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**Accessing Safe Drinking Water: A Citizen Perspective
on the Role of Science in a Contentious Issue**

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Accessing Safe Drinking Water: A Citizen Perspective on the Role of Science in a Contentious Issue

Abstract

Providing all people with access to safe drinking water is one of the central problems of our times, especially in less developed countries. However, even in developed countries such as Canada, accessing safe drinking water may be difficult. In this case study, we articulate how scientific and technological expertise and discourse are played out against local knowledge and water needs to prevent the construction of a watermain extension that would provide local residents with the same water that others in the community already access. We conclude that (a) there is a lack of solidarity and distributive justice and (b) science education ought to change such that individuals may be empowered to fend for their rights even against scientific and technological expertise.

Our (post-)modern world becomes increasingly complex, not in the least because of the changes to scientific knowledge and technological artifacts that pervade our lives. Science and technology are deeply enmeshed with personal and public issues (Latour 1993; Restivo 1988), particularly those relating to sociotechnical controversies such as mad-cow or foot-and-mouth disease, AIDS, climate change, or the diffusion of genetically modified organisms. It is not surprising that there is an increasing public awareness of the ethical, practical, and political dimensions that characterize the controversies in which science and technology are embroiled. Science and technology, as all other domains that shape public and private life, should therefore become legitimate objects of reflection on the part of all citizens. An important question poses itself, “How do *all* citizens participate in reflecting on science and technology?” and “What level of scientific and technological literacy do citizens have to bring to be legitimate participants in the public debate?” These questions are particularly salient as there are suggestions about the nonexistence and non-attainability of scientific literacy (Shamos 1995). Many citizens are said to have “blanks” in their background knowledge and are given lessons to get the “right” scientific knowledge to make up for their ignorance (Hazen and Trefil 1991). Others disagree with such assessments, taking a more democratic and emancipatory approach to the contributions different types of knowledge can play to sort through the problems that humanity faces today (Jenkins 1999; McGinn and Roth 1999). These authors take their cues from activists concerning AIDS (e.g., Epstein 1996), muscular dystrophy (Rabeharisoa and Callon 1999), or environment (Lee and Roth 2001) to show that citizens can legitimately contribute to science and its processes even if they do not have a scientific or technological training.

Democratic ideals, particularly those consistent with inclusive democracy (Fotopoulos 1999), imply a greater involvement of the public in policy-making issues that pertain to or involve science and technology. Different participation models to include the public in policy setting are currently practiced providing differing levels of

representativeness and effectiveness (Rowe and Frewer 2000, Irwin 2001). However, we are still far from an equitable approach where science and other forms of knowledge contribute in situationally appropriate and equitable way to solving problems and controversial issues. The public is often not involved because, so goes the argument, it does not understand the salient issues and concepts or the processes of science. Scientists operating in the spirit of this take “bludgeon publics with ‘certain facts,’ often ignoring the public’s own culturally embedded understandings” (Brown and Michael 2001, 18).

Controversial issues and the role science and technology play in their unfolding are often studied from the perspective of sociologists, anthropologists, or educators interested in science. In the present study, we take a different approach. One of us (Roth) had conducted an ethnographic study surrounding water issues in the community where he lives. It turned out that some residents in the community recurrently had trouble accessing safe drinking water; to date, their attempts to be connected to the watermain that supplies all other residences in the community have failed. As part of an advanced course in qualitative research, we analyzed the publicly available data in the controversy over access to safe drinking water. Our (analysts’) wide-ranging backgrounds provided us with an opportunity to analyze these data from the heterogeneous perspectives of an educated but diverse public. The purpose of this article is to articulate our understanding of the controversial issue and to derive implications for participation processes and science education that would provide more democratic, emancipatory, and legitimate peripheral participation¹ in contentious issues.

¹ The concept of legitimate peripheral participation (Lave and Wenger 1991) appears appropriate for describing the participation of individuals with varying types and levels of expertise in decision-making processes.

Background

Contested Water

Water is one of the most common substances of the world. It is so common that those of us who live in the Northern Hemisphere do not usually attend to it as something special. At least not until some serious problem arises such as the recent crisis in Walkerton, Ontario, where seven people died as a consequence of *E. coli* contamination of the drinking water.² The Canadian media (e.g., *And Not a Drop to Drink* 2001, *Safety Isn't the Only Problem*, 2001) and House of Commons (e.g., *Debate*, Thursday February 1, 2001) have since been filled with reports about the questionable quality of many other, especially native communities (). However, in some parts of the world, such as in rural areas of Africa and in parts of the Caribbean, most people lack access to a safe water supply (United Nations 2000b).

The lack of adequate water resources data, including water supply and sanitation, the report states, remains a weak link in efforts to improve the integrated management of water resources, as called for in Agenda 21. As water quality problems become more serious and widespread, water quality monitoring should become a more important component of national sectoral programmes. It is essential that the formulation and implementation of time-bound targets for future provision of water supply and sanitation be carried out within the framework of an integrated approach to water resources management. (United Nations 2000a).

Water is more than an issue contested in metaphorical way. Titles such as *Water Wars: Coming Conflicts in the Middle East* (Bulloch and Darwish 1993) and *La bataille de l'eau au Proche Orient* (Chesnot 1993) point to the fact that water is now (becoming even more so in the future) a battle ground and resource in struggle over nationhood and identity.

The possibilities of water as a contested entity and a general awareness of a looming water crisis around the world is becoming increasingly salient (Moore, 2001, UNESCO 1999). For example, in Canada, numerous special research chairs on water quality have been created and efforts are under way to establish a national research network (“Reseau-

² For weeks, this tragedy has made the headlines in the Canadian news media. One website provides links to reports from around the world: <http://xpdnc.com/links/wlkrtn.html>.

waternet”) focusing on drinking water or by cover stories in prestigious periodicals such as *Scientific American*. It becomes clear that the problems of access will only increase in the coming years:

Even in the century ahead, impressive gains in technological capabilities to find, transport and conserve freshwater may not be able to accommodate increasing demand, particularly in the developing world. Local mismatches between need and supply could push groups to violence, retard economic progress and devastate populations. (*Safeguarding our Water*, 39)

It is also becoming clear that drinking water, its quality and quantity will not remain scientific and technological issues. In Canada, the export of drinking water to other nations has entered the political arena as the federal government considers legislation to control (limit, make possible) the sale of bulk water to other nations (Environment Canada 2001; Shrybman 1999).

While the debate at the national level about the sale of water to other nations is in its beginning, many especially rural communities in Canada experience more or less severe problems with the quantity and quality of their water (Petersen 2001). Despite the concerns of those citizens who are directly affected, local municipalities, provinces, and federation seem to do little to alleviate the local concerns. It is true that organizations such as *Lifewater International* are dedicated to rural villagers to obtain safe water; but this occurs mainly in developing nations where government-operated water systems are not available (<http://www.lifewater.org/help.htm>). What options are there for people and communities in developed nations who, despite the national wealth, do not have access to the necessary quantity and quality of water as their fellow citizens do? This question is all the more pressing when other citizens, only a few kilometers away, do have access to this resource apparently denied to and withheld from them.

Social Justice

Conflicts in water use are becoming common place around the world. The development of institutional and community decision-making processes to manage such

conflict are therefore of increasing necessity. For example, the *Australian Research Centre for Water in Society* conducted several studies to identify parameters and guidelines for social justice in planning for horticultural land and water resources security (Water in Society 1994). Struggles for social justice are often articulated as struggles for fundamental rights and freedoms. As in other domains, the main questions of social justice surrounding access to water (and the related health) can be framed as, “Who gets what?” and “On what grounds does and individual/group get it?”

Most social justice research deals with state action to distribute resources through its political, health, and legal systems. The field has developed most rapidly since the 1940's with four distinct perspectives emerging: relative deprivation, distributive justice, procedural justice, and retributive justice. The most significant advances have been in the area of distributive justice (Hankivsky 1999). Distributive justice models are especially significant in the context of access to basic life necessities such as food and water. Distributive models of social justice deal with how to distribute something (e.g., rights, food, jobs, salaries, taxes) according to some basis for distribution, either egalitarian bases (e.g., humanness, basic human needs) or non-egalitarian bases (e.g., utility, compensation, merit, effort, contribution) (Young 1990).

In approaches that focus on the rights of human beings, governments are usually held to be accountable for respecting, protecting, facilitating and fulfilling the rights of their citizens. That is, governments are responsible for distributive justice. Governments therefore have the responsibility to insure that citizens have equal access to services that, like water, enable them to meet their basic needs. Rights-based approaches suggest that social injustice is generally manifested in cultural-historical fabric of local societies (CRS 1999). Part of this fabric is very difficult to change (certainly because it constitutes a stabilized actor network), especially if change threatens the existing power base and status quo. Nevertheless, local government and civic groups are the key leveraging institutions to insure economic justice is in place (Blum 2000). Through advocacy and

institutional strengthening, governments can be held accountable for their distributive justice efforts. The private sector and civic groups also play a significant role in ensuring that distributive justice is promoted.

Research Design

The present study is embedded in a larger, longitudinal study of science in the community (e.g., Lee and Roth 2001a, 2001b, 2001c; Roth and Lee 2001a, 2001b). In the course of the more encompassing study, we became aware that some residents in our community (Senanus Drive, Central Saanich) were involved in a struggle to obtain drinking water of more reliable quality and quantity than their individual wells can currently supply. At issue is whether an existing watermain should be extended from one part of the community (B, Figure 1) to the more remote and even more rural Senanus Drive (A, Figure 1).



Figure 1. Map of the Central Saanich highlighting higher density areas Brentwood (C), Saanichton (B), and the more isolated Senanus Drive (A). A watermain extension under discussion would connect Senanus Drive to Saanichton (along the road visible) so that it could provide water also to other properties currently on wells. The within the triangle ABD approximately corresponds to the watershed.

Data Sources

For the past three years, one of us (Roth) has conducted an ethnographic study of science and scientific literacy in Central Saanich. The study focused on the issue of environmental health in the Hagan Creek watershed, and particularly issues surrounding water quality and quantity in Hagan Creek and the aquifers underneath the watershed. The study focuses on the activities of an environmental group—the Hagan Creek~KENNES Watershed Project. Its mandate is “to protect and enhance the Hagan Creek stream system in order to maintain sufficient water quality and quantity so to achieve the best possible balance between ecological and agricultural needs of the watershed [roughly the area ABD, Figure 1], and to maintain these functions for future generations.” It is in this context that Roth became aware of the water issues at Senanus Drive and collected the data sources pertinent to the present study.

The data sources include extensive field notes, publications produced and appropriated by the activists, videotapes of public events, audio-taped interviews, newspaper clippings, informal interviews, and texts and inscriptions from the region that relate to the issues of water, water treatment, watershed management, and water-related ecological restoration. On several occasions, groups of activists and other interested local residents who walked sections of Hagan Creek with different consultants were videotaped. The activists drew on these consultants for advice on how to improve the creek, find the best trout habitat, and how to expand the healthier sections of the creek. We interviewed a range of participants in the Hagan Creek~KENNES Project, students, and local residents—all interviews were audio- or videotaped. For the present study, we drew on the publicly available data—reports, newspaper articles, minutes of meetings, and the transcript of a public meeting concerning the Senanus Drive water issue. These include reports to Council by the Capital Health Region,³ Lowen Consulting, by the

³ The Capital Health Region serves a population of approximately 340,000 residents on the southern end of Vancouver Island. The organization works to provide a comprehensive, integrated network of health

Water Advisory Task Force (interim and 2 final), and a memorandum by the Senior Engineering Technologist summarizing the issues for a regular council meeting. Also, the correspondence between Council and the president of the local voters association (Frank Towler) was obtained.

Data Analysis

We are not only authors but also, in a sense, participants. We provide a reading of the events that make the debate over water for Senanus Drive residents a contentious issue. We are therefore representative of an informed audience witnessing the struggle over water, which could affect us, as it already does in one case. Our ultimate goal was to construct understandings that are not only intelligible to people in the community but also transferable, and therefore useable by those (including ourselves) who are and will be involved in similar struggles over basic resources.

Our analyses are grounded in a philosophy that is reflexive, hermeneutic, and phenomenological (Changeux & Ricœur 1999, Ricœur 1991). A phenomenological hermeneutic stance takes account of the dialectical relationship between understanding and explaining: all explaining is enveloped by existing understanding, but understanding needs explaining for its development. The reflexive stance forces the investigators to ascertain that their world (research processes and products) is subject to the same analytic scrutiny that the world they study (research object) is. We used transcripts of a public meeting and newspaper articles relating to the Senanus Drive water controversy as primary data sources. We began by reading and interpreting the materials individually and subsequently met to discuss our analyses as a group. The written analyses were shared through a website. We refined our interpretations in subsequent discussions and by taking into account new developments of the issue as these played themselves out in

the local newspapers while we conducted this analysis. We also tested emerging hypotheses by explicitly seeking negative cases (Guba and Lincoln 1989), that is, for evidence that did not support a hypothesis or claim. This was achieved through a division of labor. One or two authors developed the analysis of a dimension identified and prepared a written analysis. In sessions involving all authors, the other members served as devil's advocates seeking information that disconfirmed the presented analyses.

We recorded about half our discussions, making them thereby available for subsequent viewing and constituting them as a document of the emerging concepts and understanding. That is, the recordings document "progressive subjectivity" and, together with the written artifacts, provide an "audit trail"; both processes are essential components of research that contribute to the quality of interpretive research (Guba and Lincoln 1989).

Positioning of the Authors

In this article, we investigate a controversial issue, in which scientists and engineers play an important role, through the perspective of informed but not necessarily scientifically trained citizen. Because of our diverse backgrounds (research, nursing, fine arts, and teaching), we bring to the analyses quite divergent interpretive horizons. But whatever our prior experiences and personal stance, we realized that we could have been, and in a sense are, in a similar position as the residents of Senanus Drive. We therefore expected our analysis not only to yield an understanding of the unfolding controversy, but also hoped that our understanding would allow us to be better positioned should we be involved in a similar controversy.

Situating the Water Problem

The Capital Regional District (generally referred to as Victoria, though Victoria is also the name of one of the municipalities in the District) is situated on the southern part

of Vancouver Island, British Columbia, usually associated with a lot of rain and sufficient water resources. Yet water quantity has been and continues to be a problem in the District. There is insufficient water in the reservoirs supplying the Capital Regional District so that nearly every summer, there are more or less severe water restrictions. At the time of this writing, winter has seen less than 60% of normal rainfall. The District has passed a bylaw to implement water restrictions at Level 3, which means that lawns can no longer be watered, flowers and vegetable gardens have to be watered by hand or by using micro-drip systems. (By mid-summer, Level 4 restrictions were not [yet] necessary because citizens observed the restriction to such an extent that the resources were taxed far less than they normally would.) On the reverse side, much of the wastewater is currently being released with minimum processing into the surrounding ocean. The local newspapers recurrently carry articles that feature citizens and local (municipal) government in contests over access to drinking water and removal of wastewater. Central Saanich is one of these communities embroiled in a variety of controversial issues about access to and removal of water.

Water in Central Saanich

The controversy over water at the core of the current article takes place in Central Saanich, a suburban community of the Capital Regional District. Despite its location in an area of temperate rain forests, the microclimate of Central Saanich is such that it only receives 850 millimeters of rain per year, most of it falling in the October-March period and very little during the remainder of the year. The aquifers below the community are insufficient to supply the community with water; water is piped from the dams in the nearby Sooke Hills, about 40 kilometers away.

Recent developments have exacerbated the issue by altering the water's flow over and through the ground. Much of Central Saanich lies in the Hagan Creek watershed. To drain the bogs that used to exist before the arrival of the Europeans, farmers straightened

the creek turning it into a channel. These changes allowed the water to flow away faster—with the effect that in the summer months, the creek is but a trickle (10–20 liters/second) supplying insufficient water for resident farmers to water their fields. A considerable number of wells are used for irrigation purposes. Changes are generally related to urbanization and the increase in impervious surfaces (e.g., pavement, roofs, concrete driveways), loss of forest cover throughout the watershed and along the stream banks, loss of wetlands and recharge areas, and the loss of natural stream conditions further increase the pressure on the aquifers.

To have an appropriate mechanism to deal with the pressing water problems, the community formed the Water Advisory Task Force. Its role was to make recommendations to Council with respect to drainage, watershed, water management and other environment impacts related to water issues (Official Community Plan §8.2.3, Policy 6). Its seven members represent a diverse group of residents at or near Senanus Drive including the founders of the Hagan Creek~KENNES Watershed Project.

Senanus Drive Water Issues

Central Saanich is a rural community that spreads over a considerable area, with two areas of higher concentration—Brentwood (C, Figure 1) and Saanichton (B, Figure 1). Senanus Drive, the area involved in the controversy, lies in a wooded area on the ocean, about 5 kilometers away from Brentwood and Saanichton, respectively. The residents have individual wells that draw on the local aquifers. For years, the local and regional newspapers reported that in the summer months, the water in the Senanus Drive area was biologically and chemically contaminated. Sometimes, the residents were advised by the Regional Health Board not to use their water, or to boil it considerably; many residents have opted to get their water from gas stations in Brentwood or Saanichton. For 30 years, the residents of Senanus Drive demanded to be connected to the watermain that supplies other residents of Central Saanich (McCulloch 1999). The residents brought the issues

forward to the Saanich Peninsula Water Commission, which decided that the issue was a municipal concern (Minutes of January 20, 1998 Meeting,). However, Central Saanich town council and mayor blocked all demands, attempting to keep the watermain away from Senanus Drive to prevent the area from being developed (Watts 2001).

At issue is not just the water for Senanus Drive, for the residents of Mount Newton Cross Road, which connects Saanichton and Senanus Drive (between A and B, Figure 1), currently draw their water from wells and would “benefit” from a watermain. Furthermore, a watermain would also come with fire hydrants and decreased fire insurance costs for the currently unprotected homes. However, the appropriate capacity for fire protection by far outstrips the water use by the existing homes, so that laying a watermain opens up the possibility for further development of the area—though it is currently protected from development due to its Agricultural Land Reserve status.

In the past, individual families (through consultants they hired) and the Capital Health Region had tested the water. Invariably, a variety of problems were noted including chemical and biological contaminants. However, the Water Advisory Task Force decided that previous studies and testimonial evidence was insufficient or flawed so that it hired an “independent” consultant firm, Lowen Hydrogeology Consulting. This consulting firm regularly works for various municipalities in the areas, with special expertise in groundwater, impact of effluents and sewage on water quality. The consultant is used to controversy, as there have been cases where his studies have been contradicted by the results of other studies. This has led litigants in such cases to play on the contested nature of Lowen’s reports.

Because the Water Advisory Task Force could not come to a unanimous recommendation, two reports were filed with the town council, the “majority report” and the “minority report.” The majority report largely based its recommendations on the data provided by Lowen Hydrogeology Consulting. The minority report grounded its assessment on two major pieces of information: the degree of the problem on Senanus

Drive as apparent from testimonial evidence of residents and the lower-than-recommended water quantity available to nearly two-thirds of the families at Senanus Drive.

The senior engineering technologist for Central Saanich, Donavon Bishop, prepared a report to Council that summarizes the results of all other reports and proposes a series of policies and options. A large part of the report focuses on the Official Community Plan (OCP) and the Land Use Bylaws. (This report had been reviewed and endorsed by the director of financial services and the director of planning and building services. Furthermore, municipal engineer and clerk administrator had signed to concur with the recommendations.) In particular, the report details that these existing documents do not allow the subdivision of existing rural and agricultural properties for the development of new housing units.

The direct implications of having a watermain extension are difficult to quantify. The availability of water could encourage some property owners to either develop under the existing zoning, or to apply for rezoning.

With the current Provincial support for the ALR and given the policies of the OCP, however, it would be difficult to support any rezoning of or development of the lands zoned Agriculture.

For the lands designated Rural, the OCP and the Land Use Bylaw should continue as constraints on development. Another constraint on development would be the suitability of the soil for sewage disposal. (Memorandum, 7)

At issue therefore was not merely whether and how to get sufficient and suitable water to the residents of Senanus Drive but also whether any changes would allow further development of the area. Following the meeting in which the report was accepted Council decided to provide the public with a forum in which reports and issues could be discussed. It organized a 1.5-hour open house, where the different reports and graphics prepared by the technical presenters were available. This event was immediately followed by the public meeting in which technical and advisory bodies made presentations (45 minutes), the public could ask questions directed towards the technical presentations (15 minutes), and members of the public made comments.

Citizen Perspective on the Contest over Water

In schools, science is (generally) taught as if it and its results were value free. This, as much research in the sociology of science showed (e.g., Latour 1993), is not the case. The citizens in this community in general (e.g., in a case of the application for a high-power microwave emitter) and in this public meeting more specifically realized that scientific and technological testing could not be thought independently of the uses that are being made.

Scientists and Ordinary Citizens

The first part of the public hearing constructed the scientists and engineers as “the experts.” Each expert present was provided with the opportunity to elaborate key issues in the reports that he had produced, and took the amount of time he deemed necessary. There was no attempt to shorten or curtail any of the presenters—as this would happen in the subsequent parts of the meeting. The experts were constructed as such also by their own and the moderator’s description of positions, titles, or degrees they held. Thus, individuals were variously introduced as “professional engineer and a professional geologist,” “Public Health Engineer serving the regional district,” “Environmental Health Officer for the Oceanside area... [he] has a Masters of Science degree, and has significant experience with water quality issues and he has been involved extensively in both reports in the sampling episodes” or “Chief Environmental Health Officer for our Health Region.”

The transcript of the Senanus Public Meeting held September 22, 1999, shows that the residents’ stories about their water problems experienced in the past and present are presented late in the evening, after which presentations were made by scientists, councilors, Capital Health Region representatives, and the Water Task Force. The evening’s agenda has focused on presentation of various reports followed by question and answer period from the audience. At “9:30 PM,” the meeting is moved to “public opinion

and comments.” The audience is asked to, “Just give your name and address for the record and try and keep your comments as brief as you can in the interest of time.” Once the last comment had been made, the meeting was called to an end. The agenda had not included time for questions asked of the residents by visiting scientists and the audience. The issues brought forward by the residents, who were and still are experiencing “first-hand” the effects of non-potable water and inadequate water supply, provided important contextual information regarding history of the area’s water supply and development.

In contrast to the experts’ turns at talk, there were repeated instances where citizens were cut off from talking, while asking questions or making comments in the second part and third parts of the meeting.

- T. Knott: Well it seems to me that the report is relying.... Mr. M’Gonigle’s report is relying on very heavily on your information, which would suggest that it doesn’t matter what the problem is with water, it can be treated. And I would beg to differ on that because I think that when you do something to the water, you affect it regardless of what the treatment is and where the treatment occurs. And that it affects the water in another fashion. So therefore this business of treating water is only a marginal thing with respect to water qualities.
- Bishop: We are straying sort of into the area of public opinion and your comments...
- T. Knott: He’s an expert he just told us...
- M’Gonigle: Well, I’d like to make one comment on this...
- T. Knott: I’m addressing, I’m addressing...
- M’Gonigle: You’re looking for technical... This is supposed to be a technical discussion and I think...
- T. Knott: No I’m talking to Mr. Lowen. I’m not talking to you, I don’t think...
- Several: [Hands clapping] Yeah, we wanna hear.
- Bishop: Mr. Knott, I’m sorry but you’re really not. If we can keep to a specific question you certainly able to ask questions if we’re going somewhere with it but I don’t want to get in to a detailed bit by bit tearing something apart.
- T. Knott: Why? I mean, I’m asking...
- Bishop: Because, because...
- T. Knott: This is our only chance to talk to this man who has made a report that influences our lives.
- Bishop: Yeah, but it doesn’t directly influence your life to the extent that everything is going to hinge on his report. It’s merely one bit of information and we’ve got lots of information back and forth. Other people are presenting as well...
- T. Knott: Well, I disagree with you.
- Bishop: Can I ask... Sorry, can I ask you if there is a specific question that you wish to ask of Dan Lowen specifically?

The moderator (Bishop) qualified Tony Knott’s comments as “public opinion.”

M’Gonigle (chair of WATF) implicitly disqualified Knott’s questions and contributions by contrasting them the descriptor “this is supposed to be a technical discussion.” Time and again, residents attempted to have their concerns “heard” but are silenced in

examining Council's argument. Council had elevated the "scientific" point of view as more important than the actual concrete examples of the effects of the water on residents' quality of life. During the meeting, the moderator of the meeting actively suppressed resident input. (This is not an isolated phenomenon but also occurs in other forums with public participation [Jacques Désautels, personal communication, July 6, 2001].) Time and again, the moderator stopped residents short by using comments such as, "I was hoping not to get into picking things apart ... I would prefer not to do that," "I don't want to ... get into a slugfest over particular pieces of the report," or "I don't want to get into a detailed bit by bit tearing something apart." If "hearing" individual concerns was really an important goal of the decision-making process, mechanisms are necessary that de facto allow citizen to provide their input. At this point, we can only wonder how increased levels of input would change the direction of the present dilemma? If those residents had the "feeling" council understood the enormous impact this issue has had on their quality of life for over 30 years, how would this understanding contribute to the residents' perception of a change to their quality of life?

Divergent Views of Health

Our community research (particularly in public meetings) shows that ordinary citizens often feel disenfranchised by scientists who talk in decontextualized ways about the issues at hand, which often deeply affect residents life (presence of a high-power radio emitter, access to watermain). In our community, as elsewhere, scientists bludgeon their audiences with what they call facts and methods (Brown and Michael 2001); here, as elsewhere, the scientists ignored the residents own culturally and historically embedded understandings. Highly technicist (monoglossic) discursive repertoires were played out against more heterogeneous and encompassing (heteroglossic) discourses (Lee and Roth 2001d). This is also the case when it comes to the perspective toward individual and environmental health understood in different ways by scientists and the members of

our community. Different views of health have surfaced over the years including the “medical” and “socio-environmental” approaches. The medical position, which comes from a scientific point of view, considers health as the absence of disease and focuses attention on a disease/treatment (breakdown/fix it) sequence (Labonte 1993). In the current controversy, the scientists hold this view.

Pertaining to the Senanus Drive water issue, the community meeting was primarily organized by public officials to have the “experts” present their scientific technical reports and to allow residents to “air their personal opinions” and to “talk about the various options that were available.” Generally, the scientific reports stressed the fact that the water did not present a danger to residents’ physical health because of the lack of biological contaminants at the time of the measurements conducted by Lowen Consulting. At the same time, the report by the consulting firm downplayed chemical contaminants by using the euphemistic descriptor of “aesthetic concern.” Thus, although these “aesthetic concerns” contribute to a substantially decreased quality of life (quickly corroding water pipes and appliances, dying plant life, or scales on skin while taking showers) residents, they become negligible within the technocratic repertoire of the consultant report and of those who adopt it (WATF, Council). These reports adhered to statutory guidelines, scientific language, and public policy that fit a technicist view of health.

According to the Guidelines for Canadian Drinking Water Safety,⁴ there’s no concerns related to health within the parameters we tested. There are some aesthetic objectives related to health. Aesthetic objectives are for certain parameters in the water that may cause the water to be corrosive, deposit forming or unpalatable. These are given a separate category because they are not a health concern but they are a concern. (Lowen, consultant, Senanus Public Meeting)

Chromium can be a problem when it combines with chlorine and goes to the trivalent state. This is when a carcinogen is formed. Chromium as it generally occurs in the water system is fine. It is a nutrient. But when we have to chlorinate a water system that’s where we have the potential for some problem... No problems with fecal coliform organisms... We do not have any problems relating to nitrites or nitrates that would be the influence of man via agriculture, farming, or pesticides, or run off from roads etc... Our main concern

⁴ These standards from the website of Health Canada: http://www.hc-sc.gc.ca/ehp/ehd/catalogue/bch_pubs/summary.pdf.

in this issue is the promulgation of public health and safety. (Robert Bradbury, Capital Health Region, public meeting)

In contrast to the technicist medical discourse, the World Health Organization (WHO) sees health as a personal resource that includes social and personal assets as well as physical capacities; the extent to which an individual or group is able to fulfill aspirations, to satisfy needs, and to change or cope with the environment (Labonte 1993). This view conceptualizes health in its broadest sense considering many determinants of health and emphasizing that actions to support health go beyond simply dealing with disease-treatment. In the socio-environmental approach, personal experiences of health are phenomenological experiences, constructed through social interactions with others and a shared repertoire of intersubjective meanings. To achieve this vision of health, we must explore and understand how peoples' experiences of health relate to their experiences of capacity and connectedness.

In the second half of the meeting, many residents made strong and at time emotional comments about a wide range of issues and about their experiences living without reasonable quantity and quality of the water. The residents spoke about health that we see as embodying a socio-environmental perspective in the way it is promulgated by WHO. Residents talked about daily experiences including financial costs, physical health, personal hygiene, safety issues, lack of social and personal enjoyment of their homes, and the emotional toll of insufficient quality and quantity of water. Based upon the WHO's definition of health, the quantity and quality of well water available to residents of Senanus Drive had many unpleasant effects on the residents' health.

Not until you actually live under these conditions does one realize what an amazing impact this problem has on your life... You can't drink or bathe in the water, feel clean and safe, stains household laundry, can't water our plants, can't grow a proper garden, our insurance costs are 20-50% higher. We have constant replacement of pipes and pumps. We can't clean anything in the house properly... We cannot put a dollar figure on our improved health, the enjoyment of our homes and gardens, reduced fear of forest fire, and the freedom not to worry about the next drop of water. (K. Knott, resident at Senanus Drive, Senanus Public Meeting)

Inherently, it does not appear inappropriate to bring different discursive repertoires into communicative processes. Even what appears to be a singular repertoire always and

already contains antonymic elements; monolingualism is always the monolingualism of the Other (Derrida 1998). What is of concern, however, is the fact that there are not simply different discourses and concerns but that those employing a technicist repertoire also refuse to hear and even less accept the views and repertoires of the other. Thus, as the controversy unfolds and particularly throughout the public meeting, we noted a discrediting of local knowledge and Capital Regional Health testing results.

Acceptance of Different Types of Knowledge

In the present controversy, the local knowledge, accumulated over nearly 30 years (including privately financed consultant reports), and the test results accumulated by the Capital Health Region have been downplayed and disregarded by those who are against the construction of a watermain to solve the water problem. Local knowledge was downgraded to constitute mere opinions, inappropriate to become part of the decision-making process. Thus, the Water Advisory Task Force discredited in its report to Council information other than the one provided by the consultant (whose methodology has shown to have flaws during the meeting). The speaker for the majority report, M'Gonigle, reiterated the preference for the "first systematic assessment" of the water.

Mr. Lowen's report is the first systematic assessment of the aquifer and that up until the time at which that was requested, the Council was being barraged with demands to make high levels of public expenditure based upon information from the taps. And the Capital Health Region, testing methodology, which we supplied, we made an assessment of it, if we want to talk about a testing methodology, the testing methodology up until the time that Mr. Lowen came in, was wholly inadequate. (M'Gonigle, Chair of WATF, Senanus Public Meeting)

For some 30 years residents have been expressing their concern to council over the water issue. What seems clear from an outsider's point of view is their issues, coping strategies and ongoing concerns of health issues due to the quality of water have not been truly "heard" by Council. By means of letters signed by the president of the Central Saanich West Voters Association, the Senanus Drive residents have repeatedly expressed concerns to Council regarding the quantity and quality of their water issues. Yet in their

responses, Council and the WATF have been without regard for the emotional and physical toil created. Residents continued to communicate the stresses resulting from the ongoing debate about health risks and temporary solutions, personal costs in terms of time and energy needed to find alternatives while the issue is being debated, monetary outlay to replace equipment and appliances due to corrosion, lack of ability to utilize their land productively through growing plants/gardens, ongoing concern of the potential for health issues, and the ongoing stress created by a lack of resolution of the issue.

Council has responded to resident concerns in the form of “scientific” data that there are no health concerns created by the poor quality of water, and that, “you knew this stuff and you still moved there.” Replies such as these only led to further feelings of frustration of concerns not being “heard” by Council. As one resident explained, “it’s driving me crazy. It just absolutely disrupts your life.” Such examples also illustrate the effects on residents’ quality of life. Maintaining a balanced life requires that one is able to resolve problems that create stress. It is a well-known fact that unresolved stress alone can lead to illness. What price must these residents pay for their decision to live on Senanus Drive? The stress of this ongoing issue and consequences is taking its toll on the residents’ ability to experience a good quality of life necessary to maintain health and well being.

It is not surprising that many people in the community believe that the community based its decision for not supplying Senanus with water on the report of the consultant, supported by the majority recommendation (4 to 3 against watermain) of the Water Advisory Task Force. Thus, the scientific expertise associated with one report predominated over the weight of the reports from the Regional Health Board, residents, and the data collected by other consultants hired by the residents themselves. Discourses cut up and create the world (Foucault 1972); they embody and impose particular ways of seeing the world, which in turn are reified as we see in the way the discursive concepts impose on us. Thus, technical reports can be lend credence but opinions and comments are just that. The latter are constructed here as insufficient to be used as a basis for

making decisions. Considerable differences in the way health was viewed, leading to different forms of action considered by the parties involved.

Blocking Water Access to Prevent Development

Our analysis of the meeting transcripts and newspaper articles suggests that there is a close association between the water issue and concerns about the development of the area. Every time someone talked about the extension of pipeline as an option of solution for the water problem in the area, the development issue emerged. Two opposite positions about the development issue in this community can be distinguished. These influence the different opinions about the water problem and the possible resolutions.

On one side, there are the Council members, some members of the Water Advisory Task Force (“majority” group), and some residents opposed to the watermain extension, grounding themselves in the Official Community Plan (OCP), which states that the Senanus Drive area cannot be developed. These individuals insist that residents should know, when they choose to live there, that they are not supposed to have potable water. Thus, the speaker for the WATF Majority report suggested:

We noticed as well that the OCP in the area, going back to the seventies and onwards talks about providing limited service in these areas because of population diffusion and the maintenance of the rural character. The definition of the rural zoning is limited infrastructure. So people who moved to this area, including all of us in the Task Force, came knowing that the community decision, the community status quo is one of providing lesser than the normal residential level of service in order to be cost effective and in order to maintain the rural character of the environment. And I think that it’s important, and this is a discussion that we can have at that, that the, the, the, that we recognize that our decisions do have an impact. (M’Gonigle, Senanus Public Meeting)

Mayor Wayne Hunter also referred to this issue, addressing more clearly the water services in the area, “It’s a longtime municipal policy to keep potable water away from people living on Senanus Drive. That way the municipality discourages future development. It’s a longstanding policy of making sure the people are on wells and not having potable water down there” (Times Colonist 04/20/01). Thus, although there was no written policy to keep the water away (report to Council by engineer), the enacted policy was to prevent any development by keeping city water away from Senanus Drive.

The community itself is divided on the development issue. “Anti-development” advocates distrust those of Senanus Drive who want to be connected to the watermain.

I don’t believe there are any problems with Senanus water... They want water down there in order to develop it. They want that [municipal water] because they are a development lobby. (Peter Kittredge, Senanus Drive resident, quoted in Watts, 2001)

Anti-developers do not want the proposed pipeline as an option of solution for the water problem to provide an obstacle to development. They therefore argue that there are “no problems at all,” a statement that finds support in the Lowen Consulting report. It is therefore not surprising that all other forms of knowledge and information on the issue needs to be downplayed.

On the other side, the remaining members of the Water Advisory Task Force (“minority” group) and many residents of the area, who have lived there since this issue started, 30 years ago. These people told their life stories to confirm the existence of quality and quantity water problems in this area, and they seem to be very tired to wait for a solution for these problems. These people want and need potable water, but they are not necessarily against the maintenance of the rural character of the area:

I believe they’re all very environmentally conscious and wish to maintain the environment as it is today. We’re not interested in development. (Frank Towler, resident of the area and president of the Central Saanich West Voters’ Association)

Besides, there are many other ways to avoid development without depriving the Senanus Drive residents of the right to access water in the same way that their fellow citizens do.

Several Senanus Drive residents made public statements to this affect.

Future subdivision is in the hands of both Council and the local homeowners. Public hearings would have to held, environmental impact studies must be done, in the same sort of factors that affect an applicant for subdivision now will still be in force, if and when water is finally brought to us. (Damguard, Senanus Public Meeting)

There is very little development that could occur from the water going into Senanus and their many ways that Council can curtail any future development if you’re worried about it which I now you are. And that’s fair. I’m worried about it too. (Byer, Senanus Public Meeting)

Municipalities have zoning bylaws, development permits, building permits and a whole host of legitimate means to control land use. They have no ethical right to withhold potable water from people. As well, drinking water is not the municipal service that makes high-density development possible. (Denford, Times Colonist, 04/20/01)

The real issue therefore appears to be development. The municipal government (mayor, Council) and a small number of residents do not want a pipeline for fear of further development, which might change the rural character of the community as it currently exists. Despite assertions to the contrary by those concerned, access to water continues to be blocked by the municipality. The extension of the pipeline certainly is not the only option here. But the other solutions proposed are also associated with ranges of negative aspects.

Discussion and Implications

In traditional philosophy, science used to be portrayed as the pursuit of knowledge that operated independently and unsullied by influences coming from the rest of society. If there were influences, “truth [would] out” (Gilbert and Mulkay 1984) nevertheless because of the particular nature of science. As analysts we note that (consistent with other research in science studies) science and scientists are deeply enmeshed and embroiled in techno-scientific issues. Yet our case study also shows that there exist rhetorical efforts to construct science as independent and therefore as superior to other pursuits—to be repressed and excluded from consideration (Maxwell 1992). As citizens (and independent of our personal perspectives) we note our disaffection with the political process that shows unwillingness or inability to establish an *open* debate in which all sides attempt to articulate common interests and social (distributive) justice. Clearly, although Council organized a public hearing, the concerned residents felt that they “had not been heard,” that is, that their concerns have not entered the decision-making arena. As (science) educators we wonder what our contribution might be toward “creating a good world” (Maxwell 1992) and truly “liberal society” (Rorty 1989) in which groups such as the Senanus Drive residents can fend for themselves even when they are confronted with scientific and technological experts.

Distributive Justice and Solidarity

The Senanus Drive water controversy is not unlike other controversial issues where there is a competition for resources and where personal beliefs and values are threatened. The fundamental issue is one between those who have both water and control versus those who do not have either access to water or substantial input in the decision-making process. This creates a predictable situation of polarized viewpoints that express divergent special and therefore partial interests. As the residents expressed time and again, they experienced suffering—individual suffering arises exactly when a human subject (individual, group) feels isolated from the control over relevant life conditions, that is, feels subjected to life contingencies (Holzkamp 1991). Through its organ, the Saanich West Voters Association, the Senanus Drive residents have repeatedly expressed their concerns, the special interests of one group of citizens living in a very “rural” part of the municipality. However, the formation of special interest groups for the sole purpose of advancing one partial interest over another partial interest will neither solve the problems nor strengthen special interest groups (Holzkamp 1979). To compromise, each group (Council/mayor, residents) has to give in a little (thereby losing a little face) by simultaneously attempting to impose their own visions to the corresponding Other. In the end, however, the compromise would lead to greater (perceived) advantages of one over another group. Such an approach does not address is the pursuit of common interests. What then is needed to overcome the apparent stalemate of the situation?

Clearly then, the Senanus Drive controversy is crying out for the enactment of social justice, in particular, the enactment of distributive justice. However, the questions “Who gets what?” and “On what grounds does s/he get it?” cannot be solved by banding together for the purpose of opposing partial interests. Common interests appear to be more important than partial interests, which requires a sense of solidarity. Rorty (1989) argues that we have a moral obligation to feel a sense of solidarity with all other human

beings (based on the fact of the contingency of culture, language, and community). Here, solidarity is not the recognition of a core Self that is common to all human individuals, the core essence of humanity. Rather, it is the ability to see traditional differences as unimportant relative to the similarities in the experiences of pain and suffering. Solidarity therefore involves a conversion from the use of “they” (as in “all *they* want is to develop the land”) to the use of “we,” a conversion from special, partial interests to common interests. Thus, “our sense of solidarity is strongest when those with whom solidarity is expressed are thought of as ‘one of us’ where ‘us’ means something smaller and more local than the human race” (Rorty 1989, 191). Out of this conversion contingently develop new cultural forms of life, new vocabularies, that can be explained only retrospectively. Once we master the new cultural forms and language, we can figure out how the good things that recently happened served some more general good. In a truly liberal society, ideals are fulfilled by persuasion rather than force, by reform rather than revolution, by free and open encounters of current practices, and by suggestions for new practices. In such a society, all disciplines (rather than techno-science on its own) and feelings, desires, and values have their place within rational inquiry (Maxwell 1992). Pure science then becomes but a fiber, treated like other fibers (esoteric pursuits of music, drama, or literature) in the more encompassing thread of human life.

In part, the sorry state of the local aquifers is due to the impact that the straightening of the nearby creek has had and the continuous pumping of water for irrigation purposes. The decreasing quantity and quality of the water, as testified by the residents who have lived at Senanus Drive for up to 30 years, is an environmental issue. When environmental destruction consistently and negatively affects the lives, health, reproductive choices, and overall well-being of one group of people (here those who live in a “rural” area), while other groups (here those living closer to the high-density areas) consistently escape much of the burden of such destruction there appears to be an injustice. The Senanus Drive issue therefore also becomes an issue of environmental justice, a term used in the context

of changes of the environment the “benefits” of which are born by one group of people whereas the burden are born by another (e.g., Gruen 2000). Environmental justice is about the fair or equitable distribution of environmental goods, services, and “resources.” On the other hand, injustice is exacerbated when those who actually benefit from and enjoy the goods that resulted from environmentally destructive production processes, do not pay all the costs.

The larger study (conducted by Roth) within which our work here is situated shows that what there is a relationship between the well water and the aquifer that feeds Hagen Creek. It is in the interests of the community residents who are seeking to restore the creek, to find ways to manage water in the area, so that the aquifer is protected. In the Capital Regional District (larger Victoria area) it is in the interests of the community to minimize the use of water from the Sooke Reservoir that provides adequate safe water to all the residents only with some difficulty. There are increasing numbers of communities in other areas of Canada, who are becoming aware of the fragile nature of a resource that up to now has been seen as unending. The issue of the provision of water to some 30 residents in a rural area of the Saanich Peninsula has far reaching implications. It is one more in a recent series of events that points out our need to become much more aware of how we use the precious resource of water.

This issue is of interest to the larger community of residents of Vancouver Island because it demonstrates how the conflict between urban and rural development can find itself played out over the issue of a limited resource on the island: fresh water. The Senanus Drive residents feel that they have the right to safe and plentiful water. They perceive that the most efficient and cost effective way for this to happen for them is to have a pipeline extended to their area. The community members who oppose the extension of the pipeline claim that there are alternatives to extending the pipeline that have not been fully examined. This group is against urban encroachment in the area, so they see any extension of water pipelines as an invitation for the local residents to

subdivide their large properties, thereby increasing the population density in the area. The solution to this problem must involve a decision-making process in the community that is perceived as being fair, and the clear identification of the development goals of the area.

Once development guidelines have been put in place, the water problems will be able to be addressed as just that. It is clear that the community and its elected council needs to address the issue of the quantity and quality of the water for the residents of Senanus Drive, but the present context of political wrangling is not going to lead to a solution that satisfies either of the groups. It seems that there indeed needs to be a process to resolve this issue that is satisfactory to all participants in the discussion. This will probably involve the identification of a development plan that is seen to be strong enough to withstand pressure of future councils to bow to the will of developers. There also needs to be a thorough investigation of the situation on Senanus, including the identification of possible individual solutions for those properties. From a community safety standpoint, the question of fire safety needs to be addressed; in addition, the issue of water management in a larger context needs to be investigated. This should include a discussion of recovery of waste water and sewage disposal in the area. However, as we have seen in the data we collected, the members of the community will closely scrutinize any scientific data. The data presented to form the basis for a final decision must include data collected from all experts in the area – scientists, water management consultants, and residents who live with the problem and residents who may have to share the cost of the solution.

(Techno-Scientific) Education

To address the complex problems of a complex techno-scientific world, dramatic changes throughout education are required (Maxwell 1992). However, what how such changes ought to look like and how they can be practically achieved is much less clear. “Scientific literacy” for *all* citizens is a favorite banner of current reform agendas (AAAS

1989). However, what it usually means is knowing concepts in the way scientists do independent of the social contexts in which these concepts may be relevant (Rodriguez 1997). Knowing science in the way it is portrayed in science textbook does not appear to be the issue. Some of the residents who speak out in this controversy know science, the concentration levels of certain metals, and the reactions that make these metals (e.g., chromium) in the presence of other substances (e.g., chlorine from water treatment) dangerous, though not dangerous if they appear alone. Thus, a considerable part of the Senanus Drive residents *are* scientifically informed and enhance their knowledge and understanding by hiring consultants and perusing the reports of others. The real issue seems to be one of managing the relations with scientists in the course over a controversy.

In this study, as in others (Brown and Michael 2001), the scientists and their allies use a limited discursive genre to outplay the discourses and experiences of those whose lives are directly affected by the quantity and quality of water. It may be that concentrations of certain metals are only “aesthetic objectives” that do not affect health. But to those who have to live on a daily basis with corroding pipes, dying plants, scales left by soap on their skin, and undrinkable water, overstepping “aesthetic objectives” seriously diminishes the quality of life.

What, then, ought (science) educators do to ready children and students for their participation in community life? One goal for (science) educators to achieve would therefore not be the inculcation of a limited discursive repertoire at the expense of other repertoires but an introduction into the ways in which controversies unfold and how individual citizens and groups can participate in legitimate (peripheral) ways. Such participation does not have to await the completion of one or more science courses. Rather, as an ongoing research program shows, seventh-grade students can contribute to the construction of their community’s knowledge about the environmental health of their watershed (Roth and Lee 2001a, 2001b). They not only learn science and scientific

discourse, but they do by contributing to the collective concerns about the lifeworld that each member of the community inhabits. The students are then already on a trajectory of participating in the ongoing debates about community, environmental, and personal health. There is no reason why individuals could not embark on such a trajectory at any point in their life. A question for educators would be how they can contribute to facilitate embarkation and support the trajectories that emerge.

There is no doubt that such a shift in educational thought has socio-political consequences (e.g., Roth and Désautels 2001). When an eight-grade student begins to monitor coliform levels in a local creek and report (in an open-house event organized by community activists) high increases just below certain farms, he actively contributes to bringing to awareness of everyone those who actively contribute to pollution (Roth and Lee 2001b). When eleventh-grade students conduct chemical analyses in a major river, source the pollutants, and publish the results of their inquiries, they clearly engage in political acts. In any event, by participating in and contributing to ongoing debates and controversies, these students learn and ready themselves for other controversies. As there is little support for the transfer of knowledge between situations (Lave 1988), learning to participate in controversy by participating possibly the best option we have for preparing future generations. They do not have to end up feeling like losers in an inequitable contest over resources, fought by winners under the banner of science.

Reflexive Coda

We come away from our study of the public process in our community thinking that substantial changes in the public and educational process are required to prepare citizens that can fend for their rights during public controversies, particularly when scientific and technological expertise are mounted against their case. Change will not come easy. At one point in our analyses, we found ourselves mired, having begun to empathize with the different actors and begun to take sides. A majority on our author team felt that

distributive justice required providing access to safe drinking water, forcing the community as a whole to deal with the problem of potential development in other ways. A minority had begun to agree with Council and the mayor, feeling that the Senanus Drive residents wanted to enrich themselves through selling their properties that would tremendously increase in value. We were able to get out of our problems (which we recognized to be like those that plague the community of Central Saanich) by reasserting the right of all involved to speak and to be heard. We felt that our diverse backgrounds had allowed us to bring a many different types of expertise to the table that not only enriched our discussions but also forced us to deal with different discourses, unquestioned assumptions, and forms of reasoning. It is the “we” of our collective effort that ultimately won over the juxtaposition of differences. We feel that it is only through the development of a similar solidarity that the pitfalls of playing one special interest against another can be avoided.

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