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THE CITY OF REDWOOD CITY  
CITY COUNCIL MEETING  
PROPOSED RECYCLE WATER PROJECT

REPORTER'S PARTIAL TRANSCRIPT OF MEETING

JUNE 9, 2003

CITY HALL  
1017 MIDDLEFIELD ROAD  
REDWOOD CITY, CALIFORNIA

Reported by Donna M. Lowe, CSR NO. 12113

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1 citizens that their public health will not be adversely  
2 affected.

3 My recommendation is that the Redwood City  
4 Council not act on this particular issue. My  
5 recommendation is that they seek other sources to obtain  
6 water such as desalinization or from a conservation  
7 measure rather than expose the citizens to this particular  
8 health risk at this particular time.

9 Thank you very much.

10 MAYOR CLAIRE: Thank you very much. Are you  
11 going to be around for questions?

12 DOCTOR LOFTHOLM: Yes, Mr. Mayor. Thank you  
13 very much.

14 ---o0o---

15 DOCTOR ATKINSON-BAR: Good evening,  
16 Mr. Mayor, Members of the Council, citizens of Redwood  
17 City. I am not a resident of Redwood City. I am a  
18 resident of Calabastos, which is near the San Fernando  
19 Valley in Los Angeles. I was fortunate to work in  
20 molecular biology when molecular biology was very young.  
21 I worked in a biological unit and trained there personally  
22 by the leaders of molecular biology. In recent years, I  
23 have been looking more at infectious diseases and most  
24 well known is my work in lyme disease, which has made  
25 quite a difference to sufferers of the late stages of the

1     lyme disease revolution and kind of revolutionized things.

2             In the last three years, I have been looking  
3     at bacterial bases for diseases such as Alzheimers,  
4     multiple sclerosis, rheumatoid arthritis, and we are  
5     pleased to say in December 2002, bacterial cysts were  
6     found to be present in patients with multiple sclerosis,  
7     and we are looking forward to opening that door very soon.

8             The shortage of water is not limited to  
9     Northern California. Southern California has the same  
10    kind of problems and during the 1990s, I became aware that  
11    various claims were being made for the safety of recycled  
12    water, going as far as to advocate toilet taps, and you  
13    may know that the mayor of Los Angeles has come out  
14    strongly against such use.

15            I didn't become involved with that aspect  
16    very much until I discovered a pipe was being laid up in a  
17    local elementary school, and I inquired the reason for the  
18    pipe, and I was told that they were planning to put  
19    recycled water as irrigation around the elementary school  
20    and I was somewhat concerned.

21            I had a belief that there were massive  
22    amounts of research going on in recycled water, but I  
23    asked for a meeting with the water district, and I  
24    prepared a brief for the water district for the purpose of  
25    getting us all to ground zero so we could start the

1 discussion. I had a meeting with that water district.  
2 They invited down a director of the Water Reuse  
3 Organization Association and an advocate of water reuse.  
4 And at that meeting, I was shocked to discover the lack  
5 knowledge on the basis of the reuse advocate. They had  
6 very little understanding of physiology or anatomy.

7           Following that meeting, they generated a  
8 report which worried me greatly, and I then prepared a  
9 reply to that report, and we had a public hearing for the  
10 local water district. This was in April 2001 and I almost  
11 forgot about it when I received contact from the DHS just  
12 a few months ago.

13           They had seen a letter written in our local  
14 newspaper regarding my concerns and contacted me because  
15 use they were interested in my concerns. I told them that  
16 there was a copy of the report if they wished to have it,  
17 and they took a copy of that report and they gave it to  
18 their microbiologist. Their microbiologist concurred that  
19 I was right.

20           They then asked my commission to forward it  
21 to the Salk Institute where it was sent to President David  
22 Schubert. He also contacted me and he concurred with the  
23 report. So what I have done this evening is, I have taken  
24 that report which is not suitable for presentation, and  
25 made it into something of a Power Point presentation, and

1 could you start the first slide?

2 Now, I have to try and compress into 20  
3 minutes what we could spend six hours over. I'm not going  
4 to read what is on the slide. You can all read and it  
5 annoys me when people do that. It will take a few seconds  
6 to see what my objectives are this evening. Two of them  
7 will be self-evident. The third one is a little bit of a  
8 benefit for you all, and I hope you will find it of great  
9 interest.

10 As we go through this talk I am going to  
11 repeatedly come back to this road map that is to give you  
12 an idea of the sections that we are going to go through.  
13 So just to give you an idea where we are and where we are  
14 up to, I'm going to try to make this presentation  
15 interesting. Sometimes it might even be humorous, but we  
16 should not forget extreme gravity of what we are dealing  
17 with. Archeologists have found that communities who fail  
18 to build walls around their drinking wells rapidly succumb  
19 to morbidity but those communities disappeared. Basically  
20 those who became sick consumed more resources than the  
21 ones that remained well were able to produce.

22 So we are going to look at what this waste  
23 stream is, and this is nearly all about microbiology. I'm  
24 not going to be talking about dissolved chemicals either  
25 organic or inorganic. This is a representation of our

1 waste stream. We have various commercial institutional  
2 and personal waste combined together. We have highlighted  
3 an individual's personal waste, gray water as we tend to  
4 call it, and toilet waste. Those wastes combined in our  
5 sewer system and then passed on to a stage with  
6 sedimentation removes the solids from the liquids, and the  
7 liquids go on for filtration and then disinfection  
8 typically with chlorination and then we have application.

9 This is the problem we face. People do not  
10 appreciate that one person each day produces 20 billion  
11 bacteria. It is an enormous quantity and represents 90  
12 percent of the fecal mass. If you have a reduction of a  
13 factor of ten to the five, which is a reduction of  
14 100,000, you are still talking about 200,000 bacteria per  
15 person. This is two times ten to ten bacteria per person  
16 per day. If you have a population of a thousand people,  
17 you're talking about 20 trillion bacteria that have to be  
18 disposed of or inactivated out of the liquid stream.

19 Now, there is a big change between where  
20 those conceptual sources join and where the sewage enters  
21 the treatment plant. What can happen and what does happen.  
22 is, chemicals introduced into the waste stream can induce  
23 changes in bacteria, antibiotic resistance. I'm sure  
24 you've all heard of that. If you dump a lot of  
25 antibiotics into the stream you are going to encourage

1 those organisms which survive antibiotics to survive.

2 Benign bacteria can acquire toxin-producing.  
3 In other words, they become pathogenic from other bacteria  
4 and bacteria can exchange survival abilities. These are  
5 three mechanisms by which bacteria exchange capabilities.  
6 It is easily demonstrated in the laboratory. It's been  
7 known for 60 years. It can be done by a simple  
8 undergraduate experiment. The conclusion is where with  
9 mix waste streams we end up with something even more  
10 dangerous.

11 Here are two bacteria mating. This review,  
12 as we go through the important points, we have a very  
13 dense bacterial and pathogen waste stream made more  
14 dangerous through mixing. The question is, do and can we  
15 make these streams safe through treatment. Okay. Road  
16 map, please.

17 Pathogens that go to make up the stream,  
18 bacteria which we know rather well. Viruses. I was  
19 unable to get an estimate of the number of viruses in the  
20 human solid waste stream. Parasites, I've lumped them all  
21 together but in the sense bacteria are parasites as well.  
22 The important point is that a lot of these organisms are  
23 host specific. They won't affect a duck or bird, but they  
24 will affect a human so we call them human host-adapted.  
25 And if an organism is adapted to the human, the human acts

1 as an amplifier. And I am sure some people work in San  
2 Jose, and they are particularly well acquainted with  
3 amplification. So we can use that metaphor for what  
4 happens to organisms.

5 This contrasts with organisms that may come  
6 from animals like bears which would not be amplified if we  
7 go into the human being, not normally amplified.  
8 Sometimes bacteria which otherwise are not dangerous  
9 become toxic-producing. The famous one is ecoli, which  
10 perhaps is the most well-known bacteria and is generally  
11 harmless. But ecoli, particularly in the case of fast  
12 food restaurants, is toxin-producing and made a lot of  
13 people very sick and killed some people.

14 The standard ideal, the drip solution, the  
15 safe way of using irrigation. The red represents the  
16 pathogen flow. The white box at the bottom represents  
17 water treatment. We have a thinner line of pathogens,  
18 coming out and the question is, does that line of pathogen  
19 actually exist? And we're going to deal with that for a  
20 second. And underneath the Christmas tree, you will see  
21 my representation of a nematode, which is one of the  
22 organisms, a tiny worm what will consume bacteria, and the  
23 water flow is done by distillation. The water comes down.  
24 We don't have that much risk here without contact.

25 What we have is spray irrigation. Of course,

1 now we have direct human contact. Pretty obvious slide  
2 with a couple of things I want to point out. Most of the  
3 elements are common to the last slide. The small white  
4 box to left of the human representation is hygiene. By  
5 introducing hygiene, we are cutting down the pathogen flow  
6 to a human. And if you look carefully at the little man  
7 you see the stomach. The stomach is an essential part of  
8 preventing organisms completing the circle and being  
9 amplified again by the human being.

10 One of the things we know if we close the  
11 circle biologically things get bad quickly. The birth of  
12 epidemiology was the cholera outbreak of 1854 in London.  
13 Doctor John Snow was able to stop it by taking the pump  
14 handle off. That was caused by seepage of septic tank  
15 material into drinking water which was fed by pumps and  
16 the circle was closed. The epidemic consumed 500 persons.

17 Koro is a disease which appeared in Papua,  
18 New Guinea where a tribesman ate their relatives and is a  
19 degenerative disease of the brain. Mad cow disease, which  
20 is the disease created in Britain when they decided in the  
21 interest of energy efficiency turned down the temperature  
22 at which they cooked animal food and therefore introduced  
23 this prion disease into the cow population. As a result,  
24 all the cattle in Britain had to be destroyed. The  
25 economic consequences were enormous.

1                   AIDS we know only too well; feedback as a  
2     consequence of changes in social behavior; and SARS, which  
3     was recently brought to my attention by a colleague from  
4     Afghanistan, SARS which has been linked to the civic cat.  
5     What I didn't know was that the civic cat is a carrion  
6     feeder and frequently feeds upon human remains. So one of  
7     the things that we have learned over the years is that we  
8     should avoid at all costs closing the biological circle.

9                   In review here, these micro-organisms in this  
10    waste stream are human adapted, human host-adapted. When  
11    such organisms reach humans, the human acts as an  
12    amplifier. Water treatment hygiene and host defenses all  
13    play a role in preventing infection. Issues of positive  
14    biological feedback should give us great caution. As has  
15    been said before, nature will find a way.

16                  Let's look at the disinfection methodology.  
17    Sedimentation. Oxidation. Because of the level of  
18    bacteria in the human waste stream are actually averse to  
19    oxygen, filtration which takes out the pieces makes the  
20    water look attractive but also takes away havens for  
21    bacteria to hide in so that the disinfection step which is  
22    next is more efficient.

23                  And we have applications where we put it into  
24    the ground and hopefully the organism is consumed by  
25    things like nematodes. The questions I suppose is what --

1 how do we measure the quality of a cleansed liquid stream  
2 and what are the suitable applications.

3 Coliforms, you will see a lot about  
4 coliforms in CEQA and the addendum. Coliforms are  
5 incredibly common in the waste stream, not the most  
6 common; probably the best known bacterium that indicates  
7 that the water has been in contact with fecal material.  
8 Unfortunately, they are often also used to measure the  
9 quality of disinfection. They are not the most  
10 susceptible bacteria to chlorination or disinfection, but  
11 they are certainly not the least and, therefore, if you  
12 find that you have free of chloroforms that does not mean  
13 that it microbiologically sterile.

14 Disinfection. When you put chlorine into  
15 water, this is what happens. I am sure most of you have  
16 not run a water treatment plant. The chemistry is  
17 identical. I want you to focus on the  $\text{HOCl}$ , that is the  
18 hypochlorous acid, and then hydrochloric acid is the other  
19 product. The hypochlorous acid is the most important  
20 thing here.

21 Hypochlorous acid is a wonderful  
22 disinfectant. You don't run treatments plants. Many of  
23 you have managed swimming pools, and you know if you  
24 manage a swimming pool there are two chemicals that you  
25 put in the swimming pool, chlorine and acid. Now, this is

1 the reason why you have to put in the acid. Hypochlorous  
2 acid which is what is being proposed for this treatment  
3 plant is a weak acid and associates, as you can see, into  
4 that hydrogen atom and the hypochlorous ion, and it  
5 dissociates reversibly depending upon the acidity.

6 Now, the left-hand side of that graph shows  
7 what happens to the acid level, and the right-hand side  
8 shows what happens to alkali levels. And you can see just  
9 about a pH of a seven which is neutral. You are getting  
10 significant amounts of hypochlorous acid. The left-hand  
11 side of that graph can be interpreted as how efficient the  
12 disinfectant is. The right-hand side, there is no  
13 disinfection because the hypochlorous acid is completely  
14 dissociated.

15 Now, the human stomach. Food comes in at the  
16 esophagus at the top. The stomach acts as a mechanical  
17 mixing and also acts as an antibacterial bath. Food exits  
18 via the small intestine at the bottom. It serves to  
19 digest food, but it also serves to protect us from  
20 infection.

21 This is a complete set and you're going to  
22 roll your eyes. This is what happens in the stomach. And  
23 as you can see the stomach produces exactly the same  
24 chemical. This is created by phagocytes. And so the  
25 chemistry of disinfection, this is the important thing,

1 the chemistry of disinfection in the stomach is identical  
2 to disinfection that we talked about in the water  
3 treatment plant. If the organism survives in the stomach,  
4 it is going to survive through the water treatment plant.  
5 That is a reasonable assumption.

6 The stomach is an antibacterial bath. It  
7 kills by both hypochlorous acid and enzymes. It is very  
8 acidic, a pH of two. It is muscular and mixed and it was  
9 thought to be completely sterile until the 1990s. It  
10 protects us from ingesting infections and it is not always  
11 effective.

12 If you drop the acidity down, it will be just  
13 like a swimming pool. If you have no acidity, you will  
14 not be protected. For everybody's better health avoid use  
15 of antacids, which drops the acid in the stomach, and do  
16 not use antacids as calcium supplements despite what you  
17 might have heard in the last ten years. And if you are  
18 using a lot acid-blocking drugs, I suggest you go and see  
19 your physician as soon as possible.

20 Disinfection of the stomach is a superset of  
21 that used in swimming pools and in water treatment.  
22 Organisms that survive gastric juice will survive water  
23 treatment. Acidity is essential to hypochlorite  
24 disinfection.

25 Infectious diseases. This is a small portion

1 of the map of a cholera outbreak in 1854. If you look to  
2 the upper right to the middle right, you'll see Broad  
3 Street. There is a round dot there showing a pump that is  
4 the source of infection. What I want you to note from  
5 this image is that this is a very heavily densely, very  
6 heavily populated area. Great density of habitation.

7 London at this time had been a major city for  
8 2,000 years, and I want you to notice how few homes people  
9 died. The deaths are black bars. There is lots of places  
10 where people didn't die, and the reason they didn't die  
11 over that long hot summer of 1854 was water use. Their  
12 stomachs were working and their stomachs were functional.  
13 The ones that did die were the ones that succumbed to the  
14 infection.

15 So when it comes to chlorination, if you have  
16 a functional stomach acting as an antibacterial bath you  
17 can tolerate moderate or even severe contamination. But  
18 everybody at some time has a nonacidic stomach. And prior  
19 to chlorination of water, there was a high mortality  
20 amongst children.

21 In fact, if this council was discussing the  
22 chlorination of water, I doubt how they would have done  
23 that. People would say how on earth could you put poison  
24 gas in our drinking water. Well, people did and it as  
25 probably the most important measure taken in public

1 health. It was the most important measure.

2           Very important consideration when you have a  
3 point source of infection like cholera in 1854 or like  
4 contaminated water of any kind. Notice that each person  
5 has an equal chance of getting an infection. And I want  
6 to contrast that with person-to-person transmission. When  
7 you have a person-to-person transmission as the disease  
8 progressed, those people who become very sick will drop  
9 out of the chain. And as you notice, the red lines get  
10 thinner as we go to the right.

11           As the disease progresses with  
12 person-to-person transmission of infection, the infection  
13 becomes less virulent. And this is exactly what the SARS  
14 investigators were looking for. So the point here is we  
15 should be particularly careful about point source of  
16 infection because person-to-person transmission tends to  
17 reduce the virulence of a disease over a period of time.

18           This is why schools play such an important  
19 role in our public health system because as long as we  
20 pull our children when they become sick but we let them go  
21 to school with mild infections, for the whole community  
22 infections become less virulent. This is not my work.  
23 This is the work of Paul Ewald. If you want to read more  
24 about it his book, The Evolution of Infectious Diseases, I  
25 recommend to you highly. I think everybody in public

1 health should have a copy of that book on their bookcase.

2 Pathogens resistant to hypochlorous acid.

3 This is an official EPA statement. The EPA recognizes  
4 that there are pathogens, micro-organisms that cause  
5 disease that survive chlorination. And I couldn't put the  
6 full text of the EPA statement on the slide, but I have  
7 the statement that I am distributing to council and you  
8 can find that on the Internet. And there is another slide  
9 on the EPA's position.

10 I want to focus on one particular bacterium  
11 and that is helicobactopylori discovered by Doctor Barry  
12 Marshall in 1984. I was privileged to publish with Doctor  
13 Marshall. It took him until 1991 to convince the medical  
14 community that this organism existed because nobody  
15 believed that a pathogen could exist in the stomach.

16 It causes chronic illness, and it has to be  
17 eliminated with special antibiotic combinations and is  
18 transmitted by contaminated water or kissing. It is a  
19 class one carcinogen, and 50 percent of the world's  
20 populations are infected much less in the United States  
21 because we have such good water, but more so in places  
22 likes Peru.

23 Here is what happens with helicobactopylori.  
24 The acute symptoms immediately after infection are so mild  
25 as to be unnoticeable. He actually infected himself and

1 reported he had low grade nausea and endoscopy revealed  
2 that his stomach lining became gray. After ten years of  
3 infection, stomach ulcers and duodenal ulcers will be  
4 caused particularly in susceptible people, that is people  
5 with type O blood. After 30 years, infection is  
6 associated with gastric cancer.

7 Now, when you are using recycle water, are we  
8 going to see these diseases reported? And I put a little  
9 table up here what we can expect. Mild acute problems, as  
10 I had last night, are not going to be reported. You are  
11 not go to see a physician. Severe acute, yes, you will  
12 see a physician and some might be reported and linked to  
13 the source. It is only when we get to very severe things  
14 like the cholera outbreak of 1854 that we are going to see  
15 reported.

16 When it comes to chronic diseases, diseases  
17 that develop 10, 20 years after exposure none of these are  
18 going to be linked to the source. So the assertion,  
19 Members of the Council, that because recycled water has  
20 been used it is safe and there hasn't been an increase in  
21 morbidity and no report, no increase of reported disease  
22 is unfounded.

23 In fact, we don't know in the United States  
24 the incidence of morbidity. It is a very difficult thing  
25 to measure. What we do know is 40 percent of the people

1 over the age of 45 have some kind of disease that  
2 interferes with their function, some degree of morbidity.  
3 And we don't -- for instance, in lyme disease in my  
4 particular area, the CDC says that there are 50,000 cases  
5 in the United States. If you talk to the lyme disease  
6 foundation, it is well over a million cases, and I think  
7 the Lyme Disease Foundation is a lot further along than  
8 the CDC.

9                   And so we have the real limitations on  
10 reporting which have real impact on the measure of the  
11 safety of recycled water. I did review at the time of the  
12 meeting with the water district two years ago, I reviewed  
13 the available papers. There was one study that was done  
14 and not peer-reviewed, this was to do with recharging  
15 ground aquifers and had an increase in hepatic cancers,  
16 liver cancers, which they then attempted to explain away  
17 by dose response relationship, which is completely  
18 invalid. I reviewed other papers.

19                   What has happened in the water reuse  
20 industry, is that the water reuse industry has created its  
21 own journals with its own reviewers. These papers  
22 affirming safety and not appearing in mainstream journals,  
23 they are being reviewed by water reuse advocates. And if  
24 you look in your addendum, you'll see the references there  
25 are to proceedings and conferences of their own council so

1 I caution this council.

2 Review. I'm going to let you read that. Of  
3 particular importance we recognize that bacteria can  
4 produce chronic disease 10, 20, 30 years after infection.  
5 Infectious diseases became unfashionable in the 1970s and  
6 1980s. Right now, we are on the way where everything is  
7 looking to be an infectious disease. As I said, multiple  
8 sclerosis since last December.

9 A quick look at the existing legal framework.  
10 Title 22 of the Code of Regulations controls the use of  
11 recycled water. It is not equivalent to potable water and  
12 there are area use regulations. We have to put these  
13 signs up where irrigation, where recycled water is in  
14 place. Unfortunately, many of the people, many of our  
15 population can't read the signs. Anybody under the age of  
16 five is not going to be able to understand that sign, and  
17 there are the people that are going to put their hands in  
18 their mouths and you need to understand this.

19 On the last section. Water use. Because I  
20 was interested in elementary school two years ago, I want  
21 to point out some very important things about elementary  
22 school. Mandated attendance every week day. It is not  
23 optional to go to school. The first time -- all of us  
24 have taken our children to that first day of elementary  
25 school and we all see what is going on. It is the first

1 day that children are without their parents and these are  
2 four to ten year olds. For the first time without any  
3 parental supervision.

4 Cast your mind back to that box where there  
5 is personal contact with the water. Hygiene is an  
6 important element in preventing feedback through the  
7 system and back into the human. One thing that young  
8 children have is very poor hygiene. They have undeveloped  
9 hygiene habits.

10 Next, they have an underdeveloped immune  
11 system. Some vaccinations cannot be given until children  
12 are 13 years old because their immune system is not ready  
13 to create the necessary molecules. As I said, they are  
14 not able to read and comprehend the signage, and  
15 elementary school is an essential element of all of our  
16 general public health. It is where these minor diseases  
17 become less virulent.

18 When a child goes to school other family  
19 members get sick. That is classic. You must be very  
20 careful for the health of the general population that the  
21 elementary schools particularly are protected because by  
22 careful dispersion of these mild person-to-person  
23 diseases, you overall reduce the virulence of these  
24 diseases. You must not put a point source infection at an  
25 elementary school or anywhere where children are playing.

