

CES EDITORIAL COMMENT

on Water Quality Report

There will be an addendum regarding the perchlorate found at the springs adjacent to the Buckman well field along the Rio Grande. Meetings are currently being set, to get the straight information on who knew what, when and where about the "Suggested Pathway". It seems that there is some tossing of the ball between LANL, NMED and the EPA. Not one of these agency representatives who were present at the meetings informed the task force of the information that it now appears that they knew about.

It is clear that this report slants in the favor of LANL and that not all of everyone's comments that was on the task force were included in an effort to dismantle the Task Force set by the resolution by City Council. At the end of the WQTF Report you will find a Minority Report from the Vice Chairperson and Letter from a couple of the Members. CES Hopes to include comments from NMED and LANL representatives on this report. Be sure to read the Minority Report written by Hank Daneman (see link on sidebar), Vice-Chair person of the Water Quality Task Force.

Please check back to this site for updated information from the other members of the Task force as to the Public health and Safety of the City of Santa Fe Drinking Water and the effects on the San Juan Chama Diversion Project.

Santa Fe Water Quality Task Force Report -

SECTION I. EXECUTIVE SUMMARY

The most immediate water quality issue, with respect to the San Ildefonso infiltration gallery (Collector Well), is the contamination potential associated with flooding and scouring. To the extent unfiltered surface water enters the infiltration gallery, either through flooding or riverbed scouring, total organic carbon (TOC) contamination is a concern. When water is chemically disinfected, particularly with chlorine compounds, TOCs give rise to disinfection byproducts (DBPs), including trihalomethanes (THMs), which are associated with adverse reproductive outcomes in humans. DBPs and THMs also include suspected carcinogens.

TOCs are naturally occurring, as in the decomposition of plant material, and are also introduced into the environment through farming and ranching operations. The City of Española waste treatment plant, less than 20 miles up stream on east bank of the Rio Grandé, is a potential source of significant quantities of TOCs as well.

Another concern impacting water quality in the area is arsenic and uranium. Both are detectable in area water supplies at concentrations above safe drinking water standards. The arsenic threat is more

widespread. The uranium threat is more localized and related to natural mineral deposits in the region. Both are typically associated with drilled wells however.

The recent Cerro Grandé Fire, because of its location and scale, ignited public concern over increases in contaminant migration rates and concentrations related to the Los Alamos National Laboratory (LANL). Sampling of post-fire storm runoff, along with a related independent risk assessment, shows no substantial change in potential adverse chronic health effects due to the fire. Post-fire sampling/modeling however is expected to continue for years, plus there remains considerable uncertainty regarding quantities and types of contaminants in and around LANL stemming from prior year activities. This adversely impacts the accuracy of the modeling effort and related health risk projections.

In terms of radiological and chemical risks associated with LANL contaminants, the San Ildefonso infiltration gallery is located on the opposite (east) side of the Rio Grandé relative to the LANL reservation, upstream from LANL surface drainage pathways intersecting the Rio Grandé. Because of this the related threat to the infiltration gallery, at least with respect to the foreseeable future, is minimal. Prospects for LANL-related contaminants migrating underneath the Rio Grandé, from west to east, is similarly unlikely to occur in the foreseeable future because the Rio Grandé, both above and below ground, acts as natural barrier and serves to dilute and redirect downstream contaminants coming in contact with its flow.

It's not inconceivable that water table depletion east of the Rio Grandé could someday create a large enough underground void to cause aquifer movement, west to east, to occur below the Rio Grandé. However, evidence to date suggests this is unlikely to occur in the foreseeable future, much less impact surface or near surface water extraction if it were to occur. Thus to the extent the City of Santa Fe utilizes upstream surface or near-surface Rio Grandé water, the risk associated with LANL contaminants is minimized. The opposite holds true however with respect to surface or near-surface water extraction downstream.

In December 2001 the WQTF learned for the first time that perchlorates, a byproduct of industrial activity, had been detected in water samples obtained from springs located on the west side of the Rio Grandé. The amount detected was at concentrations small enough to bring into question the reliability of the initial finding. However, if further tests should confirm existence of perchlorates in the Rio Grandé basin, the concern would be whether LANL-related contaminants are moving through the environment quicker, further, and deeper than initially thought to be the case.

Policy Recommendations (pages 22-25)

Section IV contains WQTF policy recommendations to City of Santa Fe. A brief discussion on potential funding strategies is included at the end of the section.

Methodology & Background (pages 4-8)

Section II describes the methodology and background associated with effort.

Contaminant Pathways (pages 9-21)

Section III provides detail analysis of potential contaminant pathways.

WQTF Members & Subject Matter Experts (pages 26-30)

Section V contains background descriptions on task force members and subject matter experts addressing the

SECTION II. METHODOLOGY & BACKGROUND

City Council Resolution 2000-46 directed the WQTF to consider the formation of "an autonomous independent organization" charged with "performing independent risk analysis that will safeguard the City of Santa Fe's interests in regards to water quality." (emphasis added)

"Risk analysis" is a broad term. According to the Society for Risk Analysis: "Risk analysis is broadly defined to include risk assessment, risk characterization, risk communication, risk management and policy relating to risk."

Highly quantitative "risk assessment" approaches, best carried out by outside contractors, obviously fall within this definition. But also within this definition of "risk analysis" are qualitative approaches to risk communication, management and policy issues. The WQTF's membership included subject matter experts with professional training well-suited to tackling these issues. Moreover, the WQTF leadership felt that qualitative approaches to risk analysis merely required "common sense," which many citizens possess. In our democratic society one need not be an "expert" to analyze environmental health risks.

From City Council Resolution 2000-46, the WQTF construed a discretionary role for itself in undertaking a preliminary, qualitative evaluation of whether the municipal water supply might be at risk of contamination and, if so, the nature of those risks. We endeavored to make policy recommendations for how the City of Santa Fe might best manage and communicate about both real and perceived risks.

An overall framework for this evaluation was needed, one which would provide:

1. terminology to facilitate communication among members of the WQTF;
2. a procedure for seeking and assimilating expert opinion; and
3. a framework for exploring further quantitative risk assessment projects with outside contractors.

The overall framework we adopted is based on the concept of exposure pathways. Exposure pathways are linear sequences describing how environmental contaminants move from their points of release, through environmental media (i.e., air, water, soil, and biota), and ultimately into contact with human beings. Possible threats to the Buckman wells were occasionally discussed, but not in the same degree of detail as we did for the Collector Well.

The WQTF decided to focus on the City's proposed Collecto>

Most of the exposure pathways we considered were those which might transport contaminants from

LANL into the vicinity of the Collector Well. Possible threats to the Buckman wells were occasionally discussed. Because the WQTF's mandate emphasized "the City of Santa Fe's interests in regards to water quality," we also included several contaminant exposure pathways unrelated to LANL which might threaten the municipal water system.

As the City of Santa considers new sources of water (i.e. surface water diversions), public concerns regarding potential sources of contamination should be analyzed using this framework--based on exposure pathways. A careful exposure pathway analysis for the Buckman wells is also warranted in light of recently-disclosed information about perchlorates from LANL.

In addition to the key concept of exposure pathways, risk analysis employs several important concepts, which the WQTF sought to make explicit. These are described below.

Uncertainty: complete knowledge is seldom, if ever, available to decision-makers. Risk analysts have a responsibility to identify, and be explicit about, key areas of uncertainty.

Impact: estimating the magnitude of likely effects on human health is the goal of quantitative risk assessment. In the context of the WQTF's qualitative deliberations, this boils down to "Is this potentially a big a problem?" based upon available expert opinions, scientific documents, and pathway analyses.

Subjective Probabilities: Risk analysts are human beings with prior biases, opinions and pre-conceived ideas. Individuals should speak openly about their opinions. In the wake of additional evidence, debate and discussion, or experts' opinions, they should be willing to modify their opinions, if appropriate. As in any democratic, consensual decision-making process, the respect accorded to individuals' opinions is a complex social function, which depends partly upon how they integrate objectivity and subjectivity.

Public Control and Accountability: The reasoning processes of risk analysts should be open to public input and oversight at all times. Analysts should be available to discuss and defend their decisions with members of the public. In doing so, important values of the wider community can be incorporated into the analysis. These include economic realities and priorities, political convictions, and social concerns.

The WQTF devoted its March and April meetings to a group process, which applied these key concepts of risk analysis to the municipal water system. At the March meeting, poster-sized diagrams of several postulated exposure pathways were posted on the walls of the meeting room. Group discussion led to minor modifications of, and additions to, these exposure pathways. Next, to prepare for the April meeting, WQTF members were asked to categorize each of 13 exposure pathways based on their individual (i.e., subjective) probability assessments. As part of a "homework" assignment, individual WQTF members evaluated: a) the magnitude of the pathway's possible impact on human health and b) its likelihood of occurrence.

The result was a 2 x 2 grid, into which individuals assigned each of the 13 exposure pathways. Each of the four cells in the 2 x 2 grid has a particular meaning:

- I--High certainty of occurrence with a big impact: time for action
- II--Low certainty of occurrence with a big impact: immediate priority for further studies
- III--Low certainty of occurrence with a small impact: not a priority for further studies
- IV--High certainty of occurrence with a small impact: off the table, unless we're presented with new information

These rankings were not binding upon individual members or the WQTF as a whole. As the WQTF proceeded with its mission, individuals were free to change their opinions; indeed, many did in the wake of evidence presented at subsequent meetings. For example, WQTF agendas for later meetings included lengthy discussion of pathways in Category IV, indicating that they were never completely "off the table."

Subsequent meetings of the WQTF were organized around discussions of one or more exposure pathways. Presentations by WQTF members and outside experts elucidated key areas of uncertainty and the magnitude of possible impacts. We make no pretense of having conducted a "quantitative risk assessment." That was not our purpose. However, we note with satisfaction that Dr. John Till of Risk Assessment Corporation (RAC), one of the country's top experts on radiation health risk assessment, indicated that an exposure pathway approach was a desirable framework for the WQTF to have used.

Clearly, the three aims stated above were, in fact, achieved by use of the exposure pathway approach, especially that of exploring further quantitative risk assessment projects with outside contractors. By allowing each WQTF member to apply key concepts of risk analysis, this exercise accomplished one of the first steps of any civic dialogue: to know where you stand and be able to articulate it in public. Above all, we believe the exposure pathway approach has enabled us to frame cogent policy recommendations for the City of Santa Fe in the qualitative areas of risk management, communication and policy.

SECTION III. CONTAMINANT PATHWAYS

Pathways 1-A / 1-B: LANL 'Potential Release Sites' (PRSs) Located in canyons ("1A") or on mesas ("1B") of the Pajarito Plateau are source for contaminants passing through rock strata and reaching the regional aquifer

A primary impetus for the WQTF's formation was a local citizen's long-standing advocacy on the issue of ground water contamination of areas at LANL where wastes have been, and continue to be, disposed. The WQTF discussed and debated this potential exposure pathway, and its relationship to Pathways 2A and 2B (below), at several meetings.

There is no doubt that shallow (or "perched") ground water is contaminated with LANL-related radionuclides at areas like Mortandad Canyon, to a depth of about 50 to 100 feet. A LANL ground water scientist concedes that there is also evidence that LANL-related contaminants have reached the regional deep aquifer. Monitoring wells have been installed to detect the patterns of movement of ground water contaminants.

Several lines of argument were advanced by the LANL scientist, and other participants who are not affiliated with LANL, for why these pathways are not likely to be problems for the City of Santa Fe:

1. As the contaminants migrate, Los Alamos County (LAC) supply wells will show problems first. To date, only one of 12 LAC wells has shown evidence of contamination.
2. Concentrations of contaminants will be greatly attenuated by the long distances over which they must travel before reaching City of Santa Fe drinking water sources. This applies to both the existing Buckman wells and the proposed Collector Well.
3. Radioactivity will decay over the decades required for the contaminants to migrate over long distances.
4. For waste disposal areas on mesa tops around LANL, precipitation would be greatly inhibited from carrying contamination below a depth of about 45 feet. Sample cores from the bottom of new disposal pits (after a heavy rain) show that rainfall penetrates the tuff to a depth of about 15 feet before evaporation begins to dry out and remove all traces of the rainfall from the tuff. Observation of natural fractures in the walls of new disposal pits show them filled with caliche to a depth of 6 to 20 feet, which is followed by clay to a depth of about 30 feet. While the fracture fillings of caliche and clay do not completely stop all water movement, in the fractures they greatly impede it.
5. The semi-arid climate and the thickness of the Bandelier tuff, and the sediments below it, combine to prevent most moisture from moving any great distance. Thus any moisture to reaching the aquifer, from atop a mesa, would be in the form of water vapor. Contaminants carried by water vapor would have to be in a gaseous state as well. The regional aquifer, from 200 to 2,000 feet below the surface, is not recharged by infiltration of water through the mesa tops.

However, several counter arguments were also made. In rebuttal to #4, the lateral movement of contaminants through fractures, which occurs when they encounter clay, should be considered as a pathway by which contamination could move to the canyon walls and into surface water. In rebuttal to #5, "mesa recharge" is known to occur. Tritiated water may have reached the water table.

Concern was expressed that contaminants, which reach the deep aquifer, might cross under the Rio Grandé and head north to deep wells at the pueblos and at Espanola. There is evidence in the Lab's 1996 "Environmental Surveillance..." report of naturally occurring isotopes in ground water west of the Rio Grandé in specific ratios, which are characteristic of ground water sources in the Sangre de Cristo Mountain. While this piece of evidence indicates that ground water does flow under the Rio Grandé, it suggests that the direction of flow is from east to west. For LANL-related contaminants to affect the Collector Well, ground water would have to flow under the Rio Grandé in the opposite direction. (And then flow northward, in a direction opposite to that of the Rio Grandé, which ground water does not commonly do).

A City technical specialist pointed out that the Buckman wells were originally artesian. Ground water there was under pressure to emerge at the surface and not to flow under the Rio Grandé. In addition, the deepest Buckman well is still 200 feet above the elevation of the Rio Grandé. It is not realistic to believe that pumping has formed a sufficiently large cone of depression, which would draw in LANL-related contaminants from the opposite side of the Rio Grandé.

Pathways 2-A / 2-B: Contaminants in the deep aquifer follow the Puye formation (2-A) and/or the Santa Fe Group (2-B) traversing under the Rio Grandé to the Collector Well

These potential pathways follow in sequence from Pathway 1. Once contaminants have reached the deep aquifer, are there pathways by which they might travel under the Rio Grandé and reach the City's drinking water supply at the Collector Well at San Ildefonso?

A LANL scientist expressed the view that only the deep aquifer could impact on the Collector Well. Perched ground water in alluvium (resting on Bandelier tuff) in Mortandad Canyon does not travel far. The deep aquifer is in two geologic strata: the Puye Formation and, at greater depths, the Santa Fe Group. Both are below the Bandelier tuff, which forms the mesas and canyons of the plateau. If contaminants were to cross under the Rio Grandé, they would likely have to do so via the Santa Fe Group. The Puye Formation does not go under the Rio Grandé, according to a diagram distributed by the LANL scientist. According to the "Hydrogeologic Atlas of the Los Alamos National Laboratory," neither the Puye Formation nor the top of the Santa Fe Group go under the Rio Grandé. The Rio Grandé has cut down beneath them.

Monitoring programs show that LANL-related contaminants are moving toward the regional deep aquifer in Mortandad, Pueblo and Los Alamos Canyons. However, it will take decades for contaminants to travel first vertically a minimum of 800 to 1,000 feet to the top of the aquifer, and then laterally about four miles to the vicinity of the Collector Well. Because the canyon walls in lower Los Alamos Canyon and White Rock Canyon expose the top of the aquifer, contaminants would have to move vertically at least an additional 650 feet to contaminate groundwater that, at some point, might reach the Collector Well. The deep aquifer moves laterally at a rate no greater than 300 feet per year, approximately 20 years per mile. Moreover, the likely direction of flow in the deep aquifer is not in the direction of the City's water supply. In the absence of data to the contrary, hydrologists assume that ground water tends to flow in the same direction as surface water. This would mean that the direction of ground water flow is likely southeast. The Collector Well is to the northeast of LANL.

A representative of the New Mexico Environment Department shares this point of view. He argued for "zero concern" about water passing under the Rio Grandé. It would take "lifetimes" for contaminants to reach Santa Fe water sources.

A dissenting view was expressed by a WQTF member with expertise in hydrogeology. The Rio Grandé is not a barrier to deep aquifer flow, particularly at greater depths. Moreover, perched water from the canyons could move in the direction of the Rio Grandé if it moved into pumice beds filling paleo drainages.

Pathways 3-A / 3-B: Alluvial flow of water-borne contaminants from canyon PRSs reach surface water of the Rio Grandé: (3-A) surface water moves upstream; (3-B) sediments move upstream

By careful examination of topographic maps, the WQTF was able to determine that all of the known LANL-related contaminated sites are drained by canyons reaching the Rio Grandé south of or at the mouth of Los Alamos Canyon, which lies south of Otowi Bridge. Nevertheless, we considered possible pathways by which contaminated surface water (3A) or sediments (3B) might be transported

upstream into the vicinity of the Collector Well at San Ildefonso.

A member of the WQTF with expertise in hydrogeology suggested that contaminants reaching the Rio Grandé might be transported upstream into the vicinity of the Collector Well. It depends on how new wells installed locally affect pressure heads. This drew a rebuttal: the City's report on its test well shows little "draw down" or connection to the Rio Grandé's surface water, which weighs against the postulated effect on pressure heads. The Collector Well proposes to withdraw only surface water from the Rio Grandé. Moreover, this stretch of the Rio Grandé is well known to be a "gaining stream." This means that pressure gradients favor ground water flow into the Rio Grandé, not the other way around.

However, contaminated sediments entering the Rio Grandé at Los Alamos Canyon might be transported upstream under the following scenario: if a major landslide were to occur, a debris dam could form in the Rio Grandé. This scenario forms the basis for one of the Policy Recommendations in Section IV of this report.

In rebuttal, another WQTF member with expertise in the hydrogeology of Pajarito Plateau and the Rio Grandé expressed the view that the amount of destruction of nearby mesas, which would have to occur in order to form a landslide of sufficient size to dam the Rio Grandé, immediately south of the mouth of Los Alamos Canyon, is unrealistic.

Pathways 4-A / 4-B: Alluvial flow of water-borne contaminants from canyon PRSs (if there are any) north of Los Alamos Canyon to surface water of the Rio Grandé: (4-A) surface water moves downstream; (4-B) sediments move downstream

According to a representative of the New Mexico Environment Department (NMED) there are no known Potential Release Sites (PRSs) with LANL-related contaminants, which have the potential to drain into the Rio Grandé north of Los Alamos Canyon. A local advocacy group, when invited to provide evidence to the contrary, did not dispute this fact. These three PRSs are believed to represent minor areas of contamination. Nevertheless, they carry the potential to contribute contaminants to the Rio Grandé upstream of the Collector Well via surface water run-off. This forms the basis for one of the Policy Recommendations in Section IV of this report.

Pathways 5-A / 5-B: Post Cerro Grandé worst case FLOOD conditions: Alluvial flow of water-borne contaminants from canyon PRSs reach surface water of the Rio Grandé: (3-A) surface water moves upstream; (3-B) sediments move upstream

It is widely agreed that surface water run-off from LANL property has increased as a result of loss of vegetation in the Cerro Grandé fire. According to a City technical specialist, after the Dome Fire, to the south of LANL property, surface water flows in tributaries leading into the Rio Grandé increased by two orders of magnitude (i.e., about 100-fold). Surface water run-off is likely to remain higher than usual for a period of years after the Cerro Grandé fire.

How will these post-Cerro Grandé flood conditions affect the contaminant transport processes discussed in Pathway #3, above?

Formation of a debris dam (as discussed above under Pathway #3) is more likely as a result of the Cerro Grandé fire. This could cause contaminated sediments to move upstream from the mouth of Los Alamos Canyon into the vicinity of the Collector Well. Specifically, concern was expressed over

the re-mobilization of plutonium-contaminated Rio Grandé sediments at the mouth of Los Alamos Canyon. In addition, a LANL scientist acknowledged that Lab-related contaminants in the alluvium of Mortandad Canyon could reach the Rio Grandé under post-fire flooding conditions.

In rebuttal, one WQTF member with hydrogeology expertise of the Pajarito Plateau remains skeptical that either agency, landslide or flood waters, could produce sufficient material to dam the Rio Grandé for sufficient time to form a lake which would reach the Collector Well site.

A representative of the Interagency Flood Risk Assessment Team (IFRAT) briefed the WQTF. IFRAT's modeling predicts the presence of higher concentrations of radionuclides, metals and arsenic in Rio Grandé surface water as a result of the Cerro Grandé fire. IFRAT is not specifically evaluating possible contamination of City of Santa Fe drinking water sources like the Collector Well.

Pathways 6-A / 6-B: Post Cerro Grandé worst case FLOOD conditions: Alluvial flow of water-borne contaminants from canyon PRSs (if there are any) north of Los Alamos Canyon to surface water of the Rio Grandé: (4-A) surface water moves downstream; (4-B) sediments move downstream

In the absence of evidence of LANL-related PRSs in canyons that drain into the Rio Grandé north of the Collector Well (see Pathway #4, above), the WQTF discussed three closely related subjects.

A consultant performing work for NMED expressed the view that over the long-term contaminants from LANL will impact Santa Fe's water quality. With prevailing winds from the south, air contaminants from LANL have been, and will continue to be, deposited in the Rio Grandé watershed. Eventually they will be carried downstream to the Collector Well. The likelihood of transport through ground water and surface water depends on a radionuclide's chemical properties. For example, radionuclides of plutonium, cesium and strontium isotopes all show different transport properties. Once they enter the City's water supply, the consultant asks the question "What is the risk" of low levels? A difficult related issue is "What are background" levels of radionuclides in northern New Mexico?

A member of the WQTF with expertise in environmental health sciences expressed concern about future flooding events. Naturally occurring metals in ash from the northern-most canyons burned by the Cerro Grandé fire could be carried down the Rio Grandé in the form of "muck" and deposited in the vicinity of the Collector Well. The Rio Grandé reportedly ran black after the Cerro Grandé fire. What are the concentrations of naturally occurring metals in the muck? Will they enter the City's drinking water supply? In rebuttal, a LANL scientist stated that the worst flood-related contamination has already passed.

Further, a member of the WQTF with expertise in hydrogeology described the mechanism of "scour" by which Rio Grandé sediments are disturbed and redistributed under flooding conditions. A representative of the company involved in building the Collector Well described how the collector can "valve off" any intake port during a flood.

Pathway 7: Run off in fire-damaged canyons north of San Ildefonso flows into the Rio Grandé in flood. Non-radioactive, non-laboratory contaminants are added. Collector Well pump house and well leak contaminated floodwaters down the well shaft.

Concern was expressed over a "classic public health pathway" in which floodwaters of the Rio Grandé rise to a level in which the pump house at the Collector Well is partially or wholly submerged. Contaminants in the floodwaters could be carried down the well shaft into the City's water supply. City personnel said that with proper engineering it could be made impermeable (sealed) to contaminants in flooding, but a representative of the construction company suggested that it is already impermeable. City personnel, however, implied that it was not. Raising the height of the pump house by several feet to elevate it above the height of future flood events was cited as a possible solution.

Pathways 8-A /8-B: Arsenic in Rio Grandé water/ sediments reach the Collector Well.

Arsenic and uranium, both naturally occurring in northern New Mexico, generated discussion on the WQTF. Some members questioned whether these non-LANL contaminants are within the scope of the WQTF's mandate. One member argued for their inclusion for a strategic reason: if the WQTF were to adopt an advocacy stance on LANL-related contaminants, then we could expect LANL and DOE to quickly point to the presence of naturally-occurring substances like arsenic and uranium. In anticipation of such a controversy, it is better to gain knowledge of these contaminants now. Another member of the WQTF suggested that incremental risk of LANL-related contaminants should be evaluated in the context of all carcinogens in the City's drinking water. Possible contributions by the Molycorp mine in Questa were also mentioned, although other members of the WQTF felt that it was too far away from the Collector Well to pose a serious threat.

A representative of NMED stated that the natural occurrence of uranium in the Pojoaque Valley is the leading ground water public health issue in the state of New Mexico at the present time. Arsenic is a problem in deep wells, not in surface water. A member of the WQTF with expertise in hydrogeology explained that uranium and arsenic are problems in the Buckman well field because of volcanic intrusions through the Tesuque formation. NMED's representative indicated that he did not think either arsenic or uranium would be a problem at the Collector Well.

Pathways 9-A /9-B: Total Organic Carbon (TOC) in Rio Grandé surface water and/or sediments reaches the Collector Well. Disinfection by-products formed if chlorinated/treated with ozone.

Water rich in total organic carbon (TOC), when treated with chlorine, gives rise to disinfection by-products (DBPs), including trihalomethanes (THMs). Many of these by-products are suspected carcinogens. Moreover, a growing body of epidemiologic evidence shows adverse reproductive outcomes in populations consuming drinking water contaminated with these by-products. Alternative disinfection treatments, such as chlorine dioxide or ozone, generate lower levels of DBPs and THMs.

A member of the WQTF with expertise in hydrogeology stated that TOC is a concern even if Collector Well water has been filtered through 30 feet of sand and gravel beds. Organic carbon in the form of very fine particles will still be drawn into the collector. Another member of the WQTF pointed out that Rio Grandé surface water, as well as water from a test hole at San Ildefonso Pueblo, contained dissolved TOC. A representative of the company building the Collector Well indicated the collector would draw in surface water. However, the City is hoping the water will be sufficiently free

of microbial contamination to avoid any more extensive and expensive treatment than the disinfection required for all drinking water.

A representative of NMED indicated that Santa Fe drinking water already contains high levels of THMs, albeit below regulatory limits.

Pathways 10-A / 10-B: Bulk quantities of radioactive materials (e.g. ^3H , Pu) at current Lab technical areas are released into the air by fire (10A) or other accident (10B). Wet and/or dry deposition contaminates the upper Rio Grandé and may reach the Collector Well.

A member of the WQTF expressed the view that if such an accident were to occur, then contamination of the City of Santa Fe's Collector Well would be the least of northern New Mexico's worries. Another WQTF member, emphasizing the low probability of such an accident, rhetorically asked if we should also consider the health consequences of a volcanic eruption of the Valle Grandé Caldera. However, another WQTF member pointed out that there is "a continuum of concern" associated with environmental releases of radioactive materials from LANL, including the risk associated with northerly winds blowing towards Santa Fe from Los Alamos.

At one extreme are the kinds of large-scale catastrophes noted above. At the other extreme are small-scale releases such as the approximately 1,000 curies of tritium released from a LANL facility in March 2001; it was barely noted by the news media. In between these two extremes are various scenarios, which might arouse public concern about the safety of the municipal drinking water sources at San Ildefonso and at Buckman. A member of a team of consultants, which is doing work for NMED, noted that prevailing winds could place the Collector Well in the path of air releases from LANL.

Further discussion ensued with members of NMED's team of consultants. Understanding the properties of the contaminants released is key to evaluating the potential for contamination of the municipal water supply. A fire in a plutonium facility would release mostly plutonium dioxide. It binds tightly to soil and therefore would be unlikely to enter the municipal water supply. A basis for concern about plutonium might arise if chemical conditions in the accident and/or in the vicinity of the Collector Well were optimal for the formation colloidal particles, in which plutonium can display a marked tendency for transport through soil and ground water. If a criticality accident were to occur at LANL then one of the contaminants released would be cesium-137, which is highly mobile in the subsurface environment.

A member of the WQTF proposed the following scenario: a fire at TA-54 (Area G), the waste storage area, which burns for six hours before it is extinguished. Mixed radionuclide and chemical wastes are contained in the smoke. It is raining or snowing at San Ildefonso, which hastens deposition of contaminants near the Collector Well. Some of the contaminants involved in the fire are capable of moving rapidly through the water column. Along with radionuclides, many unidentified chemicals, products of incomplete combustion, and metals are present in the smoke.

In this scenario, with prevailing winds to the north, inhalation of smoke in Santa Fe is not a major health issue. However, because of Area G's significance to environmental organizations, public concern about possible fall-out near the Collector Well is not immediately dismissed. Air doses in Rio Arriba County and on the Pueblos are presumed small, given no data to suggest otherwise. The only "big issue" for the news media is possible contamination of the City's water supply. Evacuation

of White Rock, taken as a precautionary measure during the fire, elevates the story onto the national news.

Some members of the WQTF felt it was relevant to consider the potential economic impacts on Santa Fe's tourism industry resulting from the uncertainty in the exposure pathway and scenario outlined above, and the role that social change organizations in the community would likely play in emphasizing possible threats to the City's water supply. Other members of the WQTF felt it was outside the WQTF's scope to consider economic, political and social factors. One member of the WQTF, who is identified with the former school of thought, proposed the "Rapid Monitoring and Assurance System" (or RaMAS) as a policy recommendation which the City might adopt in order to respond rapidly to such a situation (see Policy Recommendations, Section IV).

Pathway 11: Current flood plain sediments at Collector Well, percolation into city collector at San Ildefonso

Aspects of this pathway are discussed under Pathway #5 (plutonium) and Pathway #6 (metals in fire-related sediments).

Pathway 12: PRSs on mesa tops draining unnamed gullies and reaching the Collector Well

A member of the WQTF with expertise in hydrogeology argued that all of the LANL mesa tops with waste disposal sites have some drainage via surface water. He undertook a careful examination of topographical maps in search of unnamed gullies, which might possibly drain into the Rio Grandé north of the Collector Well. No such surface water transport pathways were identified.

Pathway 13: Deep aquifer contaminated but discharges to alluvium before reaching the Rio Grandé. Contamination ultimately reaches the Rio Grandé as surface water flow.

One member of the WQTF argued that contaminants on this pathway would essentially be filtered twice (on their down to the aquifer, then back up to alluvium), and then diluted in the surface water flow of the Rio Grandé, before they flowed northward (against the normal southward flow of the Rio Grandé) to enter the vicinity of Collector Well. In rebuttal, another member pointed out that dissolved contaminants (e.g., tritium, perchlorates) would not necessarily be filtered.

SECTION IV. POLICY RECOMMENDATIONS

The following policy recommendations were voted on and passed by a quorum of six task force members; one task force member being absent.

First Set of Policy Recommendations--Involving Major Fiscal Commitments

Policy Recommendation #1a: Location and Design of City of Santa Fe Water Acquisition Systems

Resolution: The water quality threat associated with flooding and riverbed scouring, as well as

contaminant sources, should be considered in the design and location of any surface and near surface Rio Grandé drinking water systems for the City of Santa Fe. With respect to such systems, such as the proposed San Ildefonso Collector Well, they would best be located east of the Rio Grandé, upstream from the Los Alamos canyon. This would minimize the potential for LANL operations to adversely impact the water quality associated with these systems.

Vote: One against, the rest of the WQTF quorum in favor.

Policy Recommendation #2a: Cost and Feasibility Study for a Rapid Monitoring and Assurance System (reference pathway 10)

Resolution: The City of Santa Fe shall seek funding for a cost and feasibility study of a Rapid Monitoring and Assurance System (RaMAS). RaMAS would be activated in response to major mishaps at Los Alamos, but not duplicate other monitoring activities by other agencies. Its purpose would be three-fold: 1) To provide the public and decision-makers with rapid information on contaminant levels in nearby City water resources; 2) To protect the Santa Fe tourism-based economy from speculation about LANL-related health risks to persons visiting or residing in Santa Fe -- speculation best countered with hard monitoring data from an independent source; and/or 3) To position the City of Santa Fe to undertake tort litigation against responsible parties in the event that City wells and collector galleries are "fouled" by activities at LANL. The WQTF recognizes that such a system would be costly. It would also entail many complex technical issues. Hence, a first step should be a cost and feasibility study.

Vote: One against, the rest of the WQTF quorum in favor.

Policy Recommendation #3a: Hydrogeological Study

Resolution: The City of Santa Fe shall seek a thorough characterization of the hydrogeological environment in the vicinity of the Buckman Wells, the San Ildefonso Collector Well, former Los Alamos Well Field #1, and the nearby section of the Rio Grandé. A key question to be answered by this study is whether the Rio Grandé, in fact, serves as a barrier to transport of contaminants under the Rio Grandé in an easterly direction. This study shall consider current and future anthropogenic influences on the subsurface environment, including the aforementioned wells and development in the Pojoaque and Espanola Valleys.

Vote: WQTF quorum unanimously in favor.

Second Set of Policy Recommendations--Involving Minor Fiscal Commitments

Policy Recommendation #1b: City of Santa Fe Should Remain Closely Engaged in Other Agencies' Work

Resolution: The City of Santa Fe should remain closely engaged as a working partner in

environmental monitoring, along with related risk modeling used to predict future water quality impacts in the area (such as initiatives sponsored by the NMED, EPA, and DOE/LANL). This means involving qualified City staffers (perhaps volunteers from the public as well) that have the requisite skills to determine the credibility of such efforts. Furthermore, because of the specialized/technical nature of such efforts, time commitment in terms of years, and considerable cost associated with sampling and analysis, the City should avoid funding or encouraging duplication of such efforts except to the extent needed to establish credibility and/or public acceptance.

Vote: One against, the rest of the WQTF quorum in favor.

Policy Recommendation #2b: "Hot list" of Monitoring and Modeling Projects by Non-City Agencies

Resolution: The City Water Department shall maintain a "hot list" of all outside agencies conducting environmental monitoring and modeling studies directly relevant to contaminant levels in and near the Buckman and San Ildefonso water sources. This "hot list" shall be updated and include the names of agency contacts, contact information, past and scheduled sampling events, activity, and descriptions of the scope of agency's work.

This list shall be made available to members of the public who inquire about the quality of municipal water related to LANL activities. To the extent feasible, City Water Department personnel shall invite interested parties to participate in on-site activities (such as field trips) with these outside agencies. Data collected in such studies, including data collected by the City and its contractors, shall be made available to the public (preferably in electronic format).

Vote: One against, the rest of the WQTF quorum in favor.

Policy Recommendation #3b: City Council Support for Studies to Characterize Background Concentrations of Radiological and Chemical Contaminants in the Upper Rio Grande Basin

Resolution: The Santa Fe City Council should lend political support and endorsement to current and future studies investigating background levels of radiological and chemical contaminants in the upper Rio Grandé basin, especially in the vicinity of municipal water sources.

Vote: One abstention, the rest of the WQTF quorum in favor.

Potential Funding Arrangements To Implement Recommendations

City Council Resolution 2000-46 entertained the possibility of creating a non-profit entity to continue investigating LANL-related impacts on municipal water sources beyond the life of the WQTF. We considered this arrangement in one of the policy recommendations and decided against it.

Implementing some of the other policy recommendations also depends upon securing outside grants. If these recommendations are adopted, the City should consider an alternative funding arrangement.

Grant monies for the studies could be "passed through" an appropriate fiscal agent. For example, the existing research foundation of a local college or research institution might serve this purpose. Utilizing an existing 501(c)(3) would allow studies of an exploratory nature to proceed without creating a new non-profit entity.

Among the private and public funding sources which might be available are: the Hewlett Foundation; the Turner Foundation; the Citizens' Monitoring and Technical Assessment Fund (Resolve); U.S. EPA's EMPACT program; the Wilburforce Foundation; the General Services Foundation; and Resources for Community Collaboration.

SECTION V. WQTF MEMBERS & SUBJECT MATTER EXPERTS

Water Quality Task Force Members

Chuck Montaña, Chair

Audit and systems background. Project leader at LANL. Served on LANL/DOE CAB nearly two years. Certified management accountant, certified internal auditor, certified information systems auditor, and certified fraud examiner. MBA from the University of New Mexico.

Hank Daneman, Vice Chair

1995

A Chemical Engineer who has been involved in monitoring and surveillance of LANL groundwater contaminants since participation in the Citizens Advisory Board for the DOE/LANL

Employment:

1946-1974

Leeds & Northrup Co., Manager: Laboratory Equipment Division,

Planning Manager: International Operations

Lab Plan - President

1972-

Consulting Services in the Development of National Laboratories

1995

Professional Engineer - Quality Assurance (QU-1526), California (retired)

1974 -

Professional Associations:

pres

ASTM: Temperature Committee (E-20) member

ISA: Environmental Standards Committee, past-chairman

NCSL: Procedure & Specification Committee

1963-

International Metrology Session, developer

1965

Education & Training Committee, chairman

1975

TEMPERATURE SYMPOSIUM:

1976-1978

Session chairman

1971

Program committee

1981\1992

Education:

1941-1944

The Cooper Union Chemical Engineering

1944-

Naval Air Electronics Aviation Electronics Tech

1946

Lehigh University Business Administration

1969-1974

Civic Involvements:

City: Water Quality Task Force

City: Airport Advisory Committee

Northeast Neighborhood Association

Old Santa Fe Association	2001
City: Electric Utilities Committee	1999
City: Mayor's Noise Task Force	1980-1999
DOE/LANL: Citizens Advisory Board	1985
State: Paralyzed Veterans of America: BOD	1988-1989
	1995-1998
	1996-1998

Sue Herrmann, Member

Attorney for the NM State Land Office. JD.

Margaret Ann Rogers, Member

Consulting Geologist in the environmental/waste management field. Employment:

Los Alamos National Laboratory 1973 - 1985

Principal Investigator , LANL Waste Disposal Sites

QA Scientist, LANL environmental & waste mgmt programs

Consulting Geologist 1981 - present

Environmental/waste management field

Registered Professional Geologist - Hydrogeology (#680), South Carolina

Technical Societies:

ASTM: Soil & Rock Committee (D-18) 1986 - present

Quality Control Subcommittee (D18.99), past task-group chairman

Ground Water & Vadose Zone Investigations Subcommittee (D18.21)

Identification & Classification of Soils Subcommittee (D18.07)

Environmental Assessment Committee (E-50) Inception-present

Storage Tanks Subcommittee (E50.01)

Environmental Assessment of Commercial Real Estate Transactions

Subcommittee (E50.02)

Global Sustainability/Pollution Prevention Subcommittee (E50.03)

Performance Standards Related to Environmental Regulatory

Programs Subcommittee (E50.04)

Wetland Ecosystems (E50.05)

AAPG: American Assoc. of Petroleum Geologists 1973 -present

Energy Minerals Division: President 1997 - 1998

Other Chairs 1994 - 2001

Division of Environmental Geosciences 1994 - present

GSA: Geological Society of America 1968 - present

NMGS: New Mexico Geological Society 1970 - present

Jemez Mountains Region Fall Field Conference, Chair 1996

AGS: Albuquerque Geological Society 1985 - present

ASQ: American Society for Quality 1992 - present

Education:

The University of Texas at Austin 1960 - 1964

B.A. Geology 1964

The University of Texas at Austin 1965 - 1969

M.A. Geology 1969

Civic Involvements:

Los Alamos Planning & Zoning Commission 1973 - 1976
Comprehensive Plan Development Committee, Chair 1975 - 1976
Los Alamos Water Advisory Committee, Cochairman 1988 - 1989
Los Alamos Water Production Acquisition Advisory
Committee 1993 - 1994

Ken Silver, Member

Health scientist. Has done health research related to LANL activities. Memberships: American Public Health Association; Association of Occupational & Environmental Clinics; AAAS. BS in chemistry from University of Massachusetts, MS in Environmental Health Sciences from Harvard School of Public Health, and PHD candidate in Environmental Sciences from Boston University School of Public Health.

Cathie Sullivan, Member

Retired printer. Independent researcher involving LANL impacts on air, soil and water.

Zane Spiegel, Member

Hydrologist. Prior government service and consulting dealing with Northern New Mexico hydrology (since 1949). P.E. (retired); ASCE (life); GSA (life); >of Chicago, PHD from NM Mining & Technology.

Subject Matter Experts Presenting to the WQTF

Bruce Gallaher

Senior Hydrologist at the Los Alamos National Laboratory. More than 20 years experience in the water resources and waste management, with emphasis in contaminant hydrology. Has been involved with a variety of water quality studies in New Mexico, Arizona, Colorado, Georgia, Texas and Australia. Member of Water Quality and Hydrology Group at LANL, supervising environmental monitoring and hydrologic investigations. Worked with public health specialists to assess the aftermath of the Cerro Grande Fire. M.S. in Hydrology from the University of Arizona. Certified professional hydrologist.

Bill S. Landin

New Mexico municipal operations manager. Supervising engineer in Montgomery Watson Harza's (MWH) Albuquerque office. Experience in the field of water supply and distribution, wastewater collection and treatment, and wastewater reuse. Background in public works engineering. Private consulting on numerous water and wastewater feasibility and master plan studies, engineering project designs, construction and capital project management, technical support to utility operations, permitting, utility finance and operations management. BS in Civil Engineering Technology from Northern Arizona University. Licensed registered Professional Engineer in the State of New Mexico.

Frank J. Bailey

PNM project engineer and manager engineer. Current director of planning for the Santa Fe Water Co.

Previously employed as assistant city engineer and assistant chief water engineer for the City of Albuquerque. BS in Civil Engineering from New Mexico State University. PE, PLS State of New Mexico. First Lt. US Army Corp of Engineers.

Kirby Olson

Member of the Hazardous and Radioactive Materials Bureau of the New Mexico Environment Department (NMED), reviewing human health and ecological risk assessments submitted by facilities throughout the state. Previously employed by the Georgia Department of Natural Resources (DNR) preparing annual Toxic Release Inventory reports and communicating with government agencies and the public regarding chemical releases and the associated risks. Was a member of the DNR Emergency Response Team for hazardous materials spills and environmental law enforcement. B.S. in biology from Eckerd College and Ph.D. in biological oceanography from M.I.T. and the Woods Hole Oceanographic Institution.

John Till

Founder of Risk Assessment Corporation (RAC), an independent group of scientists specializing in radioactive/chemical transport in the environment and related human impacts. Extensive publication in the field, including a widely referenced textbook titled Radiological Assessment. Leading expert on risk estimation involving both national and international research. Most recent focus has been independent studies of DOE facilities. U.S. Naval Academy graduate. Retired as a Rear Admiral from the U.S. Naval Reserve. Serves on numerous scientific committees and currently chairs the National Academy of Sciences Committee reviewing exposures of veterans during atmospheric testing of nuclear weapons in Nevada and the Pacific. MS from Colorado State University and Ph.D. from Georgia Tech.

Arthur Rood

A member of a team of Idaho National Engineering and Environmental Laboratory (INEEL) environmental scientists. Has worked primarily in the field of environmental contaminant transport modeling, dose and risk assessment, including food chain modeling for the NRC and groundwater screening modeling for contaminated site assessment. Founder of K-Spar Inc., a consulting firm. Collaborated with RAC on various projects, including environmental transport, exposure, and risk assessment associated with plutonium releases at Rocky Flats, plus assessing radionuclide transport in the Columbia River at the Hanford. BS in Geology and MS in Health Physics from Colorado State University. A member of the Health Physics Society.

Helen Grogan

Primary expertise in modeling the movement of radioactive waste in the environment. Founder of Cascade Scientific, Inc., a consulting firm. Collaborated with RAC on a variety of projects, including the Savannah River Site Dose Reconstruction Project, an analysis of the risk related to historical releases of plutonium from the Rocky Flats Plant, and a risk-based screening methodology for historical radionuclide releases to the Columbia River from the Hanford Plant. Consultant to the U.S. EPA, Science Advisory Board's Environmental Models Subcommittee of the Executive Committee, and a member of the National Council on Radiation Protection and Measurements Scientific Committee 64-19 on Historical Dose Evaluation. BS and Ph.D. from Imperial College of Science and Technology, University of London.

Kathleen Meyer

Biological research, teaching, and radiation protection. Organizing member of the Biology Division at the College of Lake County in Illinois. Independent work in radiological dose assessments, technical abstracting, and chemical and radiological risk evaluation for sites containing hazardous materials. Publisher of scientific papers in cancer research, historic evaluation of past radionuclide and chemical releases, and risk assessment of radionuclides and chemicals. Founder of Keystone Scientific, Inc. Member of the National Council on Radiation Protection and Measurements Scientific Committee 64-19 on Historical Dose Evaluation. BS in Biology from Carroll College in Helena, Montana and MS in Biology from Marquette University in Milwaukee, Wisconsin. M.S. in Health Physics, and Ph.D. in Radiological Health Sciences from Colorado State University.

Minority Report from Vice Chairperson Hank Daneman

January 2, 2002

Mayor Larry Delgado and Santa Fe City Council

P. O. Box 0909

Santa Fe, NM 87504-0909

Re: Water Quality Task Force - Minority Report**Introduction:**

This report is presented because the December 31, 2001 report from the Chair of the Task Force fails to adequately address the matters laid out in the City Council resolution establishing the mission of the Water Quality Task Force.

Relevant Facts:

1. Over decades, quantities of liquid chemical waste flowed into the canyons crossing LANL via "outfalls" or sewer outlets. For years, it was assumed the tuff under the canyon bottoms was impermeable. This assumption was later proven wrong and there are now quantities of hazardous chemicals in alluvial aquifers under the canyons.
2. These chemicals are now measured in monitoring wells in concentrations in excess of allowable limits (MCL). Some of these (Sr90, perchlorates, U235, nitrates, etc.) are showing up, intermittently, in the main aquifer.
3. Sr-90 in drinking water accumulates in bones leading to bone cancer. 8 pC/L is the recognized allowable limit. The NMED has already measured 88 pC/L.
4. Perchlorates have no health standard for New Mexico. They are associated with Thyroid problems. Texas considers 4 ppb a drinking water standard. Springs near the mouth of the Pajarito Canyon on the West side of the Rio Grande turned positive for perchlorates last Fall and this February

measured concentrations of 6 - 8 ppb. The State did not receive notification from LANL until this September in violation of agreements between the NMED and the DOE. Present concentrations have not yet been reported to the public.

5. The NMED says groundwater from below the lab generally moves downhill toward the Rio Grande. Any contamination reaching the river should show up in the 20 springs along the Rio Grande, also according to the NMED. Perchlorates have also been reported in a Los Alamos town well and a well in Espanola.

6. Santa Fe's proposed new water supply is between 2 - 4 miles from the contaminated canyons. Pumping large volumes of water for Las Campanas golf courses, the City of Santa Fe and the County of Santa Fe including a large new development (Rancho Viejo) will cause a depression in the depth of the main aquifer. According to hydrologist, Zane Spiegel, there will be a flow within the main aquifer toward these wells to replace the water taken out.

7. LANL hydrogeological "plan provides a process for drilling up to 32 deep research wells and 51 alluvial wells to assess the nature and extent of potential contamination of the water supply system." This program was expected to take 15 years.

8. According to Tom Todd (former DOE station chief at LANL) no information on groundwater monitoring will be available from the four accord Pueblos receiving annual grants by the DOE for groundwater monitoring on their lands.

9. We have learned over the past six years that we cannot depend on the DOE/LANL for timely information on main aquifer contamination. The Agreement in Principle (AIP) between the DOE and NMED places release of data on contaminants in monitoring wells under DOE control. This data has been withheld from public scrutiny for as long as two years after sampling but is lately being released within six months to a year. Some data is not released due to claimed uncertainty of lab results.

10. Los Alamos is one of the more active earthquake regions of the country. It has two major earthquake faults running through or adjacent to the lab. We are not aware of reports on how these faults (or future faults) might introduce channels for main aquifer recharge from perched aquifers containing excess quantities of hazardous chemicals.

11. The present monitoring programs are not co-ordinated nor are they aimed at protecting the City of Santa Fe.

Recommendations:

Protection of the City of Santa Fe's water supply from eventual contamination depends on the monitoring of the aquifer in the direction of the major sources of chemicals already in the groundwater. Presently, all monitoring wells are within the boundaries of LANL and the San Ildefonso Pueblo.

1. A professional study (Risk Based Characterization) of the area between LANL and the proposed

new Santa Fe supply wells should identify where new, shallow, monitoring wells might be needed to provide adequate warning of the encroachment of hazardous chemicals.

2. Two other DOE sites (Rocky Flats and INEEL) should be studied to learn how they dealt with groundwater contamination. I hope to attend a "DOE Site Groundwater Meeting" next month for this purpose and can report back to the Santa Fe City Council. One objective will be to find out how these municipalities financed their studies and the consequential remedial action to protect their water supplies.

3. The present City Council resolution should be reviewed in the light of these WQTF reports.

Respectfully submitted,

H. L. Daneman
Vice-Chairman WQTF