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Los Alamos Community Health Concerns*

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Risk Communication*

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A History of the Working Group to Address Los Alamos Community Health Concerns

A Case Study of Community Involvement and Risk Communication

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ABSTRACT

In May 1991, at a Department of Energy (DOE) public hearing at Los Alamos, New Mexico, a local artist claimed there had been a recent brain tumor cluster in a small Los Alamos neighborhood. He suggested the cause was radiation from past operations of Los Alamos National Laboratory. Data from the Laboratory's extensive environmental monitoring program gave no reason to believe this charge to be true but also could not prove it false. These allegations, reported in the local and regional media, alarmed the community and revealed an unsuspected lack of trust in the Laboratory. Having no immediate and definitive response, the Laboratory offered to collaborate with the community to address this concern.

The Los Alamos community accepted this offer and a joint Community-Laboratory Working Group met for the first time 29 days later. The working group set as its primary goal the search for possible carcinogens in the local environment. Meanwhile, the DOE announced its intention to fund the New Mexico Department of Health to perform a separate and independent epidemiological study of all Los Alamos cancer rates. In early 1994, after commissioning 17 environmental studies and meeting 34 times, the working group decided that the public health concerns had been resolved to the satisfaction of the community and voted to disband.

This paper tells the story of the artist and the working group, and how the media covered their story. It summarizes the environmental studies directed by the working group and briefly reviews the main findings of the epidemiology study. An epilogue records the present-day recollections of some of the key players in this environmental drama.

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1. PROLOGUE

Los Alamos, New Mexico, a city of some 18,000 inhabitants, is home to Los Alamos National Laboratory (LANL), operated by the University of California (UC) under contract to the US Department of Energy (DOE). In the spring of 1990 a local artist had set out to educate himself and his neighbors on radiation. The local newspaper reported this in a story headlined, "Artist hopes to shed light on radiation: (Artist) educates self so he can teach others."¹ The artist was tutored on the fundamentals of radiation by Laboratory scientists before giving a series of seminars in the region that encouraged citizens to monitor radiation levels independently. That summer he obtained two thermoluminescent dosimeters (TLDs), which measure radiation exposure, from a commercial supplier and placed them in canyons around Los Alamos to make his own measurements of background radiation.

He then gave local and regional newspapers the surprising news that his results showed radiation levels two-to-three times higher than the Laboratory reported. This made headlines, e.g., "Homespun test questions LANL radiation: Resident says results show contamination twice what Lab reports."² When Laboratory scientists examined his data they found that his readings were too high because he had not used his control TLD properly.

When dosimeters are shipped by the supplier, they are accompanied by a control dosimeter that is set to a zero reading (annealed) at the same time as the dosimeters intended for field placement. When the control and field dosimeters reach the user, they have had the same exposure to background radiation. The user is then instructed to place the control dosimeter in a lead-lined box to shield it from radiation while the other TLDs are in the field. When the TLDs are taken out of the field, the control dosimeter is removed from its lead box and shipped with the field dosimeters back to the supplier to be read. Thus the control and field TLDs get the same radiation exposure during shipment, but the control is isolated from further exposure in the lead box while the field TLDs are being exposed to local background radiation. The difference between the field TLD and control TLD readings is the radiation dose that the field TLDs measured while in the field.

The artist had treated his control dosimeter as a kind of independent radiation measurement, keeping it in a shoebox where it was exposed to background radiation inside his home from its building materials and naturally-occurring radiation in the soil under it. Unaware of how to use a control dosimeter, the field dosimeter readings he reported to the media were actually the sum of local background radiation measured while they were in the field, plus the additional background radiation exposures before and after being placed in the field.

Because his TLDs were sent to and from the analytical laboratory by mail and there were also delays before they were placed in the field, the differences were

appreciable. For example, during one typical measurement cycle, 63 days passed between the time the TLDs were annealed prior to being sent to the artist and when their exposure was read after they were returned to the supplier. The time the dosimeters actually spent in the field was 31 days. Thus, without the control correction, the artist's field dosimeters recorded 63 days of background radiation while he thought they were measuring 31 days, leading him to believe that background radiation levels were more than twice as high as they really were.

After Laboratory scientists made the appropriate corrections, the artist's and the Laboratory's measurements agreed within 5%. Nevertheless, the artist continued to insist that his original measurements were correct. He was soon approached by an unidentified person who told him that there had been a large number of brain tumors in Los Alamos, especially in its Western Area.

2. LET THE CONTROVERSY BEGIN

Los Alamos is located some 7,000 feet above sea level, situated on a series of finger-like mesas on the eastern slope of the Jemez mountain range. The rugged beauty of its setting and the pristine quality of its natural environment are instrumental in attracting many Laboratory employees to the area. Because its natural environment has not been subjected to the stresses of commercial or agricultural development, the 43 square miles of Laboratory land were designated as a National Environmental Research Park in 1976.

Thus it came as a special shock to both the community and the Laboratory when on May 23, 1991, the artist claimed at a DOE public hearing that 11 Los Alamos residents had died of brain tumors in the preceding eight years and that seven of them had lived on the same street in a small neighborhood called the Western Area. He suggested that the brain tumors had been caused by radiation released by Laboratory operations or by radioactive waste dumped in the early days of the Laboratory (during World War II) in what had since become a residential area. These claims made headlines in local and regional newspapers ("Rare tumor rate high in one Los Alamos area, artist claims")³ and went out on the Associated Press wire.

The Laboratory has a long-established and extensive program to monitor air, water, soil, foodstuffs, and biota. In 1991, its Environment, Safety, and Health Division and its Environmental Management Program employed about 550 people and had a combined annual budget of about \$125 million. Although the brain tumor claims hardly seemed believable, they had to be taken seriously by the Laboratory. The Laboratory and its contractors employ almost 12,000 people, some 6,000 of whom reside in Los Alamos, making it a prototypical company town. Obviously, if the community, which is composed largely of Lab employees and their families is concerned, this concern reflects back into the workplace. Health concerns induced a schizoid feeling that "we" (as residents of Los Alamos) don't really trust "them" (the Laboratory) to act in our best interests.

But, in this case, "we" became "them" every time the bridge over Los Alamos Canyon that separates the town of Los Alamos from the Laboratory facilities was crossed.

Internal Laboratory discussions about how to address the brain tumor issue were intense. By June 10, a proposal for a joint Community-Laboratory working group to address this concern had been prepared and was being discussed with community leaders. Meanwhile, the artist kept the brain tumor issue visible by giving a talk at a Los Alamos church, headlined by the local newspaper as "Artist sees radiation hazard in county."⁴ The next day, two highly respected Western Area residents petitioned the Los Alamos County Council for action on this potential public health problem. Their petition received regional media attention and was headline news in the local paper, "Residents ask council to act on radiation."⁵

On June 19, the formation of the Working Group to Address Los Alamos Community Health Concerns was announced. The initiative was received positively by the local newspaper: "LANL helps form radiation-study group: Lab expresses its concern in cancer/tumor incidence."⁶ The working group scheduled its first meeting for June 21, just 29 days after the issue was first raised at the DOE hearing.

3. THE CONTROVERSY GROWS

Because of the artist's concern about a possible brain tumor cluster in the Western Area, a "drive-by" survey of background radiation levels in this neighborhood was made before the first meeting of the working group. The survey, which used highly sensitive radiation detectors mounted in a van, was made by members of the Laboratory's environmental protection group, accompanied by the artist and DOE representatives. The survey instruments recorded only typical levels of background radiation.

However, the artist had worn his own dosimeter, supplied by a private instrument laboratory, on the tour. When analyzed later, it showed an exposure of 0.014 rem of beta radiation. Technicians at the private laboratory reported that this reading was found on only one of two identical chips mounted in the dosimeter to make independent measurements, and that the second chip indicated zero exposure; they recognized that the reading was suspect but decided to report it anyway.

However, the artist assumed it was a valid result. Although the dosimeter had been in his possession for a month before being analyzed, he stated that the exposure must have occurred during the one-hour tour of the Western Area. He extrapolated this assumed hourly exposure to suggest that Western Area residents might be receiving a radiation exposure above background of some 120 rem per year. The corresponding article in a regional newspaper, published on

June 23, read, "LANL Watchdog Fears He Was Radiated."⁷ Dosimeters worn by the other five people who participated in the drive-by did not register any radiation exposure above background.

The Laboratory urged that the drive-by radiation survey be repeated with the artist wearing another dosimeter. Although he accepted, he never found a convenient time to participate in a resurvey. He continued to insist that background radiation levels in the Western Area were elevated until a later study commissioned by the working group (see section 5.2) convinced him that radiation in the Western Area was not above normal background levels.

4. THE WORKING GROUP BEGINS

4.1 The cast of characters

The working group had 14 members, seven each from the community and the Laboratory, with a cochair from each contingent. Discussions with community leaders had identified four community members before the public organizing meeting was held on June 19. Two of the four appointed community members were the deputy administrator of Los Alamos County, who held a master's degree in public health, the editor/publisher of the local newspaper who had a degree in journalism. The latter came from an old Hispanic family that had raised sheep on the Pajarito Plateau (where Los Alamos is located) before it was taken over by the US Army during World War II. Three community members volunteered at the organizing meeting. All three were homemakers: one recently arrived in Los Alamos, who held a master's degree in genetics; another, who lived on the street where the suspected brain tumor cluster was claimed, had a Ph.D. in art history; the third held an advanced degree in music.

The two other appointed community members stood out a bit more than the rest, and for quite different reasons: the artist and the physician. As the person who had raised the concerns, the artist immediately became a key figure on the working group. He was in his early 30s and a one-time student at a Texas junior college, without any particular scientific or technical credentials. He was an articulate, soft-spoken, mild-mannered man whose wife was employed by the Laboratory as a computer programmer. Rather disarmingly, he often expressed his support for the Laboratory's mission and his admiration for its scientific contributions, saying his concerns were limited to environmental matters that he felt had not been given the attention they deserved. Although there are a number of organized antinuclear, anti-Laboratory activist groups based in nearby Santa Fe, he was not affiliated with any of them. At this point, the artist enjoyed excellent credibility with the other community members of the working group and the news media. Several letters to the editor of the local newspaper expressed gratitude to him for raising these concerns.⁸

The physician-member of the working group, also a Western Area resident, was in private practice in Los Alamos, specializing in cardiology, internal medicine and critical care. He was in his 40s and was involved in a number of community youth activities. He was clearly independent and focused on getting to the bottom of the public health issue facing the community; his fairness and impartiality were never called into question. As a physician, he had access to data in the New Mexico Tumor Registry as well as the patient files at the local hospital and clinic, allowing him to evaluate public health-related rumors and allegations without time-consuming formalities. This was especially important in avoiding panic in the early days of the investigation.

The Laboratory working group members had professional backgrounds in fields such as radiation protection, epidemiology, environmental protection and restoration, risk assessment and communications. Unlike the community members, who normally attended every meeting, most Laboratory members had alternates to substitute for them when they were on business travel or otherwise unable to attend. In addition, Laboratory membership evolved over time as people left the Laboratory for other jobs or when the subject matter of the group's deliberations required an expert with a specialty not already represented on the group. In total, almost 20 Laboratory staff served as working group members or alternates at one time or another over the lifetime of the group.

Community members of the working group received neither compensation nor reimbursement for expenses and Laboratory members were volunteers who participated on their own time. In addition to the time required to attend meetings, members each spent about half a day per week on working group business, e.g., reading reports, preparing position papers.

The working group was conceived as a full collaboration between the community and the Laboratory. However, in point of fact, the community contingent took the lead in selecting agenda items, deciding if studies were acceptable and closing out issues when they had been resolved to their satisfaction. All working group meetings were open to the public and received intense coverage by the local, regional, national, and even international print media and were often covered by regional television and radio stations and, on occasion, by national and foreign television networks.

4.2 Structuring the investigation

At the first working group meeting, DOE announced its intention to fund the Division of Epidemiology of the New Mexico Department of Health (DOH) to carry out an independent study of all cancer incidence rates in Los Alamos County. This announcement effectively divided the effort to address the brain tumor concern into two complementary subject areas: environmental studies and epidemiology.

The environmental studies were intended to address the question, "Is there anything in the Los Alamos environment that could cause cancer?" This was done by the working group collectively deciding what reviews, studies, or measurements should be carried out and then evaluating the results and determining their acceptability.

The epidemiology study was designed to answer the question, "Are Los Alamos cancer rates elevated?" However, while the contract for the epidemiology study was being formalized, the working group decided (at its first meeting in June 1991) to make a preliminary evaluation of the artist's brain tumor list to determine if any immediate public health measures were needed. (The epidemiology study steering committee did not have its first meeting until December 13, 1991.)

During its lifetime, the working group commissioned 17 studies or reports. Because the initial concern was brain tumors in the Western Area, this neighborhood was used as a case study. Results of early investigations led the working group to broaden its scope to include all cancers and the entire county of Los Alamos. These studies will be discussed in three groups: those specific to the Western Area, reviews of historical data applicable to the entire county, and special investigations requested by the artist, members of the community, or the working group.

5. WESTERN AREA STUDIES

5.1 Western Area land use history

One of the working group's first objectives was to investigate the history of Laboratory operations in the Western Area. A search of County Historical Society archives turned up some aerial photographs of the Western Area taken in 1946. A private citizen provided a 1945 photograph of the Western Area taken from the mountains at the western edge of Los Alamos.

These photographs were reviewed at the working group's August 21, 1991, meeting. The 1945 photograph showed pasture land, stables, and temporary barracks, probably built to house Army personnel stationed at Los Alamos during World War II. The 1946 photographs showed the Western Area housing (built by US Army contractors) under construction. It also showed a large, shallow pit in the southeastern quadrant of the Western Area. (The suspected cluster of brain tumors was located in the northwestern quadrant.) The pit appeared similar to those used by builders to dispose of construction debris.

Media coverage was mixed. One regional newspaper article was headlined "Lab Investigates Possible Waste Pit Under Homes,"⁹ speculating that the pit might have been used to dispose of toxic or radioactive waste. Another regional newspaper reported an interview with a retired engineer who remembered the

pit being used to dispose of construction waste ("Engineer claims dump site contains non-toxic rubble").¹⁰ The working group agreed that there was no evidence of official Laboratory operations in the Western Area that would be a credible cause of brain tumors.

However, rumors about possible "wild" dumping of wastes in the early years of the Laboratory continued to circulate. This issue resurfaced when the artist claimed that other old aerial photographs, two of the Western Area and one of downtown Los Alamos, showed white barrels containing radioactive waste. The images were enhanced and enlarged and shown as slides at the fifteenth meeting of the working group on April 22, 1992.

On a photo of what is now downtown Los Alamos, the white spots were seen to be of irregular shape and some were on tops of automobiles or buildings, in trees, or even floating in the air. It was agreed that they were blemishes on the original photograph. The second photo, of the Western Area in 1946, showed objects in front of an elementary school under construction. The artist suggested that this was an active waste dump, although it seemed highly unlikely that anyone would ever have openly disposed of hazardous waste in a school yard. The enlargement showed that the material was of irregular shape and was almost certainly rubble from the school construction. The third photo showed a scalloped pit in a corner of the Western Area. The enlargement indicated that the pit was empty and was most likely a "borrow pit," used as a source of fill dirt during construction. The artist did not attend this meeting, and the working group closed this topic out in his absence.

5.2 Estimation of radiation levels inside Western Area homes

The question of possibly elevated radiation fields inside Western Area homes due to widespread contamination continued to be raised by the artist following the drive-by measurements of background radiation. The working group came up with a novel way of getting an independent indication of Western Area background radiation levels.

Some 400 Laboratory employees reside in the Western Area. Of these, 135 are issued personal radiation dosimetry badges because their work could bring them into contact with radiation. A telephone survey identified 67 of this group who take their dosimetry badges home with them evenings and weekends. Their badges would record any radiation that might be present inside their homes as well as any radiation exposure in the workplace. These dosimeters would typically be inside the homes some 100 hours per week, considerably longer than they would be in the workplace.

The dosimetry records of these 67 employees were examined for the five-month period January-June 1991. Of these, 57 showed total home-workplace radiation exposures at or below the measurement threshold for the dosimeter, effectively

zero exposure. The remaining 10 cases had average monthly radiation exposures ranging from 0.004 to 0.018 rem. (The monthly occupational exposure limit is 0.410 rem.) Each of these ten employees did work with radiation and their monthly exposure was consistent with that of their coworkers. In addition, three of them lived at the same address as another employee whose radiation dosimeter reading was zero, further indicating that the workplace was the sole source of their radiation exposure.

On the basis of this evidence, the working group concluded there was no reason to believe there was any widespread source of man-made radioactivity in the Western Area. This issue was closed out at the working group's sixth meeting (August 7, 1991), with the agreement of the artist.

5.3 Analysis of Western Area soil for contaminants

At one of its first meetings, working group members raised the issue of possible carcinogen contamination of soil in the Western Area and requested that the soil be analyzed. A sampling plan was prepared and approved by the working group. It called for a stratified sample focusing on the area where the suspected brain tumor cluster had first been reported.

Twenty-one surface samples and three subsurface samples were taken from 21 locations for analysis by a private laboratory. They were analyzed for organic chemicals, heavy metals, and radioactivity. All results were within normal ranges, except for one DDT "hot spot" in the Western Area park, which showed a DDT concentration of 97 parts per million (ppm). (Preliminary results from the private laboratory had showed tritium in four of the samples; however subsequent quality control checks found that none of the samples had in fact contained tritium.) The 97 ppm DDT result was obtained by the Laboratory's Environmental Chemistry group; a replicate sample, taken immediately adjacent to this one and analyzed by the outside Laboratory showed a concentration of 6.7 ppm. A third sample, taken about one foot away, also analyzed by the outside laboratory, gave a reading of 0.8 ppm.

The Environmental Protection Agency's (EPA's) proposed standard for DDT in soil foresees a minimum level of 2 ppm, below which no action need be taken, and a maximum level of 200 ppm, above which remediation is recommended. The gray area in between calls for a health hazard assessment. The New Mexico DOH inspected the Western Area park in July 1992, and found that the area of DDT contamination was under a heavy grass cover. Because DDT is only hazardous if ingested or inhaled, DOH recommended that no remedial action be taken as long as the grass cover was maintained. Soil samples taken by the New Mexico Department of Agriculture to provide an independent check on DDT levels gave DOH no reason to revise its original hazard assessment. The DDT issue was front page news for several days in the local newspaper and was covered daily by the regional newspapers.

5.4 Western Area home construction materials

Western Area housing was built by U. S. Army contractors shortly after World War II. At an early working group meeting it was suggested that if carcinogenic materials had been used in the original construction they could have caused brain tumors later. It was agreed that Laboratory industrial hygienists, at the invitation of homeowners, would inspect the original construction materials as they were laid bare during home remodeling projects. Two Western Area homeowners took advantage of this offer.

Samples of stucco, paint, and insulating materials were taken and submitted for laboratory analysis. The only findings of interest were that asbestos had been used to insulate heating system pipes and that lead-based paint had been used on interior walls. These facts were already widely known and did not suggest a link to brain tumors, so this issue was closed out on October 2, 1991, at the tenth meeting of the working group.

5.5 Measurement of lead in Western Area drinking water

At one of the first working group meetings, community members asked that residential drinking water in the Western Area be tested for lead. Although lead is not a credible causal agent for brain tumors, the analysis was performed. This was one of several examples where an issue of community concern was investigated despite scientific opinion that the study was not necessary.

Containers for water samples, and sampling instructions, were made available to interested Western Area residents. Twenty-nine people submitted samples for analysis. Lead levels were found to be below the minimum detection level of 5 parts per billion (ppb). (The June 1991 EPA "Action Level" for lead in drinking water was 15 ppb.)

The lead analyses were carried out by a State of New Mexico laboratory. Two of the 29 samples were randomly selected to be analyzed for the presence of other heavy metals. Both tested positive for mercury at concentrations about twice the EPA allowable limit. Knowing that mercury is a notorious laboratory contaminant and that the Los Alamos water distribution system had never tested positive for mercury, LANL scientists were quite certain that these readings were erroneous. However, after much internal debate it was decided that the mercury findings had to be reported to the working group with the qualification that they were believed to be in error.

This was done at the September 18, 1991, working group meeting. The announcement caused some concern in the community. The two homes in question were resampled and the samples split for parallel analyses by the State laboratory and the LANL environmental chemistry group. Both laboratories

confirmed that mercury concentrations were below detectable limits and the residential water testing activity was closed out on October 2, 1991, at the working group's tenth meeting.

5.6 Measurement of Western Area electromagnetic fields

In collaboration with Los Alamos County, Laboratory industrial hygienists measured external electromagnetic fields (EMF) in various parts of Los Alamos. Readings were in the milligauss range, which is typical for urban areas, and were no higher in the Western Area than in other parts of town. EMF measurements were also made inside two homes with similar results. In addition, twenty-four hour EMF dosimeters were used to measure EMFs at the intersection of two primary power distribution lines in the Western Area. These measurements also revealed nothing out of the ordinary. The working group closed out the EMF investigations at its tenth meeting, on October 2, 1991, agreeing that the measurements did not suggest EMF as a credible cause of cancer in the Western Area.

5.7 Measurement of radioactivity in Western Area produce

Produce samples were taken from six Western Area residential gardens in 1991 and analyzed for six radionuclides: tritium, two isotopes of plutonium, total uranium, strontium, and cesium. The levels of these radionuclides were not statistically different from background samples taken from the Española valley in northern New Mexico. Differences among produce from the three sampling strata used in the Western Area soil sampling were also not significant. This issue was closed out at the fifteenth meeting of the working group, on April 22, 1992.

6. HISTORICAL REVIEWS

A number of existing, historical documents were reviewed by the working group to see if they could shed any light on the current health concerns.

6.1 Survey of radon levels in New Mexico homes

At its sixth meeting, on August 7, 1991, the working group reviewed a report by the State of New Mexico that summarized radon measurements made in homes in various parts of the state. Readings for Los Alamos were not much different than the rest of New Mexico and it was concluded that radon was not a credible cause of excess cancers in Los Alamos.

6.2 Review of Los Alamos drinking water quality

The Los Alamos water supply system was owned by the DOE and managed by LANL, which monitored water quality to ensure compliance with state and

federal regulations. Water quality data for the period 1971–1990 were reviewed to determine if there was any possible link between water quality and cancer incidence.

Los Alamos water is tested for inorganic and organic chemicals, radioactivity, and bacteria. The only significant anomaly found was that naturally occurring arsenic levels in one of the system's three well fields had exceeded EPA standards from 1972 to 1975. This problem was solved by blending water from this well field with water from the other two well fields. The offending well was taken off line in 1975. Radioactivity levels in the distribution system have always met standards.

Aside from the arsenic problem in the early 1970s, it was concluded that Los Alamos had enjoyed excellent water quality and the working group closed out this investigation at its eleventh meeting, on November 6, 1991.

6.3 Review of radionuclide concentrations in locally-grown produce

The Laboratory has collected annual samples of fish, produce, and honey since 1975 and tested them for radioactivity. Fish are taken from a reservoir upstream of the Laboratory and their radioactivity levels compared with those of fish taken from a downstream reservoir. Honey and produce are collected from three kinds of locations: on-site (grown on Laboratory property), perimeter (private property in Los Alamos County, including the Western Area), and off-site (other parts of northern New Mexico). These samples are analyzed for tritium, two isotopes of plutonium, total uranium, strontium, and cesium.

Tritium is the only radionuclide that has been found to be significantly higher in fruit collected on-site than that taken from perimeter or off-site locations. Tritium concentrations in perimeter produce and off-site produce have not been significantly different, suggesting that tritium from Laboratory operations does not affect foodstuffs beyond Laboratory boundaries. Other radionuclides in produce collected from Laboratory lands over the years have not been significantly higher than in produce collected from perimeter or off-site locations.

After reviewing these data, the working group concluded at its eighth meeting, on September 4, 1991, that radioactivity in locally-grown produce was not a likely cause of cancer in Los Alamos.

6.4 Plutonium in tissues of Los Alamos residents

At the first working group meeting, the artist had listed among his concerns "plutonium in the nasal cavities of Los Alamos residents." At a subsequent meeting he circulated a page from a 1974 report documenting the presence of plutonium in the tissues of Los Alamos residents as determined at autopsy. The

artist claimed that this indicated high releases of plutonium from past Laboratory operations and, further, that Los Alamos residents had higher plutonium body burdens than occupationally exposed Laboratory workers.

This report and later follow-up reports were reviewed on March 11, 1992, at the fourteenth meeting of the working group. The author of the reports explained that the Los Alamos data were part of a study comparing seven locations across the US between 1959-1971. The levels of plutonium found in tissues were low in absolute terms and paralleled world wide plutonium fallout from atmospheric weapons testing. Los Alamos tissue concentrations were not significantly different from those found at the other locations.

The discussion was continued at the next working group meeting, on April 22, 1992. The author noted that data had been analyzed for three groups: workers occupationally exposed to plutonium, Laboratory employees whose jobs did not expose them to plutonium, and residents of Los Alamos who did not work at the Laboratory. The artist's claim that Los Alamos residents had higher plutonium body burdens than occupationally exposed workers was shown to be incorrect. This issue was closed out at the 17th meeting of the working group on May 20, 1992.

7. SPECIAL INVESTIGATIONS

Some special investigations were undertaken to respond to issues raised by the artist, by community members, or by the working group.

7.1 The Acid Canyon affair and the Agency for Toxic Substances and Disease Registry (ATSDR)

Acid Canyon is part of a canyon system that carries runoff water to the Rio Grande River, some 10 miles away. On August 4, 1991, the headline in a regional newspaper read "Polluted Los Alamos canyons were playgrounds for kids."¹¹ The artist was quoted as saying that his list of brain tumor victims had reached 55 names, 22 of whom had played in Acid Canyon as children. (The local newspaper of this date reported that the artist's list contained 58 names.)

The working group had already asked for more information on the history of Laboratory operations affecting Acid Canyon, and this was provided at the sixth working group meeting, on August 7, 1991. The Laboratory reported that untreated, plutonium-contaminated effluent had been released into Acid Canyon from 1943 to 1951. This was a high-volume release of water containing low concentrations of plutonium. The total plutonium release was estimated at less than 2.5 grams. From 1951, until the facility was closed in 1964, the effluent was treated before release.

Acid Canyon was first cleaned up in 1966-67, primarily by digging up contaminated soil and trucking it to authorized disposal sites. After this cleanup, the area was determined to be "sufficiently free of contamination to allow unrestricted access and remove signs designating it as a contaminated area." In July 1967, the Atomic Energy Commission turned it over to Los Alamos County by quit-claim deed. In 1982, the areas of highest residual contamination were cleaned up to then-current standards by removing a few additional truckloads of material. Lab scientists estimated that in its 1991 condition, a hypothetical person living in the canyon, keeping livestock for milk and meat and growing their own produce, would receive a total effective radiation dose of less than 0.01 rem per year, which is 10% of the DOE maximum allowable annual exposure for members of the public.

On March 18, 1992, the artist formally petitioned ATSDR, a federal agency part of the Public Health Service in the US Department of Health and Human Services, to carry out an emergency health consultation on Acid Canyon, which he said "... should immediately be closed to the public...."¹² This apparently offended other community members of the working group, whom the artist had not consulted about his plans to approach ATSDR. The community members were adamant that ATSDR was not needed, partly because of the feeling that ATSDR would be duplicating studies already underway under the working group's aegis, and partly because a recent report by the Government Accounting Office had expressed serious reservations about the technical competence of the ATSDR.¹³ Subsequent interactions with staff were not to change the community members' opinions of ATSDR's ability to add value to the process.

The community contingent of the working group then decided to organize a community-wide study tour of Acid Canyon, to be held on April 16, 1992, to allow people to obtain first-hand knowledge of conditions there. They asked the Laboratory for technical support in the form of experts on radiation, chemicals, Acid Canyon history, and for instruments to measure radiation. In addition, the Laboratory provided personal TLDs for those taking the tour.

On April 13, 1992, the artist wrote to the US Secretary of Energy, asking him to stop the tour of Acid Canyon, which is public property. The tour went on, as scheduled, drawing 85 participants despite heavy rainfall at the beginning and the threat of thunderstorms. The participants included classes from a Santa Fe high school and a Los Alamos grade school class, which were studying radiation and had brought their own radiation detection instruments with them. Neither Laboratory technicians nor the students found radioactivity above the normal background range and the TLDs issued to tour participants also showed no radiation exposures above background. A regional newspaper that headlined "Canyon Hike 'Insane,' (Artist) Says"¹⁴ on April 10, headlined "Acid Canyon Hike Finds No 'Hot Spots'" on April 17.¹⁵

On April 28, 1992, a six-person delegation from ATSDR toured Acid Canyon as part of the petitioned emergency health consultation. They were accompanied by Laboratory staff carrying the same radiation detection instruments that had been taken on the public tour. ATSDR staff were also provided with a complete set of documentation on the history of the canyon, past cleanups, and environmental surveys. ATSDR staff attended a special meeting of the working group on April 29, where it was agreed that their draft health consultancy report would be sent to the working group for comment, May 13 being the expected completion date. The artist did not attend this meeting.

The draft ATSDR health consultation report on Acid Canyon was received on June 26. It concluded that "plutonium levels in Acid Canyon do not represent an imminent public health threat" and "it is not necessary to restrict access to the canyon at this time."¹⁶ Although ATSDR had authorized the release of this report, marked "Official Use Only," to the working group, the artist contended that it should have been released only to him (as petitioner), DOE, and the Laboratory for technical review prior to revision for public release.

In an about face, senior ATSDR officials claimed, contrary to an audio tape of the April 29 meeting, that ATSDR had not authorized release of the draft report. The artist claimed in an interview with the local newspaper that (the release) was "a violation of my civil rights"¹⁷ and, in a regional newspaper, that a July 15 meeting of the working group, convened to discuss the draft report, was "illegal."¹⁸ He asked a congressional oversight committee to investigate the report's release. After exploring the circumstances, the oversight committee's staffers decided that an investigation was not warranted. The final ATSDR health assessment of Acid Canyon was released in September 1992. It said that "Plutonium levels in Acid Canyon do not represent an imminent public health threat; it is not necessary to restrict access to the canyon at this time..."¹⁹ The artist was quoted in a regional newspaper as saying he felt "vindicated" by the report and that "There could easily be other lethal contaminants down there that no one knows about."²⁰

In October 1992, ATSDR announced that it would carry out a full-scale health assessment study of Los Alamos, defining this as "an in-depth review of environmental data to determine whether there is a connection between hazardous waste exposures and adverse health effects." In a newspaper article headlined "Full health probe of LANL area ordered,"²¹ an ATSDR official said that the study would be done in response to petitions made by the artist and the congressman representing the district. As of early 1998, ATSDR had sampled some environmental media in the Los Alamos area, in collaboration with EPA, and anticipated being able to complete the health assessment by the year 2000.²²

7.2 Radioiodine release from the Los Alamos Meson Physics Facility (LAMPF) in 1985 and an alleged outbreak of thyroid disease

At the first meeting of the working group, the artist had listed airborne radioactivity releases from LAMPF as one of his concerns. He asserted that a total of 750,000 curies of radioactivity had been released in 1985 and that there had also been an accidental release of radioactive iodine in July and August of that year that had caused an outbreak of thyroiditis (a nonspecific inflammation of the thyroid gland).

These assertions were addressed at the tenth and eleventh meetings of the working group, on October 2 and November 6, 1991. An evaluation of LAMPF operating records established that 750,000 curies of total radioactivity had been released by LAMPF in 1984, not 1985. This figure included isotopes of very short half-life, which had largely decayed by the time they reached the facility boundary. Subsequent facility modifications had reduced 1985 emissions to less than 200,000 curies. An unintentional iodine-126 release in the summer of 1985 had been reported in Laboratory documents, although because of the small quantity released the iodine amount had been added together with that of other isotopes also released in small quantities. The size of the iodine release had originally been estimated as 0.0247 curies in a 1985 internal report. When this incident was brought up in 1991, the data were reviewed and a calculational error was discovered (a half-life mistakenly given the wrong units), so the 1985 iodine release had actually been 0.00052 curies.

Assuming a hypothetical person had spent 24 hours per day at the downwind LAMPF fence throughout the period of the iodine release, their maximum calculated uptake would have been less than one picocurie (i.e., one trillionth of a curie). To put this number in perspective, radioactive iodine-131 is used in diagnostic medical procedures to illuminate the thyroid gland. Patients are typically given about 15 million picocuries and this amount is administered without the expectation of damaging the thyroid gland.

The physician-member of the working group reviewed emergency room records at the local hospital for July and August 1985, and found no evidence of admissions for acute thyroid disease. The working group found it unlikely that there was an increased incidence of thyroid disease in 1985 or that the LAMPF iodine release could have caused one. The artist did not accept this finding, insisting that the "experimental error" in estimating the magnitude of the 1985 release be investigated.

7.3 Historic radioactive iodine releases from the Laboratory

At its June 26, 1992, meeting, the steering committee of the Los Alamos Cancer Rate Study announced that thyroid incidence rates were higher than expected and showed a continuing upward trend. They decided that of the 23 cancer sites

initially reviewed, only thyroid and brain cancer rates should continue to be monitored by the study. The artist, who was also a member of the steering committee, argued that the increase in the thyroid cancer rate was caused by the release of radioactive iodine from the Laboratory. (Radioactive iodine, which is stored in the thyroid gland in the same way as stable iodine, is a known causal agent for thyroid cancer.)

The working group asked for a review of the Laboratory's radioactive iodine inventories and past releases. At the 21st working group meeting, August 12, 1992, the processes that could have produced radioactive iodine were reviewed over the history of the Laboratory and the probable and maximum releases estimated. The probable Laboratory release of radioactive iodine since 1943 was estimated at about one curie, with a maximum of "a few" curies. For comparison, iodine releases from the Hanford production site over the same period have been estimated at 530,000 curies.

The physician-member of the working group reported that the local medical center uses about 0.0006 curies of radioactive iodine per year for diagnostic thyroid scanning and, until 1987, used an additional 0.06 curies per year for therapeutic thyroid ablations. Over the past twenty years, the medical center usage (all of which ultimately finds its way into the environment) has been about one curie, roughly comparable to the Laboratory's total inventory.

7.4 The radioactive fruit tree

In the course of analyzing produce samples for the 1991 radionuclide survey, fruit taken from an apricot tree on private property in downtown Los Alamos was found to have elevated levels of tritium and plutonium. The tree was located on the site of some original Laboratory facilities that were operational during the 1940s. Laboratory technicians who found these relatively high readings reported them to the working group.

Results from the one sample of fruit taken from the tree in 1991 were reported at the working group's 14th meeting, on March 11, 1992. The sample contained plutonium at a concentration (0.02 pCi/g) about 100 times higher than usually found in samples collected in this area and tritium at a concentration about 10 times higher (16 pCi/ml). The tritium concentration was below the EPA guideline for tritium in drinking water (20 pCi/ml) and the radiation dose from eating 50 pounds of the fruit was estimated at 0.3 mrem. (The tree would produce less than 50 pounds of edible fruit per year.)

Analyses of woody tissue, soils, and (1992) green fruit samples were reported at the 18th working group meeting, on June 17. Plutonium concentrations in the five samples of fruit taken were a factor of 100 less than had been found in the 1991 fruit sample, i.e., similar to other trees in the area. It was concluded that the high 1991 plutonium reading was caused by a one-time contamination of the

sample. Tritium levels in the soil immediately under the tree were found to be much lower than those in the fruit and twigs, so that was not the source of tritium. However, the tree was located near an asphalt parking lot, and soil samples taken under the asphalt at a level of three feet showed tritium levels similar to those seen in the fruit and twigs, suggesting that the source of tritium was probably uptake by roots growing under the asphalt. Nearby air monitors did not show elevated levels of either tritium or plutonium.

The working group asked for another update in October 1992. Reports were analyzed of a cleanup of this area carried out to the standards of the time in 1975-1976. Tritium concentrations in the soil covered by the asphalt in 1976 were consistent with those measured in 1992 when the half-life of tritium was taken into account. Tritium and plutonium levels in ripe fruit picked in the 1992 growing season were also reported. The dose from eating 50 pounds of the ripe fruit was estimated at 0.12 mrem, less than 1% of the permissible dose for all pathways, 80% of which was due to strontium-90 from worldwide weapons testing fallout. This issue was closed out by the working group. (The property owner cut the tree down in 1995 to construct a parking lot for a new office building.)

7.5 Laboratory air emissions

On June 25, 1991, the DOE's Los Alamos Area Office formally notified EPA that the Laboratory was not in full compliance with the provisions of 40CFR61 of the Clean Air Act (CAA). On August 16, the LANL director appointed an internal task force of three scientists, whose normal jobs were not related to environment, safety, or health, to perform a "quick-look technical review" of the Laboratory's air emissions monitoring program. Their report was submitted in mid-September. In the meantime, a whistleblower employed in the Laboratory's air emissions compliance program made media headlines by claiming that the Laboratory's air emissions constituted a public health hazard ("Scientist Says Los Alamos Misled Feds on Emissions").²³ On November 27, 1991, EPA issued a formal notice to DOE of LANL's noncompliance with 40CFR61.

In the context of the ongoing cancer scare, these events raised questions in the Los Alamos community, so the working group asked for a presentation of the Laboratory Director's air emissions report at its 12th meeting, on December 4, 1991. The report found "no reason for immediate alarm...(the program is) judged to be adequate to protect both Laboratory employees and the general public, both off and on site, from significant levels of radioactive emission." However it also noted that "Stack emissions monitoring is out of compliance with 40CFR61---a fact well known to those responsible for this effort...."²⁴

Concerned Citizens for Nuclear Safety (CCNS), a Santa Fe activist group, wrote to the regional EPA office on December 4 to request an independent audit of Laboratory air emissions. On March 27, 1992, CCNS formally notified the DOE,

via a Santa Fe law firm, of its intention to sue the DOE and the University of California, under CAA provisions. In August 1992, EPA began an audit of Laboratory air emissions. At their exit briefing, EPA officials confirmed that they saw no imminent hazard to public health and welfare. This essentially confirmed the findings of the Laboratory Director's report that, although not yet in full compliance, Laboratory air emissions did not pose a public health threat. Because of the continuing developments related to this issue it was not considered further by the working group.

In 1994, CCNS did file a lawsuit under the CAA against DOE and the then-director of the Laboratory. Between 1994 and 1996, the Laboratory and Region VI of the EPA negotiated a Federal Facilities Compliance Agreement, which specified the technical methods the Laboratory would use to demonstrate compliance. In April 1996, the court granted a partial summary judgment to CCNS based on DOE's admission that full compliance had not yet been achieved when CCNS filed its motion in 1994. (However, DOE contended that it achieved full compliance in June 1996.) The lawsuit was resolved by a negotiated settlement, and the resulting consent decree, signed in March 1997, included a series of independent technical audits by an external organization to verify if the Laboratory was indeed in full compliance. In addition, CCNS was allowed to retain a consultant group, at DOE's expense, to monitor the activities of the auditor. The first independent audit was expected to be completed in mid-1998.

7.6 The dose reconstruction flap

On May 14, 1992, the Laboratory offered to guarantee funding for a dose reconstruction study if the working group wanted one. The idea was that the working group would identify a suitable contractor to carry out the study by consulting appropriate professional societies and, presumably, that the group would also play a key role in managing the study. This well-meant offer triggered one of the more controversial episodes that the group faced.

At the next working group meeting, on May 20, a DOE representative reported that there was a memorandum of understanding between DOE and the Centers for Disease Control (CDC). That memorandum, signed in an effort to gain credibility for health-related data on DOE facilities, said that any such studies would be done by CDC. The DOE representative announced that the Department had made a determination that it would ask the CDC to perform a dose reconstruction study of Los Alamos with DOE funding.

The DOE decision suddenly changed an offer of funding to the working group for a dose reconstruction study, if they deemed it necessary, to the *fait accompli* that the CDC would definitely be doing the study, most likely without working group involvement. Several community members of the group expressed dismay that this decision had been reached without consulting them in their capacity as community representatives. Even the artist was quoted in a regional newspaper

as saying, "My (background radiation) readings have never been high enough to justify a dose reconstruction."²⁵ An editorial in the local newspaper ("Way too fast") complained that the scope of the study would be decided in Atlanta, apparently without input from the citizens of Los Alamos.²⁶

CDC officials attended the June 17, 1992, working group meeting. They said the study, if one were carried out, would cost several million dollars and take years to complete. They also observed that, if a study were done for Los Alamos, it would be the first for a nuclear design facility, which typically releases much less radioactivity than does a production facility. The CDC representatives added that a local citizen panel would be part of the process, but replied in the negative when asked if the working group would be that panel.

In March 1993, a CDC contingent returned to New Mexico to hold a public meeting in Española, in Rio Arriba County, some 17 miles distant from Los Alamos, to hear the public's concerns about health effects related to Laboratory operations. In December 1998,²⁷ CDC staff visited Los Alamos to announce that they had let a contract for \$4.25 Million for document discovery. The dose reconstruction itself was expected to take until 2004 and cost an additional \$7 Million or so.

8. THE LIST OF ALLEGED BRAIN TUMOR VICTIMS

The publicity the artist received from the two dosimeter controversies and the brain-tumor-cluster allegations made him the focal point for those in Los Alamos and nearby communities with concerns about radiation or Laboratory operations in general. He was contacted by other people with mostly anecdotal information about suspected brain tumor victims and he began keeping a list that had grown from 11 to 20 names by the first meeting of the working group on June 21, 1991. By the second meeting, on June 27, it had increased to 24 names and, by the third meeting, on July 2, the list was reported to have 26 names. However, by that time the working group's physician-member had reviewed medical records of 19 of the 26, and discovered that seven of the 19 had actually had primary malignant brain tumors.

It is important to distinguish between a primary brain tumor (one where the cancer begins in brain tissue) and a secondary (or metastatic) tumor that has spread to the brain from a primary tumor in another organ. The site where a secondary tumor occurs is largely random and not of epidemiological significance. The artist had not appreciated the difference between primary and metastatic brain tumors and this caused a great deal of confusion in media coverage of this issue.

On July 14, a regional newspaper feature article titled "Los Alamos Tumor Mystery,"²⁸ quoted the artist as saying that his list now had 36 names, 29 of whom had already died of brain tumors, 27 of them between 1988 and 1990. By

July 18, his list reached 43 names and, on August 4, 58 names. By then, the working group physician-member had obtained and evaluated 32 medical records from the list of 58, finding 15 cases of primary malignant brain tumor. On August 8, the artist's list passed 70 names.

At the seventh working group meeting, on August 21, 1991, the physician announced that he had evaluated a list of 59 suspected brain tumor cases given to him by the artist and had located the medical records of 40 of them, the remaining 19 names being residents of other states. Of the 40 records examined, a total of 22 primary malignant brain tumors were found—the rest of the cases were either metastatic brain tumors or other diseases. The official statistics kept by the New Mexico Tumor Registry (one of the National Cancer Institute's eleven reporting centers) for the years 1970–89 contained 18 of them, while the remaining three cases were too recent to have been reported to the registry but were recorded in hospital records.

In summary, the artist's list did not contain any new primary brain tumor cases, it had merely reproduced the names already known to the tumor registry or found in hospital records.

At the same meeting, DOE and the State of New Mexico announced that a contract for an independent epidemiology study had been signed; DOE would contribute about \$406,000 and the state about \$24,000. Both the artist (whose list had since reached 75 names) and the working group physician agreed that they would no longer keep nor evaluate lists of cancer cases—this function would be assumed by DOH as part of the epidemiology study. The working group unanimously agreed to accept 22 brain tumor cases for the 1970–1990 period as their "official" figure, pending results of the epidemiology study. The state epidemiology office was announced as the contact point for anyone having relevant information to offer in future.

9. THE RETURN OF THE BRAIN TUMOR LIST

In the fall of 1991, the Los Alamos brain tumor scare was discovered by the national media. The community was astonished to see the artist appear on an NBC program, "Our Town," on October 13, 1991, to say that his brain tumor list now contained 86 names. The October 28 issue of *People* magazine, in an article titled "Hunting a Silent Killer: An artist checks out a nuclear lab,"²⁹ quoted him as claiming 41 "recent primary brain tumor cases." The Associated Press Wire, on November 2, said his list contained 80 "suspected brain tumor victims," 22 of which were in the last four years.³⁰

At the 11th working group meeting, on November 6, 1991, the other community members confronted the artist. His statements contradicted the case numbers the group had agreed to and also violated their pact with DOH. In a heated discussion, one community member complained of feeling "betrayed" and

"blindsided" by the artist who was again giving his own, unevaluated case numbers to the media after having agreed with his working group colleagues that the tabulation of medical reports should be done by health professionals at DOH.³¹ On the morning of November 9, the headline in a regional newspaper read, "Tumor List Hits 94..." attributed to the artist. The article quoted him as saying, "I don't see that anything productive is being done by the (working group)."³²

On February 14, 1992, the front page headline in the local newspaper announced "Sculptor who raised cancer concerns leaves town."³³ Among his reasons for moving to Santa Fe, 35 miles away, were that he feared for his personal safety in Los Alamos and that he felt its environment was a health hazard for his young son. He said that his brain tumor list now stood at 97, and further claimed that 41 primary brain tumors had been confirmed, 22 by the tumor registry and 19 out-of-state cases known to him. DOH asked him to give them his list of 19 former Los Alamos residents, whom he claimed had been diagnosed with brain tumors out-of-state, so it could be evaluated. He promised to do so, but never did.

10. THE LOS ALAMOS CANCER RATE STUDY

At the seventh working group meeting, on August 21, 1991, DOE announced that a contract had been signed with the New Mexico DOH to carry out an independent epidemiology study of Los Alamos County (LAC) in conjunction with the New Mexico Tumor Registry

The DOH selected a diverse, 13-member steering committee to guide the study. It included nine members with doctorate-level qualifications, eight of them in a health-related field, such as epidemiology or medicine, and one in statistics. The remaining three members were a Los Alamos resident with a master's degree in genetics, a representative of a Santa Fe antinuclear group, and the artist whose claims had initiated the original brain tumor scare.

One of the eight health professionals was a former Laboratory epidemiologist, now a university professor, who had resigned from the Laboratory in anger, charging that an attempt had been made to suppress one of his publications; another was a former colleague of his, a current Laboratory epidemiologist chosen to represent the community. The remaining six health professionals were employed by DOE, CDC, the ATSDR, the New Mexico Tumor Registry, the New Mexico DOH, and a Los Alamos physician in private practice.

Four members of the epidemiology steering committee were also members of the working group. The Los Alamos physician, who was elected chairman of the steering committee, also served as community cochair of the working group. In addition to the artist, the other members of both groups were the Laboratory epidemiologist and the community member who had studied genetics.

As its first task, the steering committee examined Los Alamos cancer incidence rates for 23 bodily cancer sites, plus all childhood cancers as a separate group. A review of these data showed the incidence of some cancers in LAC to be greater than that observed in New Mexico and national populations (the "comparison populations") and some to be lower. Cancers with consistently elevated incidence rates during 1970–1990 included skin melanoma, prostate cancer, non-Hodgkin's lymphoma, ovarian cancer, and female breast cancer. The incidence of other types of cancers—leukemia, lung and major cancers of the respiratory and digestive systems—was lower than or comparable to that observed in the comparison populations.

10.1 Los Alamos demography

The demography of LAC is unique, making the definition of a true comparison population difficult. More than half of its adults have college degrees and one in 15 residents holds a Ph.D. Its median family income (\$61,000 in 1989) is fourth-highest among US counties, and is more than twice the New Mexico average. Its unemployment rate, which hovers around 2%, is amongst the lowest in the country. Many of its demographic variables, e.g., affluence, reduced fertility, delayed childbearing, are risk factors for some cancers.

10.2 Brain tumor results

Athas and Key³⁴ concluded that "Los Alamos County experienced a modest elevation in brain and nervous system cancer incidence during the mid- to late-1980s. Incidence in the county during this time period was 70%–80% greater than that observed in a New Mexico state and a national reference population. Due to the small number of cases, random fluctuation in the LAC incidence could not be ruled out as causing the observed elevated incidence." The brain tumor incidence rates are plotted as a function of time in Figure 1.

Figure 1. Five-year average annual incidence of brain and nervous system cancer: Los Alamos County and New Mexico

Note that the curve uses a five-year rolling average, and there is at least a one-year delay in processing the data, so the 1988 data point was the most recent available in 1991. Figure 1 also shows that the incidence rate for these tumors, which was never elevated to a statistically significant level, has since subsided and is now comparable with the state and national averages.

The incidence of brain and nervous system cancers within different Los Alamos neighborhoods was also examined by comparing the county's five census tracts. Athas and Key found that "The highest incidence occurred in the census tract corresponding to the Western Area neighborhood. The Western Area incidence rate was based on three cases, all of which were diagnosed between 1986 and 1987. Due to the small number of cases in each census tract, random fluctuation in the tract rates could not be ruled out as causing the observed variability in incidence."³⁴

In summary, Athas³⁵ reported that "No particularly unusual or alarming pattern in the incidence of brain cancer was found. Reconciliation of the study results with citizen claims of a large excess of brain tumors revealed that many of the alleged cases identified by residents as part of the excess involved metastatic brain disease or nervous system tumors diagnosed among former residents of the county. Based on these findings, a recommendation was made that no further study of brain tumors in LAC was needed beyond routine surveillance of brain cancer." However, Athas went on to say: "One study finding which did not fit the overall profile was a large increase in the incidence of thyroid cancer during the late-1980s." During the 1986-1990 time period the thyroid cancer incidence rate in Los Alamos County was nearly four times the New Mexico rate and was statistically significant.

10.3 Thyroid Cancer Results

Phase II of the epidemiology study focused on an examination of medical records for all thyroid cancer cases diagnosed among LAC residents from 1970-1995. This study had two basic goals. The first was to determine if there had been changes in the detection or diagnosis of thyroid cancer in LAC that could account for the recent excess. The second was the extent to which established or suspect thyroid cancer risk factors (e.g., some environmental exposure) could have accounted for the excess. With respect to the first goal, the investigators found little evidence that the detection or diagnosis of thyroid cancer in LAC had changed, e.g., none of the cases had been detected by thyroid ultrasonography. In fact, the majority of cases were found by palpation of an asymptomatic neck mass by local health care practitioners.

Regarding the second goal, a review of the descriptive epidemiology showed a pattern of contrasts between males and females that suggested there was not a common causal agent. Analysis of the case-series review data also suggested that the excess was multifactorial in etiologic origin with different risk factors for

males and females. Another possible explanation is that the Chernobyl accident, which occurred in April 1986, caused an increased awareness among the LAC medical community of the possibility of an increase in thyroid cancers (although thyroid cancers diagnosed before and after Chernobyl failed to show obvious differences in the extent of the disease). "It is possible, however, that a reservoir of undiagnosed clinical disease exists in the general population. This seems particularly likely for thyroid cancer given the indolent nature of the disease. Thus one could hypothesize that a 'harvesting' of cases in LAC might not necessarily be accompanied by an obvious shift toward less advanced tumors. The finding that nearly all of the LAC tumors were detected by palpation, a relatively insensitive technique for detecting small sub-clinical cancers, would be consistent with this hypothesis" [Athas].

The final conclusion of the epidemiology study was, "The investigation described in this report did not identify a specific cause of the unusually high number of thyroid cancers recently diagnosed in LAC. The likelihood is that the excess had multiple causes, some of which have been examined in this investigation, and some of which may never be identified" [Athas]. In any case, subsequent data, shown in Figure 2, indicate that the excess has been declining and that LAC thyroid cancer incidence is now roughly comparable to the state and national reference populations.

Figure 2. Five-year average annual incidence of thyroid cancer: Los Alamos County and New Mexico

11. THE INEVITABLE LAWSUITS

In December 1991, when the working group had been in existence for only six months and the cancer rate study had not yet begun, a lawsuit was filed against the University of California in the US District Court for New Mexico on behalf of two former Los Alamos residents who had been diagnosed with brain tumors. Some months later a third person joined the lawsuit. The plaintiffs asked for a total of \$75 million (\$25 million each) in compensatory damages as well as an unspecified amount in punitive damages to be determined at trial.

In May 1992, a federal class-action lawsuit was also filed against the University. It asked that an independently administered fund be set up to compensate members of the class for medical and psychological costs, including medical testing, preventative screening and independent scientific studies. The class was defined to include anyone who had lived or worked in Los Alamos since 1943, so the cost of medical surveillance alone would have been enormous.

In the meantime, the working group continued to accumulate evidence that the presence of carcinogens in the Los Alamos environment was unlikely. Similarly, results emerging from the Los Alamos Cancer Rate Study indicated that the modest increase in brain tumors, which was beginning to recede, was likely due to chance alone. In October 1993, the class-action lawsuit was dismissed at the request of the plaintiffs. Some months later the three brain tumor lawsuits were likewise withdrawn. The Laboratory had estimated the cost of defending the lawsuits, had they entered litigation, at \$7 million.

12. THE END OF THE WORKING GROUP

Based on his 1990 measurements, the artist had continued to assert that background radiation levels in Los Alamos were more than twice as high as would have been expected. Laboratory scientists had explained to him in person the procedural errors he had made in handling his dosimeters, but to no avail. Reconciliation of his measurements with those of the Laboratory had been on the working group's list of topics to address since its inception, but it had never been possible to schedule a meeting date acceptable to the artist.

By August 1992, community working group members were beginning to lose patience with the artist. Noting that many of the issues the working group still wanted to address had been initially raised by him and that he had missed three consecutive meetings, the community chair sent him a letter saying that they would discuss these issues in his absence if he failed to attend meetings. At the 22nd working group meeting, on September 9, 1992, the group examined the artist's and the Laboratory's monitoring data. The group concluded that the artist's mishandling of his control dosimeter invalidated his readings and that when this correction was made, his readings agreed with the Laboratory's ("Differences in TLD readings explained").³⁶ Community members decided to close out this issue in his absence, the first time this had happened.

The artist was outraged, first denying that he had received the letter from the community cochair, and then saying that he had received it but had not understood the implications of the agenda. He reported to the media that telephone threats he received on the days of working group meetings were a factor in his frequent absences ("Artist won't attend working group meeting"), although he could not "tell if the caller is a man or a woman."³⁷ At this point, the working group announced that there were only five issues left to resolve, all

of which had been raised by the artist. The community members decided not to wait for him in future, but to close out issues, when justified, in his absence if he failed to attend meetings. A community member of the group said, "To me, this looks as if we're getting very close to finishing." She went on to suggest that the group needed to decide on its future.

A newspaper article in January 1993 ("Working Group might refocus"),³⁸ reported that the artist had written the community cochair of the group, saying, "I see no reason to continue the working group." The community members held an open caucus, to which the artist was invited but did not attend, and voted 5 - 1 to accept his resignation. They elected a retired chemist to replace him, noting that the working group had now fulfilled its mission "except for a few loose ends." The artist was quoted in the same article saying that he hadn't intended to resign, but rather he wanted the entire working group to disband. He said he would fight his removal, that "it was improper and unlawful," adding that "I'm going to drag them in front of a lot of investigative committees." The community cochair responded through the newspaper, saying that the group had replaced the artist because "he's not participating—not because he's controversial."³⁹ The artist had now missed seven of the past eight meetings.

In a newspaper interview published in January 1993,⁴⁰ the artist claimed that a "LANL official," whom he would not name, had threatened (in August 1990) to burn down his house in Texas if he did not stop raising concerns about community radiation levels. Six hours after the drive-by survey of Western Area background radiation levels, his house in Texas was demolished by fire. Local police and fire investigators determined that the fire had been started by two young children living in the house, but the artist maintained that it had been "firebombed" because of his activism, pointing out that the Texas fire investigator had worked for DOE from 1979-1984. In this same article, the artist was quoted as saying "The fact that they are threatening me and that members of the community are making these attempts to silence me is all the more reason to continue."

Having completed its original tasks, the working group decided at its 26th meeting, on January 15, 1993, to update its charter, broaden its membership by including a regional representative, and to invite the local DOE office to nominate an *ex officio* member. The new charter was more proactive, focusing on giving the Laboratory advice about potential community implications of planned facilities and activities. But the working group was getting tired, and there were no longer pressing community health concerns. After accepting the new charter, the group met eight times in the following year, gave advice on a number of upcoming issues, but decided to disband on January 26, 1994, after having met 34 times in 31 months.

13. CONCLUSION

We didn't find the risk communication literature to be particularly helpful in the messy, real-world risk communication process we faced. Much of this literature is free of context. It seems to assume a familiar model in which an authority figure, e.g., a corporation or a government agency, possesses information about a risk and wants to provide it to the public in an understandable, sensitive, and persuasive way; perhaps even in a one-off communication campaign to address a specific situation. The literature tends to focus on the mechanics and etiquette of risk communication and on guidelines for communicating technical risk information credibly to a lay audience.⁴¹

In the situation described here, the Laboratory did not itself have the required information, so it was developed over the course of a three-year collaboration between the Laboratory and representatives of the affected public. The "how-to" guidelines for successful risk communication were still important, but much less so than developing a sense of trust between Laboratory and community representatives. The topic of trust has since received more attention, reminding us that risk communication is not an end in itself. It is an enabling agent to facilitate the continual evolution of social relationships in which mutual trust and respect are nurtured.⁴²

The working group experience was instrumental in improving public trust and confidence in the Laboratory, at least in the Los Alamos community and at that specific time. As Slovic has said, "Trust is fragile. It is typically created rather slowly, but it can be destroyed in an instant...."⁴³ Maintaining these improvements depends to a large extent upon what LaPorte calls "institutional constancy," i.e., "the willingness of future decision makers to hold to the resolve—or perhaps the commitments—of present leaders and operating managers."⁴⁴ This presents a difficult longer-term challenge for the Laboratory.

The initial investigations (1991-1993) of the alleged brain tumor cluster cost at least \$2 million of taxpayer money, about \$1 million for the working group's activities (staff time and studies) and another \$1 million for the epidemiology study and the costs of other state and federal agencies. Follow-up studies by federal agencies put into motion by the initial scare are still underway and are likely to bring the grand total close to \$10M over the next five years or so.

What did we get for our money? The working group found no evidence of carcinogens in the Los Alamos environment and results of the epidemiology study strongly suggest that there was not a cancer epidemic after all. The main outcomes appear to be that the Los Alamos community seems to trust the Laboratory more than it did, and Los Alamos residents are clearly more confident that they live in a safe environment. Certainly the intense concerns that arose when the claims of a brain tumor cluster were first made public have dissipated

and Los Alamos has the arguable distinction of being one of the most studied communities in the country.

14. EPILOGUE

Looking back on the working group experience some five to seven years later, we asked a representative of each key category of actor involved to reflect upon what their impressions were at the time as well as what they thought had been done right and, of course, what could have been done better. The interviewees are identified by the positions they held during the time the working group was active. Their statements were made in a series of interviews conducted by the senior author (HO). They have been edited for length and to eliminate redundancy.

14.1 The chair of the Los Alamos County Council

I followed the working group from a distance. I was impressed with the diversity of the participants and felt they made an honest effort to look at the issue objectively, especially on such an emotional issue. I was somewhat skeptical at first, but my respect for the working group increased over time because of the behavior of people I respected, who were not afraid to ask questions, tough questions.

Perhaps a more formal sense of closure would have been helpful. When it began to look like there was no serious health problem the media quit covering the issue and there was no effective way to convey the final outcome of the situation to the community.

The artist did not behave in a responsible manner. It's OK to raise questions, but it's not OK to raise them and just walk away and leave people who are invested in the community to pick up the pieces.

The working group was absolutely a good idea. It showed courage on the part of the Laboratory and the community. They were not afraid to look at this issue, not afraid of the truth whatever it might have been. It would have been easy to stonewall, to walk away and insist there was no problem. The working group was a successful example of public participation in a meaningful way, much more substantive than the years of "feel-good public participation" or "participation lite" that followed it.⁴⁵

14.2 The manager of the DOE Los Alamos Area Office

When the working group started, I was skeptical about its advisability. But something had to be done and it seemed reasonable, especially since we didn't know what else to do, but I really didn't expect much. It took a long time, but gradually the truth began to emerge and the hysteria and alarmist claims didn't get the same coverage as before. DOE headquarters liked the idea from the beginning because they could take credit if it went well and the Lab would have to take responsibility if it went wrong.

It was a painful process to go through, but I still can't think of a better substitute. If we had to do it all over again I wouldn't change anything about the broad approach. It resulted in a better understanding of the facts, promoted a reasonable dialogue, calmed a volatile situation, and fostered a spirit of cautious cooperation between the Laboratory and the community.

In the end, the data emerged to really discount the allegations the artist had made. Before we had the working group, he could make allegations anywhere without being accountable to anyone. The patience shown by the other working group members, staying the course, allowed a common-sense understanding to emerge. This invalidated the artist's accusations and he quit coming because people weren't listening to him any more

The working group process did much to improve relations between Lab and the community, at least with respect to environmental and health issues, which were still apparent when I left Los Alamos in mid-1994, although the Lab was not as good at other community issues.⁴⁶

14.3 A journalist who covered the story for a regional newspaper

The working group was a good idea. The public questioning was very good for the Lab. It made the Lab more open and, by putting Lab experts and managers in the public eye, they were held accountable through the media. Many Lab experts began to see the media as representatives of the public for the first time. I thought the working group was sincere within the parameters of denial; that is they really wanted to know if something was wrong in their community, but at the same time were unconsciously hoping to exonerate the Laboratory. If the same situation arose again, it would be good to have working group members from other communities and organizations.

The artist was sincere at the beginning, but the media attention inflated his ego and, especially at the end, he began using the media to make his points. The working group chairs responded through the media and this brought in a public relations element. But Los Alamos, and every town, needs someone like the artist. It was hard for Los Alamos to look at itself the way he did.

Given the history of the work that was done in Los Alamos, it's logical to assume there must be some effects. If its population were larger the elevations in some cancer rates that were found not to be statistically significant might become significant.⁴⁷

14.4 A journalist who covered the story for the local newspaper

When the formation of the working group was first announced, I thought it might be a good thing, but I was cautious. It looked like a sincere effort early on. We really had access to anyone from the Laboratory we wanted to interrogate and we could get answers to hard questions. At the start, the artist seemed to be quite sincere, and many people believed that the Lab could be causing cancer but were afraid to say so. It was a relief to have it out in the open where it could be discussed.

If the same situation arose today, I would do the same thing again. The working group provided a "window of opportunity" that had never been possible in Los Alamos before (or since) to ask questions and to interact with the Lab in an "anything goes" kind of atmosphere. My one regret is that there was not a stronger summary at the end, a solid closure to the issue. That was partly the media's fault in that we all drifted away when it began to look like there was no bad news coming.

Although the Lab was very open on health and environmental issues, the openness didn't really spill over to other topics. After the working group ended, the window closed again and today the Lab is only slightly more open on health and environmental topics that it was in the preworking group era.

Our newspaper was swamped with calls from all over the world, mostly from the news media, but also from concerned people. It was also obvious that the Los Alamos community was following the situation closely through the media. Now people in Los Alamos feel more comfortable living here, and it has to do with trust generated by this experience, but there is still a residue of concern.⁴⁸

14.5 The director of a Santa Fe antinuclear activist group

I thought the working group was a sincere effort. People in Los Alamos were interested in finding out what was going on in their community, but there was also a strong need for the community to heal possible damage to its belief system. Given the overwhelming psychological need for this to happen, it could have affected the objectivity of the group. Since the data admitted no definite conclusion, they might have been interpreted in a way that would exonerate the community's most important institution.

But, basically, the working group was a good idea. It is important to take matters related to the impacts of science and science policy and subject them to public discourse. If the same situation were to arise again, it might be useful to formalize it into a science court kind of process where each side has an advocate to make its best possible case. This would assure that there was someone whose job would be understood to be that of a "troublemaker" on behalf of the community. The artist's role was to attack the consensus, but he was marginal in this role and it was too much for him in the long term. It was too great a weight for one person and, under the stress of the situation, he became an issue himself.

The federal health agencies have had years to act but have done nothing. The working group did wrest power from these elite expert groups for whom a health crisis is a potential budget gain. The working group democratized science, that was its strong point, and it happened quickly. Los Alamos has a lot of citizen expertise in its community, but people in any community could be motivated in a similar situation.⁴⁹

14.6 The deputy director of Los Alamos National Laboratory

The artist's first claims of a brain tumor epidemic definitely raised concerns in the community. There was mistrust of the Lab and many of the people in the community who were concerned also worked at the Lab. We believed that the Laboratory had always been careful in its operations, but we had to understand if there was anything going on that we didn't know about. Lab management had a sincere desire to take an objective look at this issue because we also raise our families here.

Collaborating with the community in this way was very successful. It can serve as a model for how to work with the community. The Laboratory learned about the importance of engaging the community, making it part of the study. If a similar issue arose

today, I would do the same thing. It was especially good that the Los Alamos medical community got involved. They made an impressive voluntary investment of time and energy.

We have continued to interact more actively with the community. The working group established a precedent for involving the community in issues that affect them. It helped to break down barriers between the Laboratory and the community and our relationship with the community is better today because of the working group experience.⁵⁰

14.7 The artist

My first impression of the working group was very good. I expected to have an open dialogue on technical issues. There were a lot of documents on pollution that weren't really clear and I hoped to get some explanations. By the second or third meeting it became obvious that the Lab's main objective was damage control, that there would not be an open dialogue. There was a strong feeling that the Lab was hiding something of significance. I was told that, as a member of the working group, I couldn't talk to the news media, and this was a violation of my civil rights. There also were veiled threats that if members of the public brought up uncomfortable issues there would be repercussions.

The working group got lots of publicity and increased public awareness of the extent of public health issues in Los Alamos. There was some value in the access to environment, safety and health experts that the working group made possible, but it was difficult to get the public's issues on the agenda. To the degree that dialogue took place it was very productive. Disturbing data was well-covered by the news media. The air emissions whistleblower case (see section 7.5) damaged the Lab, which again focused on damage control. By the fourth or fifth meeting I felt it was not a safe place for a public dialogue.

We moved from Los Alamos to Santa Fe in February 1992 and, in December 1996, moved again to central California, an area where people are committed to health and the environment. Health is a lower priority to the people of Los Alamos than it is to me. If I had it all to do over again, I would not become an activist, I would just realize that people in Los Alamos don't care about their health and just leave. I found it surprising that people so educated didn't care about the health and welfare of their kids and their families. Los Alamos people are callused, only interested in their careers. After all, what kind of people go to work for a nuclear weapons lab? My

values are different. Lab employees and their spouses are afraid to criticize the lab. I had 20-30 strong supporters at the Lab until the Lab's efforts to suppress the air emissions whistleblower scared them away.

There was definitely an attempt to scare me away, and I decided to leave Los Alamos about the time the human study experiments were made public. I was accosted in the grocery store, people yelled at me, and there was a general atmosphere of hostility. I don't know for sure if there was a coordinated effort against me. Historically, the Lab has been capable of egregious criminal behavior—and this is absolute fact—for example, the President of the US formally apologized to the experimental subjects involuntarily injected with plutonium. The day after a heated working group meeting my neighbor backed his horse trailer into my car and totaled it. On another occasion, somebody threw a railroad tie in front of my wife's car on the road near Santa Fe. It severely damaged the car and almost caused a rollover. In retrospect, I can't ignore the possibility that some people didn't want public disclosures. Finally, I didn't feel safe driving up to the Lab anymore. Could this all be just coincidence?

The Lab is not trustworthy. It has not demonstrated that it is an institution that can be trusted. It has operated without oversight and has not developed a structure for dealing with public concerns. It is responsive to DOE because that's where the money comes from. The Lab's PR people are not remotely credible. How could the Lab earn the trust of people in the region? Keep the PR people at home and let the scientists go out and just tell people the truth about what they're doing and how. Lab scientists must ultimately be responsible to the public for their work. The best thing about the working group were public presentations by Lab technical staff who gave people first-hand information about the risks.⁵¹

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