutes for smoking a cigarette and 0.1 minutes for every mile driven with an unfastened seat belt. See "A Catalog of Risks." Health Physics, 36 (June 1979): 707-722. Richard Wilson compares activities which increase chance of death by one in a million, for instance smoking 1.4 cigarettes, eating 40 tablespoons of peanutbutter or 100 charcoal broiled steaks, and drinking 30 12 ounce cans of soda. See "Analyzing the Risks of Daily Life." Technology Review, February 1979, pp. 41-46.

¹¹³Frank Corrado, "Communication with the public on health effects," EPA Communication manual, p.75.

¹¹⁴David Eaton, "Human Health Effects of Increased Herbicide Use: Perceived Vs. Actual Risks," "Environmental Outlook," Institute for Environmental Studies, University of Washington, 12(1), January 1984.

¹¹⁵The flouride controversy continues, exemplifying the role of technical information in decisions. See for example, Bill Stimson

and Cheryl Ernst. "The great flouride debate." Spokesman Review, Spokane, Washington, 22 October 1984, p.12.

116. "A Town is Troubled by Toxic Wells and Pits," New York Times, 23 August 1981, p.6.

117. John Wardell, Environmental Protection Agency Region VIII, "How Clean is Clean Enough?" Presentation at the Pacific Division American Association for the Advancement of Science 66th Annual Meeting, Missoula, Montana, June 11, 1985.

118. Barbour, cited in note 96, describes ethical issues in regulating risk (pp.181-184), some of which also apply to communicating risk. He feels that "free informed consent" to risks from environmental toxics is "totally unrealistic," since "even when people are aware that there are risks, they have great difficulty evaluating complex statistical data, and little opportunity to choose their level of exposure."

119. Dr. Paul Miller, Department of Sociology, University of Montana, suggested to me the relevance of this concept at Milltown. Personal communication, 21 October 1985.

120. Frederick Allen, Environmental Protection Agency, Office of Policy Planning and Evaluation, Washington D.C. Interview 1 November 1984.

121. Howard Lewis, National Association of Science Writers, cited in note 110.

122. Frederick B. Fields, Office of Policy Planning and Evaluation, EPA, "Educating the Public on the Meaning of Risk Assessment," Speech given at the Environmental Risk Assessment Conference, Arlington, Virginia, 2 November 1984.

123. Ibid.

124. Ed Coate, Deputy to the Director, EPA, Region X, Seattle, Washington, interviewed 17 July 1984, under an internship with KCTS-TV, Seattle. He also noted how hard it was for toxicologists to actually say "deaths."

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Appendix

Resident Questionnaire

On April 2, 1985 I delivered questionnaires to 28 Milltown households. At 15 I spoke directly with the residents, leaving questionnaires at the doors of the others. I returned April 4 and picked up 12 questionnaires. I left return mail envelopes after speaking with occupants of 6 other households. I also left envelopes at 10 other residences where no one was home. I received 7 of these in the mail, a final return of 19 out of 28 (68%). (Two of the 28 houses may actually have been unoccupied at the time.)

The following pages include the cover letter, complete questionnaire, and compiled results. For each question, tabulated responses and other comments are reported. Though most respondents followed the instructions, some marked more than one answer where only one was requested. Three and sometimes four respondents skipped the backs of the pages. Thus total responses and total respondents are indicated for each question. Percentages are based on the total responses.



University of Montana

Missoula, Montana 59812

Nancy Heil
Department of Environmental
Studies

April 2, 1985

Dear Milltown Resident,

As you probably know, metals can sometimes contaminate drinking water. When this happens, public agencies need to inform communities of any precautions to take or possible dangers. However these agencies may not always understand what the public wants or needs to know. I am examining communication in communities facing metal contamination. From information you provide, future Montanans facing these problems will benefit and receive accurate, understandable information from agencies.

I am asking for your help. Because of the arsenic contamination of Milltown's wells, you have dealt directly with many problems. This study depends on understanding your experiences dealing with arsenic information. I will be asking how you got information, what concerns you had about it, and what changes it made in your life. Your answers to these questions are valuable; each household's answers are important. Please ask one adult in your household to respond.

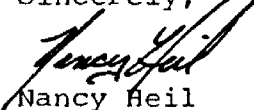
Your responses will be kept confidential. The identification number at the top of each questionnaire is only used to keep track of household response. Your name or address will never appear on the questionnaire or in print for public view.

The results of this study will be available to public agencies that deal with metal contamination. If you would like a summary of the results, place your name and mailing address on the back of this letter and return it with your questionnaire.

I will be returning Thursday evening to pick these up and answer any questions. You may also call me at 243-5886 if you have any questions or problems.

Thank you for your help.

Sincerely,



Nancy Heil
Researcher

A-2

Equal Opportunity in Education and Employment

MILLTOWN RESIDENT SURVEY

Please place a check by one answer for each question, unless otherwise indicated. Feel free to add any comments to your answers.

1. How did you first hear of Milltown's arsenic problem?

- FRIEND OR NEIGHBOR
- MEDIA (NEWSPAPER, RADIO, OR TV)
- HEALTH DEPARTMENT NOTICE
- OTHER Please specify: _____

2. Do you feel well-informed about progress on the new water system?

- YES, USUALLY
- NO, NOT USUALLY

3. How do you usually keep informed about progress on the water system?

- FRIEND OR NEIGHBOR
- COMMUNITY MEETING
- MEDIA (NEWSPAPER, RADIO, OR TV)
- HEALTH DEPARTMENT NOTICES
- OTHER Please specify: _____

4. Since the arsenic discovery, how important have these concerns been to you? (Please circle your answer for each.)

Quality of the neighborhood....	VERY IMPORTANT	IMPORTANT	NOT IMPORTANT
Difficulty and inconvenience of hauling water.....	VERY IMPORTANT	IMPORTANT	NOT IMPORTANT
My personal health.....	VERY IMPORTANT	IMPORTANT	NOT IMPORTANT
Value of my personal property..	VERY IMPORTANT	IMPORTANT	NOT IMPORTANT

5. Which one of these have you been most concerned about?

- QUALITY OF THE NEIGHBORHOOD
- DIFFICULTY AND INCONVENIENCE OF HAULING WATER
- MY PERSONAL HEALTH
- VALUE OF MY PERSONAL PROPERTY
- NONE
- OTHER Please specify: _____

6. Did you ever consider moving because of the arsenic problem?

- YES
- NO

7. Which of the following do you think best describes your community?

- EVEN WITH THE ARSENIC PROBLEM, MILLTOWN IS AN EXCELLENT PLACE TO LIVE.
- THE ARSENIC PROBLEM HAS HAD SOME NEGATIVE EFFECTS, BUT OTHER MORE IMPORTANT QUALITIES STILL MAKE MILLTOWN A GOOD PLACE TO LIVE.
- THE ARSENIC PROBLEM IS A REAL THREAT; NO ONE SHOULD LIVE HERE.
- ARSENIC IS JUST ONE OF MANY PROBLEMS FACING MILLTOWN THAT MAKE IT AN UNDESIRABLE PLACE TO LIVE.

8. Do you believe that you, acting as an individual, can help end the arsenic problem?

- YES
- NO

9. Do you believe that you, co-operating with your neighbors, can help end the arsenic problem?

- YES
- NO

The next four questions ask about changes in how you use your well water, since the arsenic discovery.

10. Does anyone in this household presently drink the water from your well?

- YES
- NO

If NO, when and why did you stop drinking the water? (I would like to know what information from what source caused you to stop.)

- I NEVER DRANK THE WATER.
- BEFORE THE ARSENIC WAS DISCOVERED. When and why? _____
-
- WHEN ARSENIC WAS DISCOVERED AND WARNINGS WERE ISSUED.
- SOMETIME AFTER THE INITIAL ARSENIC DISCOVERY. When and why? _____
-

11. Do you use your water for any of these activities? (Please check all that apply.)

- COOKING
- BATHING
- WASHING DISHES
- DOING LAUNDRY

12. Do you garden?

YES

NO

If YES, have your gardening habits changed since the arsenic discovery?

YES Please describe: _____

NO _____

13. If you have any children living at home, do you restrict any of their outside activities because of the arsenic?

YES Please describe: _____

NO

I DON'T HAVE ANY CHILDREN LIVING AT HOME.

The next questions ask about arsenic and information about your health.

14. What do you think about the amount of information you received concerning precautions to take with your water?

I WOULD HAVE LIKED MORE INFORMATION. Please specify:

_____ I RECEIVED ENOUGH INFORMATION.

I WOULD HAVE LIKED LESS INFORMATION.

I NEVER RECEIVED ANY INFORMATION.

15. What do you think about the amount of information you received concerning any possible health risks from arsenic in the water?

I WOULD HAVE LIKED MORE HEALTH INFORMATION. Please specify:

_____ I RECEIVED ENOUGH INFORMATION.

I WOULD HAVE LIKED LESS INFORMATION.

I NEVER RECEIVED ANY INFORMATION.

16. Have you ever tried on your own to find information about arsenic and human health?

YES

NO

17. Have you ever asked your doctor about arsenic and your health?

YES

NO

18. If you had a question about a health effect of arsenic, who would you probably ask first?
- FRIEND
 DOCTOR
 LIBRARIAN
 HEALTH DEPARTMENT OFFICIAL
 OTHER Please specify: _____
19. How would you prefer to be informed of any new health information?
- PHONE CALLS
 COMMUNITY MEETINGS
 WRITTEN NOTICES
 PERSONAL CONTACTS
 OTHER Please specify: _____
20. In the future, if the local health department again recommended that you stop using your water, would you follow its advice?
- YES, PROBABLY
 NO, PROBABLY NOT
21. Do you think that there is enough arsenic in your water to make you sick right after drinking it?
- YES
 NO
22. Do you think that there are any health problems that can result from being exposed to small amounts of arsenic for a long time?
- YES, AND I KNOW OF SOME. Please list: _____
 YES, I KNOW THERE ARE SOME, BUT I'M NOT SURE WHAT THEY ARE.
 NO, I DON'T THINK THERE ARE ANY.
23. Do you think that there are any signs of arsenic exposure in humans?
- YES, AND I KNOW OF SOME. Please list: _____
 YES, I KNOW THERE ARE SOME, BUT I'M NOT SURE WHAT THEY ARE.
 NO, I DON'T THINK THERE ARE ANY.
24. In your opinion, do medical experts agree on the long term (20 or more years) effects of drinking water containing small amounts of arsenic?
- YES
 NO

25. Do you know of anyone in Milltown who has gotten sick from arsenic in the water?

- YES
- NO

26. Do you feel that arsenic has ever made you sick or contributed to any health problems?

- YES Please describe: _____
- NO

27. Do you worry about you or anyone in your household getting sick from having drunk the water?

- I'M NOT AT ALL CONCERNED.
- I'M A LITTLE WORRIED.
- I'M VERY WORRIED.
- I DON'T THINK ABOUT IT MUCH.

28. Suppose that you continued drinking arsenic contaminated water. Do you think that the following activities are more or less likely to have bad effects; in other words, are they more or less risky? (Please circle your answers.)

	Compared to drinking arsenic contaminated water		
	MORE RISKY	LESS RISKY	SAME RISK
Smoking cigarettes.....	MORE RISKY	LESS RISKY	SAME RISK
Driving on the highway.....	MORE RISKY	LESS RISKY	SAME RISK
Breathing polluted air.....	MORE RISKY	LESS RISKY	SAME RISK
Working at a dangerous job.....	MORE RISKY	LESS RISKY	SAME RISK
Boating.....	MORE RISKY	LESS RISKY	SAME RISK

29. Do you agree or disagree with this statement? Arsenic makes Milltown a dangerous place to live.

- STRONGLY AGREE
- AGREE
- DISAGREE
- STRONGLY DISAGREE

31. Do you think anyone knows how long arsenic has been in the water?

- YES
- NO

32. Which of the following do you think is the most likely source of the arsenic in the water?

- AN OLD LANDFILL
- RUNOFF FROM CHAMPION
- SEDIMENTS BEHIND MILLTOWN DAM
- BLACKFOOT RIVER

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33. Do you know of any other metals in your water?

- YES Please list: _____
 YES, I KNOW THERE ARE SOME, BUT I'M NOT SURE WHAT THEY ARE.
 NO

34. Once the new water system is operating, will you have any concerns about arsenic in your life?

- YES Please describe: _____
 NO

Finally I'd like to ask you some questions about yourself to help interpret the results.

35. Have you been involved with community efforts to solve the water problem?

- YES, VERY INVOLVED
 YES, MODERATELY INVOLVED
 NO, NOT AT ALL INVOLVED

36. Have you ever attended a community meeting or hearing related to the arsenic problem?

- YES
 NO

If YES, have you attended one of these meetings in the past year?

- YES
 NO

37. Since the arsenic discovery, have you written letters or made phone calls requesting or supporting action?

- NEVER
 ONCE OR TWICE
 A FEW TIMES (3-6)
 OFTEN

38. How many people live in your household? (Include yourself.)

39. Please list the ages of the other members of your household.

40. How old are you?

41. How many years have you lived in Milltown?

42. What is the highest level of formal education you have completed?

- NO FORMAL SCHOOLING
- SOME GRADE SCHOOL
- COMPLETED GRADE SCHOOL
- SOME HIGH SCHOOL
- COMPLETED HIGH SCHOOL
- SOME COLLEGE OR POST HIGH SCHOOL
- COLLEGE DEGREE
- GRADUATE WORK OR GRADUATE DEGREE

Is there anything you would like to add about your experiences with arsenic information?

Thank you for taking the time to fill this out.

Nancy Heil
Department of Environmental Studies
University of Montana
Missoula, Montana 59812
(243-5886)

Questionnaire Results

1. How did you first hear of Milltown's arsenic problem?

	#	%
FRIEND	8	38
MEDIA	4	19
HEALTH DEPT.	7	33
OTHER	2	10
Total responses	21	
Total respondents	19	

Double answers:
media/health dept.
media/friend

Other: landlord, realtor

2. Do you usually feel well-informed about progress on the new water system?

	#	%
YES	10	53
NO	9	47
Total responses	19	
Total respondents	19	

Other comments: "I've only lived here since January." (4)

3. How do you usually keep informed about progress on the water system?

	#	%
FRIEND	7	27
COMM. MEETING	6	23
MEDIA	9	35
HEALTH DEPT.	2	8
OTHER	2	8
Total responses	19	
Total respondents	19	

Double answers:
2 friend/media
1 media/comm. meeting
1 media/health dept.
1 All of the above

Other: "letter from the state health board"
"We don't."

4. Since the arsenic discovery, how important have each of these concerns been to you?

	VERY IMP.		IMPORTANT		NOT IMP.		Total responses
	#	%	#	%	#	%	
NEIGHBORHOOD QUAL.	5	31	9	56	2	13	16
INCONVENIENCE	15	83	3	17	0	0	18
PERSONAL HEALTH	15	79	4	21	0	0	19
PERS. PROPERTY	10	53	7	37	2	11	19
Total respondents	19						

Other comments: One who listed personal property as not important said, "renting." (19)

"Water leaves a residue on everything from plastic to fine china and woodwork one's washed with." (4)

N.B. The questions in this section are in abbreviated form.

5. Which one of these have you been most concerned about?

	#	%
NEIGHBORHOOD QUAL	0	0
INCONVENIENCE	6	29
PERSONAL HEALTH	13	62
PERS. PROPERTY	2	10
NONE	0	0
OTHER	0	0
Total responses	21	
Total respondents	19	

Double answers:
pers.health/incon.
pers.health/pers.prop.

Other comments: "After the new well is in, some will still have to continue hauling their own water because the pipes are corroded within the houses." (4)

6. Did you ever consider moving because of the arsenic problem?

	#	%
YES	8	42
NO	11	58
Total responses	19	
Total respondents	19	

Other comments: "Obviously since I just moved here 4 months ago, I'm not too anxious to move again. I do hope for better water to bathe in although I doubt I will ever drink any water from any well out here." (4)

"I did move." (12)

7. Which of the following do you think best describes your community?

- A. EVEN WITH THE ARSENIC PROBLEM, MILLTOWN IS AN EXCELLENT PLACE TO LIVE.
- B. THE ARSENIC PROBLEM HAS HAD SOME NEGATIVE EFFECTS, BUT OTHER MORE MORE IMPORTANT QUALITIES STILL MAKE MILLTOWN A GOOD PLACE TO LIVE.
- C. THE ARSENIC PROBLEM IS A REAL THREAT, NO ONE SHOULD LIVE HERE.
- D. ARSENIC IS ONE OF MANY PROBLEMS FACING MILLTOWN THAT MAKE IT AN UNDESIRABLE PLACE TO LIVE.

	#	%
EXCELLENT	5	28
GOOD	9	50
THREAT	2	11
UNDESIRABLE	2	11
Total responses	18	
Total respondents	15	

Double answers:
exc./good
threat/undes.
threat/undes., changed to
des.

Other comments: One changed undesirable place to "desirable place to live and clean up." (4)

8. Do you believe that you, acting as an individual, can help end the arsenic problem?

	#	%
YES	3	20
NO	11	73
Not sure	1	7
Total responses	15	
Total respondents	15	

Other comments: "I believe the arsenic is in the ground and will remain there polluting all wells eventually." (4)

9. Do you believe that you, cooperating with your neighbors can help end the arsenic problem?

	#	%
YES	12	80
NO	3	20
Total responses	15	
Total respondents	15	

Other comments: "hopefully" (16)

10. Does anyone in this household presently drink the water from your well?

	#	%
YES	0	0
NO	16	100
Total responses	16	
Total respondents	16	

Other comments: "Except our dog." (23)

If NO, when and why did you stop drinking the water?

I NEVER DRANK THE WATER.
BEFORE THE ARSENIC WAS DISCOVERED.
WHEN THE ARSENIC WAS DISCOVERED AND WARNINGS WERE ISSUED.
SOMETIME AFTER THE INITIAL ARSENIC DISCOVERY.

	#	%
NEVER	5	31
BEFORE DISCOVERY	2	13
WHEN WARNED	9	56
AFTER WARNED	0	0
Total responses	16	
Total respondents	16	

Other comments: Before: "Since we lived here. It smelled horrible and had a rusty color." (10)

"Around four years ago. It always had a lousy taste." (13)

When warned: "Health board." (5)

"A neighbor had samples tested summer of '81 in August. When she got her reply from the state she warned me not to use it." (15)

"No good for health." (20)

Never: "Moved here after the discovery." (16)

11. Do you use your water for any of these activities?

	#	%	
BATHING	15	37	11 bathing, washing, laundry
WASHING DISHES	15	37	3 bathing and washing dishes
DOING LAUNDRY	11	27	1 bathing only
COOKING	0	0	1 washing dishes lonly
Total responses	41		
Total respondents	16		

Other comments: Bathing: "Have had qualms about this; surely one absorbs a certain percentage thru one's pores during a bath?" (4)
 "Usually go to relatives." (10)
 Laundry: "When minerals in water not so bad." (15)

12. Do you garden?

	#	%
YES	6	32
NO	13	68
Total responses	19	
Total respondents	19	

If YES, have your gardening habits changed since the arsenic discovery?

	#	%
YES	3	60
NO	2	40
Total reponses	5	
Total respondents	5	

Other comments: "Returned to grass, not used." (12)
 "This will be the first year I've gardened out here so I'll have to have soil tested and treat accordingly." (4)
 "Haven't grown a garden yet but plan to this year." (17)
 "Not sure if safe to use water in garden growing food." (18)

13. If you have any children living at home, do you restricy any of their outside activities because of the water?

	#	%	% w/children restricting
YES	4	22	36
NO	7	39	64
NO CHILDREN	7	39	--
Total responses	18		
Total respondents	18		

Other comments: "No swimming or use of water." (15)
 "No more swimming pool." (10)
 "Never let them do anything with water." (16)
 "Summertime activities with water." (17)
 "It doesn't have anything to do with children playing outside!" (21)

14. What do you think about the amount of information you received concerning precautions to take with your water?

- I WOULD HAVE LIKED MORE INFORMATION.
- I RECEIVED ENOUGH INFORMATION.
- I WOULD HAVE LIKED LESS INFORMATION.
- I NEVER RECEIVED ANY INFORMATION.

	#	%
MORE	7	33
ENOUGH	8	38
LESS	0	0
NEVER REC.	6	29
Total responses	21	
Total respondents	19	

Double answers:
2 more/never

Other comments: "I'd like to know more about the breakdown of arsenic and accumulation rates, effects upon the body, reasons for it being here, especially on this street, effects on plants indoor and outdoor, normal or natural arsenic levels in humans...etc." (4)
 "Concerning health." (12)
 "Need info about health hazards." (19)
 "The minerals and other things they found in water and how it touches our health and etc." (20)
 "Effects of arsenic." (25)
 "Nothing was said about the harm done to our bodies in the years we drank the water (the accumulative effect)." (23)

15. What do you think about the amount of information you received concerning any possible health risks from arsenic in the water?

	#	%
MORE	5	26
ENOUGH	8	42
LESS	0	0
NEVER REC.	6	32
Total responses	19	
Total respondents	19	

Other comments: "On effects of what it does." (12)
 "I called the health dept. but all they said was not to water my plants as it was accumulative and not to bathe infants in it." (4)
 "Effects of arsenic." (25)
 "I was told no one knew how much arsenic was too much when it came to my garden produce." (23)

16. Have you ever tried on your own to find information about arsenic and human health?

	#	%
YES	5	26
NO	14	74
Total responses	19	
Total respondents	19	

Other comments: "With small success." (4)
 "Only a little." (16)

17. Have you ever asked your doctor about arsenic and your health?

	#	%
YES	7	47
NO	12	63
Total responses	16	
Total respondents	16	

18. If you had a question about a health effect of arsenic, who would you probably ask first?

	#	%
FRIEND	2	10
DOCTOR	9	45
LIBRARIAN	1	5
HEALTH DEPT.	7	35
OTHER	1	5
Total responses	20	
Total respondents	16	

Double answers:
3 doctor/health dept. official
1 doctor/librarian

Other: Environmental specialist at the University
Other comments: "Called them (at the health department) and they weren't very informative." (4)

19. How would you prefer to be informed of any new health information?

	#	%
PHONE CALLS	3	14
COMMUNITY MEETINGS	2	10
WRITTEN NOTICES	13	62
PERSONAL CONTACT	3	14
Total responses	21	
Total respondents	16	

Double answers:
phone/written
pers./written
1 all of the above

20. In the future, if the local health department again recommended that you stop using your water, would you follow its advice?

	#	%
YES	16	100
NO	0	0
Total responses	16	
Total respondents	16	

21. Do you think that there is enough arsenic in your water to make you sick right after drinking it?

	#	%
YES	2	13
NO	14	88
Total responses	16	
Total respondents	16	

Other comments: Yes: "Something does (or has)." (4)
No: "Not right away, maybe over a period of years." (23)

22. Do you think that there are any health problems that can result from being exposed to small amounts of arsenic for a long time?

	#	%
YES	4	25
YES, BUT NOT SURE WHAT	10	63
NO	2	13
Total responses	16	
Total respondents	16	

Other comments: "Cancer" (5)

"Death" (17)

"Cumulative effects--doesn't go away." (16)

"Cancer, poisoning by overaccumulation." (4)

23. Do you think that there are any signs of arsenic exposure in humans?

	#	%
YES	0	0
YES BUT NOT SURE WHAT	11	73
NO	3	20
DON'T KNOW	1	7
Total responses	15	
Total respondents	15	

24. In your opinion, do medical experts agree on the long-term effects of drinking water containing small amounts of arsenic?

	#	%
YES	2	13
NO	8	53
DON'T KNOW	5	33
Total responses	15	
Total respondents	15	

25. Do you know of anyone in Milltown who has gotten sick from arsenic in the water?

	#	%
YES	1	6
NO	15	83
MAYBE, DON'T KNOW	2	11
Total responses	18	
Total respondents	18	

Other comments: "It's hard to say if it's the arsenic or it may be something else." (10)

26. Do you feel that arsenic has ever made you sick or contributed to any health problems?

	#	%
YES	5	31
NO	9	56
NOT SURE	2	13
Total responses	16	
Total respondents	16	

Other comments: "loss of hair" (5)
 "disoriented me mentally" (12)
 "am nauseated by the smell alone" (4)
 "turned blonde hair red" (19)
 "water dies your hair and ruins your clothes" (17)
 "not sure, but certainly possible" (25)

27. Do you worry about you or anyone in your household getting sick from having drunk the water?

	#	%
I'M NOT AT ALL CONCERNED	0	0
I'M A LITTLE WORRIED.	7	37
I'M VERY WORRIED.	4	21
I DON'T THINK ABOUT IT MUCH.	7	37
NEVER DRANK.	1	5
Total responses	19	
Total respondents	19	

28. Are the following activities more or less risky than drinking arsenic contaminated water?

	MORE RISKY		LESS RISKY		SAME RISK		Total
	#	%	#	%	#	%	
SMOKING	8	47	1	6	8	47	17
HIGHWAY DRIVING	6	43	3	21	5	36	14
BREATHING POLL. AIR	4	27	1	7	10	59	15
WORKING HAZ. JOB	6	40	3	20	6	40	15
BOATING	3	25	4	33	5	42	12

29. Do you agree or disagree with this statement? Arsenic makes Milltown a dangerous place to live.

	#	%
STRONGLY AGREE	1	5
AGREE	6	32
DISAGREE	10	53
STRONGLY DISAGREE	2	11
Total responses	19	
Total respondents	19	

Other comments: "Would probably make that strongly agree with more information." (4)

31. Do you think that anyone knows how long arsenic has been in the water?

	#	%
YES	1	5
NO	16	89
NOT SURE	1	5
Total responses	18	
Total respondents	18	

Other comments: Yes: "Feel as if the Power Company at Milltown Dam knew there was arsenic in the water." (20)

No: "Although I believe it can be figured out." (4)

32. Which of the following do you think is the most likely source of the arsenic in the water?

	#	%	
OLD LANDFILL	3	13	Multiple answers: runoff/sediment landfill/runoff/sediment 1 all of the above
RUNOFF FROM CHAMPION	3	13	
SEDIMENTS BEHIND DAM	16	67	
BLACKFOOT RIVER	1	4	
DON'T KNOW	1	4	
Total responses	24		
Total respondents	18		

Other comments: Landfill: "What was this filled with?" (4)

33. Do you know of any other metals in your water?

	#	%
YES	6	35
YES, BUT NOT SURE WHAT	9	53
NO	2	12
Total responses	17	
Total respondents	17	

Other comments: "Copper, iron, manganese" (5)

"Iron" (23)

"A lot of hard minerals" (10)

"All you have to do is look at the color--orange!" (16)

"Lead, magnesium, copper" (25)

"Iron" (28)

"Iron which causes water to be a dark brown." (20)

"Iron, manganese." (4)

34. Once the new water system is operating, will you have any concerns about arsenic in your life?

	#	%
YES	7	41
NO	10	59
Total responses	17	
Total respondents	17	

34. (cont.)

Other comments: Yes: "I'm not very sure that they can clean it all up." (13)
 "New well might be contaminated." (15)
 "That the years of drinking arsenic contaminated water and eating garden produce may cause health problems." (23)
 "Will always wonder if it will come into the new well." (10)
 "I'm not sure." (4)
 "It could get into other systems." (14)
 "Because the problem has made our mines aware of unclean water." (20)
 No: "Only if has been tested." (18)
 "But other minerals--yes!" (16)
 "Not as long as it is checked periodically." (25)

35. Have you been involved with community efforts to solve the water problem?

	#	%
YES, VERY INVOLVED	2	12
YES, MOD. INVOLVED	7	41
NO, NOT AT ALL INV.	8	47
Total responses	17	
Total respondents	17	

36. Have you ever attended a community meeting or hearing related to the arsenic problem?

	#	%
YES	10	59
NO	7	41
Total responses	17	
Total respondents	17	

If YES, have you attended one of these meetings in the past year?

	#	%
YES	8	80
NO	2	20
Total responses	10	
Total respondents	10	

37. Since the arsenic discovery, have you written letters or made phone calls requesting or supporting action?

	#	%
NEVER	8	50
ONCE OR TWICE	4	25
A FEW TIMES	2	13
OFTEN	2	13
Total responses	16	
Total respondents	16	

38. How many people live in your household?
 39. Please list the ages of the other members of your household.
 40. How old are you?
 41. How many years have you lived in Milltown?

<u>Length of Residency</u>	<u>No. in Household</u>	<u>Ages Resp. first</u>
58 years	1	69
58	1	73
39	2	67,69
35	2	68,73
35	3	44,57,3
30	4	52,49,23,4
22	4	50,56,17,3
20	2	45,48
20	6	34,30,15,15,7,4
16	4	34,10,8,6
15	1	59
8	1	37
5½	5	31,40,10,5,3
4	2	26,45
3	3	36,32,15
8 months	2	29,3
7 months	5	29,37,12,10,5
6 months	6	28,23,23,21,4,1
4 months	3	31,39,7

42. What is the highest level of formal education you have completed?

	<u>#</u>	<u>%</u>
COMP. GRADE SCHOOL	1	6
SOME HIGH SCHOOL	1	6
COMP. HIGH SCHOOL	10	59
SOME COLLEGE	4	24
COLLEGE DEGREE	0	0
GRADUATE WORK	1	6
Total responses	17	
Total respondents	17	

Other comment: "How much education a person has has not anything to do with the problem." (21)

Is there anything you would like to add about your experiences with arsenic information?

"I'd like to be better informed." (4)

"We know the situation could have been worse and we've been hauling water over three years and are going to be so happy to just get good water." (10)

"Yes I believe that the health board covered up this problem very well. Corporate responsibility is a must. To hell with jobs. We need clean (H₂O + air + ground)=good health. We cannot continue allowing corporations to monitor their own settling ponds or smokestacks." (12)

"Once they got going on this, they just forgot to keep us updated." (16)

"A health survey was taken by Mt.Pirg but we never learned the results. There was talk of taking hair and fingernail samples to see if the arsenic was affecting our health. This was never done. The news media always knew about anything new in regard to our water before we did." (23)