Jim Baker, Marley Cooling Tower Company: Let me welcome everybody to the educational program this year. It is divided into two parts. Today's part will be the panel discussion on *Legionella*. I would like to introduce the moderator for today's panel discussion, Mr. Roy Manley. Roy is the Manager of the Environmental and Regulatory Group of BetzDearborn Inc. in Horsham, Pennsylvania. He has been in the regulatory area with BetzDearborn for 15 years. Prior to that he worked for 6 years as a research consultant with the EPA in North Carolina where he developed emission regulations for synthetic fiber manufacturing plants. He also worked for the Georgia Environmental Protection Division for 5 years. He is a Major in the US Army Reserve, Chemical Corps and has a Bachelor of Science in Chemistry and MBA in Management from the University of Georgia.

Roy Manley, BetzDearborn: Good morning. Today’s discussion brings to the Cooling Tower Institute a wide variety of disciplines in the area of *Legionella Pneumophila* (*Legionella*). This program is an offshoot of a discussion in the Water Treatment Committee last year. We have gathered experts from industry, from OSHA, CDC (Centers for Disease Control), and medical microbiology. We also have with us a Public Health Engineer, an Epidemiologist/Lawyer (that’s all one person) who specializes in *Legionella* litigation. Our speakers have reviewed the CTI position paper that was prepared a couple of years ago.

Our speakers are: Janet Stout, PhD with the VA Medical Center in Pittsburgh. Dr. Stout received her Bachelor of Science in Biology from Clarion State University and her Masters and PhD degrees in Microbiology from the University of Pittsburgh. She is currently director of the VA Medical Center’s Special Pathogens Laboratory where she is working *Legionella* detection and disinfection. She is concurrently a research assistant professor at the University of Pittsburgh School of Medicine. Her recent projects include, Eradication of *Legionella* from Hospital Water Supply Systems, Molecular Epidemiology of Legionnaires’ Disease and Legionnaires’ and BioFilms. She has authored numerous papers in the area of Legionnaires’ Disease that have been published in the New England Journal of Medicine, The Journal of the American Medical Association and the Journal of Infectious Diseases. Dr. Stout is a member of the American Society for Microbiology and the Society for Healthcare Epidemiology of America.

From OSHA we have Kevin Cummins. Kevin is Senior Industrial Hygienist with the OSHA Health Response Team in Salt Lake City. He is involved in field investigations of Legionnaire’s Disease for OSHA. Mr. Cummings has a Master of Science in Public Health and in Chemistry from the University of California at San Diego. He has a Bachelor of Science in Chemistry from Colorado State University in Fort Collins.

Also with us is Linden Witherell. He is a Public Health Engineer and Lawyer. He is a career officer in the Commission Corp of the US Public Health Service. He retired as a Navy Captain in 1992 and is now an independent consultant. He has a Masters Degree in Engineering and Administration, a Masters of Public Health in Environmental Epidemiology also Jurist Doctor. He practices law in Massachusetts and Vermont in
state and federal courts. He is also in the American Academy of Environmental Engineers.

Also with us from the CDC in Atlanta is Barry Fields, Ph.D. He received his PhD at the University of Georgia Medical School in Microbiology. He began with the CDC in the Legionella Laboratory in 1980. He was the Chief of the Legionella Lab in 1991, and Chief of Respiratory Disease Diagnostic Unit from 1993 until now. He has investigated over 40 outbreaks of Legionnaires’ Disease. He has performed initial studies with Ciliated Protozoa that, as we learned in the last few years, is significant in Legionella. He is the author of over 50 articles, chapters or reviewed articles on Legionella.

Finally, Ian Priestnell is with us. He is a chemist, having worked over 30 years in water treatment and process industries in the United Kingdom, Europe and North America. He has worked in Research and Development, Sales, Marketing and General Management. For 12 years he was the President and CEO of Dearborn Water Treatment Specialties in the United Kingdom. He has 2 years of presidency in Europe, 5 years as president worldwide, 2 years as the senior vice president of the merged companies of Betz and Dearborn.

Last but not least, I am very grateful to my team who helped put this together. Without their effort this project would not have been successful. John Zibrida, Delisa Kennedy, and my friend and associate Helen Cerra have all been tireless in their efforts in putting this together.

I’m going to ask Janet to begin the discussion. After an initial discussion of a few minutes for each opening statement then we will go to prepared questions that we have received from you that we have put into groups and main issues and will have those as an open panel discussion. Provided there is room, we will have questions from the audience, if not then we will all be available at the Water Treatment Committee meeting this afternoon and the Operating Seminar.

Janet Stout, PhD: Thank you Roy. I want to thank Roy and John Zibrida for the opportunity to be here today talking to the membership of the CTI. As Roy said, I am the Director of the Special Pathogens Laboratory at the VA Medical Center and I think the piece of information that is important for you to know is that I have essentially spent my entire career as a microbiologist on this particular organism, Legionella. So I have more than 15 years in the field of research in this area and have had the opportunity to talk to the number of engineering groups over the last 3 years.

I thought I would start today with an article in a well respected peer review journal, The National Enquirer that appeared during the outbreak in 1976 at the American Legion Convention in Philadelphia. The reason that I bring this up is that I have been told that there are amongst you some individuals that have an opinion that the problem of Legionella in cooling towers might be a little over blown. To give you a break, I would say that there are reasons for you to have that perception. One of the things that I want to do as a medical microbiologist is to talk to you a little bit about why you have that perception and also to say that cooling towers are only one of the reservoirs that Legionella can affect. Legionnaires’ Disease, given that name in honor of the American Legion Convention delegates in a 1976 outbreak that died of that disease, is a form of bacterial pneumonia. The thing that you also have to keep in your mind is that this form of pneumonia cannot be differentiated from any other form of pneumonia. You go to the
doctor, they look at you, and they cannot tell that you have Legionnaires’ Disease. They have to use a special test to make that diagnosis.

Cooling towers are just one of many reservoirs that *Legionella* can colonize and grow or amplify to high numbers. As a result of the American Legion outbreak and the focus on the air conditioning system at the Bellvue Stratford Hotel, there was a tremendous emphasis on cooling towers and air conditioning systems as reservoirs and disease causers. As we have gone on to learn more about this disease, cooling towers are now put into perspective among other reservoirs which may contain *Legionella*.

Much of what we have learned about Legionnaires’ Disease comes from investigation of hospital outbreaks. People that are in the hospital for other reasons come down with pneumonia while in the hospital. It has been linked to the presence of the organism either in the water supply or in a cooling tower. The debate that goes on here is the same debate that is going on with respect to what we do about *Legionella* in hospital water systems.

But Legionnaires’ Disease does not just occur in hospitals. You can save your money and go on a Caribbean Resort vacation and get Legionnaires’ Disease. You can go to work and get Legionnaires’ Disease. This happened at a Social Security building in California. You can go to the grocery store and get Legionnaires’ Disease. What is really bad is that you can even get Legionnaires’ Disease at home.

Is there any one here that has had Legionnaires’ Disease, would you raise your hand? (Not a big response if any.) Well, that is part of the reason that you have the perception that there is a whole lot of something over nothing. What I want you to come away with this morning is the reason you don’t necessarily know someone that has had Legionnaires’ Disease is because a number of factors must come together at the wrong time and wrong place in order to get Legionnaires’ Disease. One critical element of that is laboratory diagnostic testing for Legionnaires’ Disease. When somebody goes to the hospital with pneumonia, these tests are not routinely done. It is only done if the physician thinks about Legionnaires’ Disease. As I said earlier, Legionnaires’ Disease doesn’t look any different than any other form of pneumonia. One of the best methods to make the diagnosis is labor culture.

As a microbiologist I think the way that *Legionella* looks on BCYE, or the media that we grow it on, is pretty cool. Here are colonies of *Legionella*. It is hard to see but there is sort of an opalescence of purple, pink and green. That’s what *Legionella* looks like on culture. Culture is the best way to make the diagnosis of Legionnaires’ Disease; and probably the least often requested test.

What has to happen in order for you to make a diagnosis of Legionnaires’ Disease? It must be in a water supply, whether in a water supply or cooling tower. There must also be sufficient inoculum. A susceptible host is necessary. The physician has to think about Legionnaires’ (that’s what index of suspicion is). Then he must order the correct diagnostic test, and finally there may be a diagnosis of Legionnaires’ Disease. All of these steps have to be fulfilled in order to make a diagnosis. One might think, “OK, that’s why we don’t make a diagnosis of Legionnaires’ Disease very often.”

I’m going to talk briefly about the issue of sufficient inoculum. As yet there is no known magic number above which you get Legionnaires’ Disease and below which you do not.
Brian Shelton’s group at Pathcon Laboratories, put together a table of criteria for accessing risk. I only discuss this because I want to tell you not to depend on it. There is a little qualifier in the statement with this categorization of risk that says, “If you are basically not a normal host (that means somebody that is immuno-compromised, is on immuno-suppressant drugs, has diabetes, cancer, etc.) the numbers become meaningless.” What that means is that even low numbers can cause Legionnaires’ Disease. Just cross any specific numbers out in your mind.

Why is that true? Three things must occur simultaneously. *Legionella* must be present in water, the right exposure must occur and a person must have host factors immuno-suppressant (smoking is a very significant risk factor), chronic diseases. This is why I was not too concerned when I saw this next National Enquirer article, “Di’s Son Exposed to Deadly Disease.” They are young children. They found *Legionella* in Buckingham Palace but we knew, didn’t we, that they were not at risk at getting Legionnaires’ Disease because they are basically healthy people.

Again, the controversy involves hospital Epidemiology. That is, what’s going on in hospitals is exactly what you are talking about today. In the December issue of *Infection Control and Hospital Epidemiology*, there was an article “Resolving the Controversy on Environmental Cultures for *Legionella*, A Modest Proposal by Victor Yu.” There were also 2 papers from the CDC and one from our group in Pittsburgh. Well what is the controversy? The controversy in hospitals is the same as it is in the cooling tower industry. What role does culturing play in making sure your system is safe? These are the arguments on reasons not to culture, it’s expensive, results are not reliable, *Legionella* is everywhere, it can be present without causing disease and then there is public panic.

There is some new validity to some of these arguments. One of the things that I want to bring to your attention is just a few points about whether culturing is a good idea. ASHRAE is developing a draft guideline, "Minimizing the Risk of Legionellosis". Both Barry and I are on this committee. Culturing is appropriate to: 1) verify the effectiveness of water treatment; 2) trace the source of an infection; 3) evaluate whether or not this particular tower is an amplifier; 4) verify decontamination with biocides, and 5) if you have a facility housing individuals at high-risk you might want to culture. This is the last statement in the guide, “Testing is not a substitute for sound maintenance practices and water treatment.” I would say you could also reverse that and say that sound maintenance practices are not a substitute for testing. So you know my bias there. One of the things that you need to consider is the way you collect a sample and how you process a sample impacts whether or not you are going to recover *Legionella*. There are specific things that you can do in a laboratory to optimize culture. Doing acid treatment and using multiple media will improve your ability to culture *Legionella*. There is a need for standardization in this area.

There are certain biocides that are better than others in controlling *Legionella*. There was an outbreak in Maryland where people died of Legionnaires’ Disease. This tower was treated with a biocide that wasn’t particularly effective against *Legionella*, something that many of the water treatment people don’t know. So among commonly used of biocides there are some we know today to be very ineffective against *Legionella* and we need to know more about the ones that are effective. The way to do that is through research. Our laboratory is doing research on biocides and the CDC in conjunction with ASHRAE is doing research on biocides.
My message is not to be in that position, like hospitals have been, where there have been outbreaks. I want to leave you with this question today, how safe is your water? I think it is a valid question that you should be thinking about and feel somewhat responsible. There is a website, Legionella.org. If you have any questions a person can check that website.

Kevin Cummins: I am with OSHA (Occupational Safety and Health Association) in the Salt Lake City office. The office has a technical center and I work with a group that supports area offices all over the country, mostly in federally operated offices, but on occasions we do support investigations on a state programs as well. I do other things besides Legionella. I’m sort of a jack of all trade, master of none. So, I certainly like to take the opportunity to learn from you people as well.

I don’t know how many people are aware that the OSHA put out a chapter on Legionnaires’ Disease a number of years ago. It is intended to provide some background on the organism. We describe some methods of control. It is not particularly specific but it does try to touch on some of the basic control strategies. We outline a protocol that is written for the industrial hygienist, on how they might evaluate a water system. It doesn’t focus so much on the disease aspect but on how to evaluate water systems. This information is on the internet at osha.gov. We have moved into the 20th Century as well. Buried in there somewhere is what we call a technical section. There is a section on Legionnaires’ Disease. There are other places it is also available.

My focus was to prepare something for the professional hygienist as to how they would approach the potential problem if it occurred, focusing on water systems. We do recognize that there are certainly a lot of aspects on how to confirm the disease, and we try to coordinate our efforts with health departments or CDC and depend on them for that aspect of the investigation.

I would like to cover the extent of the problem and future needs from my perspective. I think it is a valid concern. It is my belief that the problem certainly is significant and it is important to look at what constitutes good control. I am a proponent of a performance-based standard for Legionnaires’ Disease. Our agency is really quite reluctant to issue new standards. In fact, our standard making process is so slow it would probably be more likely to be a guidance document than OSHA Standard. Of course we always have what we call a General Duty Clause, which is enforceable by our agency. It basically says that even though OSHA doesn’t have a specific standard for Legionnaires’ Disease, OSHA can write a violation of the General Duty Clause (5A1) if the company or the responsible party, the employer, has not followed generally recognized good practice.

I have put together some numbers that are probably a good discussion point for today. I applied some numbers from the perspective that Legionnaires Disease is a problem from an occupational standpoint disregarding the cases you may get at the grocery store or in your home. Using some CDC numbers, I estimated that there were roughly 2,750 hospitalized cases. Basically, I assumed that 25% of the 11,000 community acquired cases were acquired in the work place. Then I applied a 15% fatality rate for those numbers and came up with the 1.2 deaths per thousand worker life times. It is probably a pretty conservative number.
Then I ask the question, is prevention feasible? I’m making a broad assumption that 10% of the systems are not in compliance. I’m applying this to hot water systems as well as cooling towers, but I did put these numbers to it. We did a rough estimate of the cost to address the problem in hot water systems, which is certainly a major source of the disease. Then we also put a number to estimating biocide treatment. Maybe you people would have some thoughts on that. We came up with somewhere in the neighborhood of 4 million per year. That is really for the 10% of the systems that are not in compliance; and that may be a low number.

What do we look at in terms of cost benefit? I’m projecting that you are in the neighborhood of spending roughly $14 million to reduce the risk in these 10% of the non-compliant systems, including hot water. The potential savings just on a dollar number would more than justify this kind of expense let alone the fact that you would be preventing a significant number of disease cases.

Linden Witherell: I am a consultant in the legal epidemiological and public health engineering of Legionnaires’ Disease. My public health career spans over 30 years, starting in the US Public Health Service where as an engineer I begin the design, construction, and operation of water supply and waste water disposal facilities on Indian reservations. That included maintenance of these facilities, an area that I found my engineering background and degree really didn’t prepare me for. In fact, I think the whole aspect of operation and maintenance is kind of the weak underbelly of our technological society. Cooling towers are no exception to that. The Service was good enough to send me back to school where I received a master’s degree in Engineering and Administration. This helped me to set up programs for the operation and maintenance of these facilities. In the course of my career I was often tapped to be on disease outbreak investigation teams to find out why people were getting sick from such things as water systems, and ultimately cooling towers. The service sent me back and I got a master’s in Public Health and Epideminology, the study of disease outbreaks. Probably a third of my career has been spent on disease outbreak investigations. That often led to being in court as a fact witness. I found it very confusing, and very upsetting at first; but led me to the realization that often there are gray areas in our modern environment. There is no correct answer. If there were correct answers we wouldn’t have problems or disputes. Law is a method of dispute resolution. That is what we face in the whole issue of Legionnaires’ Disease. No one has “the” single answer at this stage and probably won’t for long time, if it ever occurs. Yet as you have heard from the previous two speakers problems certainly do occur and there is always the question of how are we going to resolve this.

I want to thank the Cooling Tower Institute for asking me to participate in this discussion. Unfortunately, I received notice only about 2 weeks ago and haven’t really been able to prepare a talk specifically for this group. So I’m referring to some work I prepared for the Virginia Electric Company and the Virginia Department of Health for a series of lectures I made throughout Virginia to their customers. They were concerned about the possible transfer of customers from water-cooled units to air cooled units and the effect that may have on their power load. As a result they put on three seminars to instruct their users as to how the problems they may face and how they may limit their liability. Here we have two disease Legionnaires and Pontiac Fever. We haven’t heard much about Pontiac Fever but that is also a problem. These two diseases are caused by the same organisms. Most people are very familiar with Legionnaires’ Disease from the press, etc. Pontiac Fever is less well known but it is certainly an important issue from
the standpoint of industrial health because the attack is nearly 100%. If there is an outbreak in a manufacturing facility the whole workforce may be out of production for several weeks. The good news is that the recovery of this is almost 100%. The fatality rate in Legionnaires’ Disease is almost 20% even with treatment.

My background in Legionnaires’ Disease actually began in 1977 when I was part of a team assembled mainly of CDC personnel to investigate an outbreak the Medical Center Hospital of Vermont. This was an outbreak that occurred just about a year after the Philadelphia outbreak. By that time we knew what was causing the disease. We knew what the organism was and we also knew a little about Pontiac Fever but no one had any idea of where the organism came from. In this outbreak we tried to find out. We took over 200 environmental samples but we didn’t have the scientific knowledge at that time to really analyze the organism from the environment. That knowledge was gained in 1978 when CDC for the first time was able to recover *Legionella* from a cooling tower in Memphis, Tennessee. We went back on a follow up on the ’77 outbreak and looked for *Legionella* in nearby cooling towers and found it, but it was pretty much ignored. The people involved, the people who owned the cooling towers, were different from the hospital where the outbreak occurred. The scientific community felt that there was such a great separation, over 300 feet from the cooling tower to the hospital that it couldn’t have been the source of the outbreak. The cooling tower owners did contract with a national water treatment company to begin treatment in the system. Unfortunately it wasn’t totally successful and in 1980 there were two separate outbreaks from the same tower. The tower was located at the medical school and the hospital had no tower. It was felt at that time that it was impossible for organisms from the medical school tower could travel the distance between the school and hospital, and enter into the windows of the hospitals to cause the outbreak in ’77. Unfortunately we found out in 1980 that it was possible and caused two outbreaks.

What we now know of the organism itself is that it is a naturally occurring aquatic organism. You will often hear the term ubiquitous. That gives some a sense of security, saying that ubiquity means that it is everywhere. If it is everywhere why test for it? Well first, it isn’t everywhere. It isn’t on these walls, on this floor or on the material. It is an aquatic organism. It is only found in water. It is not found in all water. Most samples, even of cooling towers, come up with no recovery of *Legionella*. In a study of over 160 cooling towers that we conducted we found it present in only approximately 14% of the towers at any given time.

One must keep in mind definitions. I’m putting on my legal hat now. Definitions are important. Ubiquitous is an important word and the definition of ubiquitous is important. In this context and probably in this audience, most people think that ubiquitous means everywhere. That certainly is one meaning of ubiquitous. Another meaning is wide spread. That is a better meaning in this context. This organism is found in many fresh waters. It is not found in all fresh waters or at all times.

Going back to the 1980 outbreaks, the water looked very clean and I reflected on the statement that was made by George Malison of the CDC in 1978 when this problem was first identified. The statement was, “A clean cooling tower is a safe cooling tower.” That isn’t necessarily true. The tower water was certainly clean from a clarity standpoint. I would like to point out that in our later study of the 160 cooling towers we found a greater percentage of recovery in the clean towers, meaning at low turbidity, than in the dirty.
cooling towers, meaning towers with a lot of materials in them. It is probably a lack of competition. That is my theory.

Certainly *Legionella* is also recovered from dirty cooling towers. I was once accused of saying that we shouldn’t treat cooling towers. That is totally incorrect. As a public works engineer, I feel that all cooling towers should be treated and all cooling towers should be properly maintained to preserve the mechanical integrity and efficiency of the devices. That should be the primary goal of treating cooling towers. A secondary goal should be that *Legionella* is also controlled to non-detectable levels. Notice I did not say eradicated. We will probably never get to that stage but we certainly need to control it and I think that it is possible with testing.

That was the end of the medical school’s cooling tower. The local health officer, a carpet salesman in his previous occupation, issued a health order removing the tower as the equivalent of a pest house. It was replaced with an air-cooled unit. I believe it was a poor choice but it is a threat facing this industry. There is more and more use of air-cooled units, which I think, is a mistake. Cooling towers have an efficiency that is much better than air-cooled units. There are a lot of advantages to them. The problem of Legionnaires’ Disease must be recognized to avoid this type of drastic solution.

Another factor that I would like to touch on briefly is location. For instance, there was a situation where cooling towers were placed close to the air intake of a library. Cases of Legionnaires’ Disease developed, and it was theorized that the organisms came from the cooling towers into the library through the air intake. The architect for this project originally had the tower placed on top of the building. The college president thought that looked ugly and wanted it put somewhere else, so it was put in a pit. Location is important, and it shows the complexity of determining liability after the fact if something occurs. There can be so many intermediate and unattended steps.

Another factor is investigations. In the early 1990’s there was an outbreak at the Westwood Horizon Nursing Home. I became involved well after the fact. The problem was thought to be an evaporative condenser in a below grade pit with an air intake further up coming into the unit. Our investigation found there were also some evaporative coolers on a roof closer to the air intake that were obviously not maintained at all. We didn’t sample them, since it was years after the case but we were the first to introduce that the original investigation may have been flawed. This actually helped our client who was the firm that sold an evaporative condenser in 1987 that replaced the original unit that was installed in 1972. We were able to convince the plaintiff’s attorneys that it was possible that the original investigation was flawed and they dropped this one particular from the case. You need to look at studies carefully and if unfortunately you are involved in litigation you want to make sure you start from ground zero and look at all aspects of the surrounding environment.

Another case was a cooling tower I was involved with last fall. It was located at a Midwest metals finishing plant. There was a worker inside the plant who developed Legionnaires’ Disease. We found that the unit tested positive and the airflow was into the unit. It was a brand new tower – only 3 years old, under contract with a water treatment company, and it was thought to be well treated. It was clean inside, at least clean to appearances. The contractor did perform routine standard microbiological tests with a dip stick, commonly used in the industry. There was no correlation between those results and *Legionella* results. We determined that years ago in our study of over 160
towers. I would recommend that you review this study because it does show a lot of the conventional wisdom is not correct. The other factor was the placement of the cooling tower. We found that many times the exhaust from this tower was going directly into a doorway that was left open. *Legionella* is not necessarily found only in old towers that are poorly operated and maintained. There are a lot of different factors that must be considered. This is a potential problem but one that I think can be controlled.

I am a fan of testing. I feel testing is very important. I think that it has to be the specific testing. Janet talked about many of these aspects and I certainly agree with her. You’ve got to make sure you have the proper test that is done by a reliable laboratory and that the results are properly interpreted.

Finally, I think that this field is certainly going to be faced with all kinds of legal issues. One is regulatory, I’ve mentioned OSHA’s interest, but there is certainly growing interest by the EPA in this area. There is a publication called the “Wisconsin Guidelines”, which is often referenced. If you are not familiar with that document you should become aware of the guidelines contained in it. Some local governments have actually taken some control on the monitoring of cooling towers. The greater interest today is certainly in the common law actions. One thing that is very poorly utilized as far as a method of risk control is contracts. I found this to be an industry, especially on the treatment side, which has few if any contract basis. Generally, users have purchase orders or informal agreements with their water treatment supplier. In the majority of outbreaks that I have been involved with no one really had any clear delineation of who was suppose to do what. That is a problem that should be overcome. I recommend to my clients from the corporate structure turnkey projects where they have an outside entity to do all of the work and it would be very clearly defined as to who does what and separate monitoring for control.

This concludes my comments. If you have further questions I’m available at Lindenwitheral@ehslaw.com.

**Barry Fields:** I’m going to present to you some of our policies. I will do that by describing how we go about an epidemic investigation. CDC is an institution of your federal government. We are in the Department of Health and Human Services and represent the Public Health Service. That gives us a somewhat unique perspective in this area. Our concerns are primarily protection of the public health. Although we sympathize with some of the other issues that are represented here, our charge is to protect the public health and increase the quality of health. Reducing the number of Legionnaires’ Disease cases is our primary focus. In doing this CDC adopts the attitude of being a hard science institution. That means that most of the policies or recommendations generated by CDC are faced strictly upon scientific data. We don’t make recommendations based on opinion and are not a particular fan of any procedure. All of our policies are based on fact. For that reason on a number of issues such as minimal concentrations or infectious dose of *Legionella* we have no policy. Also, on the practice of testing water for the presence of *Legionella* organisms, we have no data or studies that show that testing of water reduces the number of cases of Legionnaires’ Disease. It may protect you in one sense or another entering a legal situation but for CDC we don’t know that this procedure will result in a reduction of cases. That is our primary concern. That may give you some of the perspective on how we generate statements.
One of the things that CDC does is to approach outbreaks through two components and that is epidemiology and laboratory testing. Actually, for this group I think you hear more about laboratory testing than I think you do about epidemiology so I would like to present you with a little bit of information on how we do an epidemic investigation, what the epidemiology is and how you can benefit from this.

The following are the components of an epidemic investigation:

1. Case identification
2. Descriptive Epidemiology describes cases in context of where they were and what they were doing at a particular time.
3. Analytic Epidemiology is mathematical calculations, using statistical analysis of the patients that were infected and comparing them with controls (persons who were healthy in the same area but did not get the disease). The Descriptive Epidemiology and the Analytic Epidemiology are then used to focus the environmental investigation. The information on the behavior on the persons who got sick then can direct you to a particular source or reservoir for the organism. We don’t just focus on where that person worked or the nearest cooling tower. There are varieties of exposures that a case encounters during the two to ten day incubation period. Any of those water sources could be the source of the infection. It is important to get information on behavior to target you to the right areas.
4. The environmental investigation can then detect the organism in the environment. It is critical that this isolate, or the organism that is found be matched up through laboratory techniques to the clinical isolate and that obtained from the patient, to show that yes this is the same strain of _Legionella_ that caused the disease in this person or group of people.
5. The control measures are then focused on the findings of all of these components of the outbreak investigation.

I want to quickly run through one outbreak that happened just a couple of years ago. I’ll first start with the case identification and descriptive epidemiology. This outbreak occurred in a community hospital in Pennsylvania. There were 25 cases of pneumonia within 72 hours, a significant increase over the normal pneumonia rate. The following day CDC and Pennsylvania Public Health Department arrived on the scene. The next day we were able to diagnose Legionnaires’ Disease in five patients using the Urine Test. On the following day it was determined that these persons all contracted the disease while they were in the hospital, allowing us to focus on the hospital as the source of the problem. We began an environmental sampling of the hospital on that same day and preliminary decontamination procedures were initiated immediately following the environmental sampling.

The next component was to do the analytical epidemiology by collecting information on all the cases and comparing the data to a control group. This is done with a questionnaire. The types of questions asked include the use of domestic potable water, outdoor exposures of their home, outdoor exposures in and around the cooling towers and public fountains, time spent in specific areas within town, time spent in and around the hospital and hospital potable water source exposures. From this questionnaire the data are tabulated and we were able calculate odds ratios and particular behaviors. Those that stood out in this epidemic investigation were that entering the hospital or visiting within a thousand feet of it, entering it more than three times, spending greater than 5 hours in the hospital and finally not entering by just visiting within a thousand feet...
were all associated with an increased odds ratio listed there as the MOR. Anything over 1 increase risk you are at for acquiring the disease. Some of these had some fairly high odds ratios of risk. Based on this information we could then tell that the hospital was associated, but not only being in the hospital but also being in the general area. This tells you we are looking at something that generates a large aerosol that is covering quite a wide area. So you can start thinking about things such as cooling towers or fountains or something that would match up with the analytic epidemiology.

This can be used to focus the environmental investigation. In this case we already knew it was coming from the hospital. One of the first things we found upon in inspecting the hospital was that one of the cooling towers on the roof of the building was only a few feet away from the air intake. This raised our level of suspicion of this particular water source.

Water samples were taken back to the lab. As expressed by several of the speakers, you need a reliable lab that knows how to grow *Legionella* and has experience with it. *Legionella* is a very fastidious organism and has its own peculiarities and expertise in working with this organism is essential to isolate it from the water samples. Following that it requires some fairly sophisticated DNA fingerprinting techniques in order to match the isolate from the water to the patient. There will be a number of strains shown where you can see each patient’s isolate is matched up to the source or environmental source. Making this kind of an association at that level is essential to establish that particular reservoir containing *Legionella* was the one that caused the disease. As pointed out earlier, the organism a widespread or ubiquitous.

There are control measures when we go into this. The control measures are based on all the three components of the investigation.

We issue recommendations at the end of the outbreak investigation. We are not a regulatory agency. We do not have that authority, so we publish our recommendations. For this particular outbreak we told them to monitor the *Legionella* counts in the cooling tower water, to monitor the pneumonia cases in the hospital, to use the urine antigen test to screen for Legionnaires’ Disease in these patients. An important part of the recommendation is surveillance for the disease, not just testing the environment but also looking at whether there is any disease occurring. For the facilities with cooling towers in the area to develop guidelines for maintenance and start up procedures. That is generally our approach.

*Ian Priestnell* – As Roy said initially, I have been in the water treatment industry in varying positions for approximately 30 years. In that time I have seen *Legionella* practices in 50-55 countries and they differ vastly from one to another. That, for a water treatment company, brought all sorts of difficulties in terms of standard procedures applied across all the countries in the world.

The bulk of my experience with Legionnaires was in the United Kingdom. At the time I was the Chief Executive of Dearborn in the UK and in the middle to late ‘80’s there were a number of pretty significant outbreaks of Legionnaires’ Disease. The highest profile one was the British Broadcasting Corporation. You could only pick one institution to have an outbreak which would have been worse and that would have been Buckingham Palace. We saw reference to a scare of an outbreak in Buckingham Palace.
One of the things I would like to do is to dwell on some of the practicalities of being involved in the Legionnaires outbreak. Some of you would probably be able to associate with some of this and for some of you it may be new. When there is an outbreak that results in fatalities then the pressure on the individuals involved, whether it’s the operator of the cooling tower or the water treatment company, the pressure on those individuals is quite intense. It is extremely difficult to deal with all of the people who become involved in that situation. As a water treatment company we have an obligation to our customers to stand shoulder to shoulder with them in terms of getting to the bottom of an issue and finding out what went wrong. We also have all the regulatory authorities that want to know what is going on. Then, in our own corporation, we have the legal department; we have the regulatory department, all of whom are lining up to give you advice, when you, as the individual responsible for that company, really have other things that need to be attended to in terms of the investigation.

I remember going through something like six days during that BBC outbreak where I didn’t get one hour off the job. That was just me, as the chief executive. There were a lot of other people, my colleagues and so on, that were also working with it, our customer, and myself. Perhaps the height of that investigation in the UK of the BBC was when parliament decided to get involved. The parliamentary private committee was chaired by a Queen’s Council, which is about the highest level of prosecuting attorney you can have in the UK. They decided to get involved and interview all the companies, operators, and water treatment companies involved in the outbreak. Just to give you an example of how you can be deceived as to the intent of committees like that, it was supposed to investigate to advance knowledge so that we could all learn from the situation. The opening question to me was, “Mr. Priestnall how does it feel to be personally responsible for the deaths of 15 people.” In general, I found when an outbreak does occur the initial reaction of everybody is not to advance knowledge and science; and to understand what is going on, it is to point fingers, to find culprits and in many ways to prosecute the innocent.

One of the things that I would advise those of you responsible for operating cooling systems or water treatment companies who are involved in treating those systems, is that you need a clear line of control in the event of an outbreak. You need to know who is going to be responsible for handling the situation. The media is very adept at getting beneath the surface and talking to a dozen people in your organization, some of whom will know the facts, some of whom will not; and the end result will be a very distorted picture which only confuses the investigation as it goes forward.

The next thing I would say is that those people appointed in your own company, from the customer, and the water treatment company should be trained in how to handle that situation. I don’t mean technical knowledge of Legionnaires or water treatment or operation of a cooling system, I mean media training in terms of how to handle the barrage of questions that come from all directions. I say that not to mislead, I say that to create clarity in the investigation so that you can get to the bottom of it quicker and move forward to a position of learning, not accusation.

One of the things we did in the UK immediately following the two major outbreaks was to get the chief executives of the major water treatment companies together. They represented some 70% of the UK market at the time. Through their auspices a Code of Practice was developed, which was submitted to organizations representing cooling tower owners, manufacturers, and others associated with the construction and design of
cooling systems. We rapidly got a formal Code of Practice in place, which was broadly accepted. It has stood for twenty years. Some modification may be useful at this time, but it turns out that the basis of the code is extremely good. It required a lot of cooperation to get it done and done quickly. It is interesting that the number of Legionnaire cases in the UK has dropped off significantly since that Code of Practice was put in place.

You notice we established a Code of Practice, not legislation. Law does not mandate the steps outlined. With such a common consent Code of Practice it makes it extremely difficult for anybody operating a cooling system, by that I mean the owners and water treatment companies, not to pay attention to the code and to make sure that they are applying the practice in their own situation.

Of course the risk of not coming up with a voluntary Code of Practice is that government legislation will be enacted. The legislation inevitably becomes draconian and impractical and in my view rarely moves the situation forward. Ultimately, the Code of Practice was adopted by the Cooling Water Association of the UK, and by BACS (The British Association of Chemical Specialties). One of the elements that was included in that code of was a bi-annual sterilization (chlorination) of all systems, with appropriate certification.

In my personal opinion, I believe a semi-annual sterilization is reasonable for another reason, it focuses attention on the system. If an operator is obliged to carry out a semi-annual sterilization, it brings the operation of that cooling system back into the forefront of his mind. In most cases it encourages the operator to review the operation of his system, to review any changes in the construction of the system that have been made, and to change his practices accordingly. I believe it is good if only to bring the cooling tower back in to the focus of the mind.

Let me relate a few other lessons that I have learned during my exposures to Legionnaires outbreak in the UK and elsewhere. When some of the major outbreaks in London occurred, and later in Birmingham and Manchester, I was horrified that it took days in many cases to find the offending water system. This applies in the United States also. If there is an outbreak in a major downtown area, particularly in the southern states, where every building has a cooling tower, it is impossible to know where all the cooling towers are located. Precious days can be lost identifying the source of the infection. We all know that days can mean more fatalities. I would recommend some sort of a register of cooling systems. It doesn’t have to be by legislation, but it can be done in the same way that boilers are registered by insurance registration and classification. When there is an outbreak we would know where to go to look at the cooling tower. We know exactly where each one of them is and can short cut the investigating process.

I believe, that good water treatment is essential to the prevention of Legionnaires’ Disease. But the best water treatment in the world is not going to work if the system is improperly designed and improperly operated. It requires good cooperation between the water treatment company in terms of prescribing the program and the customer in terms of the design and operation of the cooling system. I believe an industry code of practice is better than a government imposed legislation. I believe in semi-annual sterilization for two good reasons. Finally, I believe that when there is an outbreak it is absolutely essential that all the parties involved, whether regulatory authorities, the operator of the
cooling system or the water treatment company need to truly believe that no one deliberately caused the Legionnaires outbreak. All those involved need to stand shoulder to shoulder to investigate the problem rather than distancing themselves from it and trying to imply or point at one another saying its their fault.

**Manley:** Thank you all very much. We will now move into our discussion. I will present an issue or question, directing it to one person but please jump in and answer, as you feel comfortable.

**Q:** We apparently need to bridge a gap in technical and academic understanding of Legionnaires versus framing the issue from a company's viewpoint, an employee’s viewpoint, a union’s viewpoint, or a water treatment company’s viewpoint. There are several authoritative groups in the US and around the world that has each independently developed a position or guidance document. To name a few there is CTI, OSHA, CDC, UK Guidance, Japanese Document, Singapore Document, ASHRAE and now I understand maybe EPA. So to who should a user, or anyone of our membership here look for proper guidance? Dr. Fields could you field that first?

**Fields:** That is a good point. *Legionella* is unique in that it is an environmental disease. For a lot of diseases CDC steps in and develops policies and guidelines, but this bridges gaps in that it involves environmental transmission and it is something that is really outside of medical expertise. It is going to be something that requires multiple disciplines to come together. There is no single institution that does that. So I don’t think that you are going to find a single government body or even a private or academic body that is going to develop policies or guidelines. CDC’s approach up to now has been to work through ASHRAE where we have biocide manufacturers, public health persons, and people representing cooling tower manufacturers bringing in all the expertise to develop these guidelines. We certainly think that increasing the partnerships by bringing in CTI and other groups is the way to develop a guideline that will satisfy everyone. Everybody has to be on board for it to be something for it to be adopted on a national sense.

**Manley:** Is Paul Lindahl here? I believe Paul is our liaison to ASHRAE with respect to development of the biocide efficacy issues.

**Witherall:** I would like to add to this point. Barry mentioned something that anyone else in this group has mentioned, and it is very important. This is an environmental disease. It is not transmitted person to person and doesn’t appear to come from natural aquatic sources. I far as I know in every outbreak situation the transmission has come from some device such as a cooling tower that was owned, designed, sold, operated and maintained by someone. I hate to give you shorthand for it but it’s unfortunately a litigator’s ideal disease because it is only from a mechanical device that this disease occurs and we now have the methods, which Dr. Stout mentioned of actually identifying the specific disease.

Also, to comment on what Barry has mentioned. I don’t think you are ever going to find a unified force, a unified document, a unified organization in coming out with this because there are so many different parties involved with cooling towers. We have certainly the manufacturers and the treatment people present but there are architects involved and all different kinds of groups that come into this. I believe that lines of communications need to be open from an industry standpoint. I think there has to be
some reflection on all of the different groups involved. I share Barry’s conclusion that you will probably never find a single position on this.

**Stout:** This is not what you want to hear but you are not going to be told by any organized group whether it be the CDC, CTI, ASHRAE, or others, exactly what to do. The end user, water treatment company, and the employee want to be told exactly what to do to prevent this disease from occurring. Again, maybe it is my hospital background, but I think the parallels are striking that each individual hospital now is in a position of designing their own standard, what they decide within their facility to do about *Legionella.* They use guidelines issued by these organizations as help in deciding what to do. But *Legionella* is a hot potato and nobody wants to hold it very long and so unfortunately the onus is going to be on you. We are here to give you information but your water treatment company, your cooling tower manufacturer will have to get together and decide on an approach.

**Priestnell:** I would like see a global code of practice, which could be adopted in every country of the world. It would make life a lot easier for everyone, for water treatment companies and regulatory authorities. I’ve seen how difficult it is to get one code of practice in one country never mind the 60 industrialized countries around the world. It’s not impossible but I think it’s highly unlikely. I don’t think it is difficult for an individual cooling tower operator to take the 4 or 5 most important codes of practices recommendations in a particular country or region and to develop a code of practice for their specific systems. That is the way it has to be, because as we all know every system has it’s own operating and design peculiarities. Plus, different regions even different states within the US, have different regulations determining which chemicals can be used or not used, all of which mitigates against having a standard code of practice.

**Manley:** I wonder if there is some direction that we shouldn’t go. In the UK there is a Code of Practice that was a consensus standard among the water treatment providers. I don’t believe we have such a document here. So I guess the question is, should we at least have an agreement amongst ourselves as chemical suppliers for a code of practice and maybe done in concert with users and with manufacturers of the towers themselves? If we don’t go to a global should we at least have a US Code of Practice?

**Fields:** Currently we don’t have a US Code of Practice. CDC is telling everyone that the documents that we’re drafting through ASHRAE will be the US guidelines. But certainly that is open to modification. A couple of points, one is that a lot of these documents from different countries incorporate similar text and similar approaches. One thing you will have to decide as an institution is what do you want this document to do. There are two major issues. One is reducing disease as we pointed out; the other is protecting you from litigation. How the document is written and it’s purpose, considering those two points, is a critical issue. Do you want a document that protects you from litigation if you follow this procedure you are not liable or do you want a document that reduces the amount of Legionnaires’ Disease? Ideal would be both.

**Manley:** Yes to all.

**Witherall:** Following up on that concept, for some this will be bad news. From a legal standpoint, regulations don’t provide protection. They are often used for that, saying we did what the regulations said. Most people try to use regulations as a shield, if you will,
to protect them from litigation. That is not the way it works. Regulations are meant, from a legal standpoint, to be a spear to make you do something that is required, but not necessarily to provide protection. In fact quite the reverse is true. If there is a regulation out there and you don’t follow the regulation, it will result in a legal situation called “Negligence per se,” which is not a good position to be in because the case could go directly to the jury. The other side of the coin though, is that we follow the regulations aren’t we safe. That is not the case. Regulations as you certainly know from our discussion this morning followed science by probably by at least one decade, sometimes 3 or 4 decades, they are usually out of date by the time they are issued and there are new advances at all times. You have to keep current and you have to really look on a case-by-case basis at the extent of risk. Your extent of risk of putting the evaporative condenser at a remote industrial site in the middle of a rural area is far different than if you are putting a cooling tower at a hospital complex that has a bone marrow transplant unit. But I don’t see any type of code of practice or regulations as being the “great white hope” that will solve all of the problems.

**Stout:** I actually have a question for you and maybe people in the audience. It sort of goes to this whole issue of our litigation prone society. You ask what you as a water treatment group or cooling tower group need to establish guidelines or codes of practice? It seems to me that much like hot water tank manufacturers have to post information about the dangers of hot water tanks (i.e. you can get carbon monoxide poisoning, you can get scalded, etc.) but nothing on there about keeping your tank at too low a temperature or bacterial amplification. Is there anything that you can provide an end user in the materials given to them with their warranty and maintenance agreement that says that *Legionella* is a bacteria that can amplify in these systems? You could use whatever verbiage you want to use but at least notify them or alert them to this issue at that level? Is that a crazy idea?

**Manley:** No, not crazy at all. A lot of us have individually developed as companies such a document, and the CTI a position paper, although it doesn’t give specific guidance for a given location. Maybe that is what we are talking about. You said that these are sites specific and maybe we can participate in assisting a customer and coming up with a code of practice for that site.

**Stout:** Or something that is in the documentation that goes with the equipment or goes with the chemical contract that just says that this is an issue to be concerned about. You don’t have to give them the whole position statement but maybe just alert them. There is the issue about failure to warn as a legal issue.

**Manley:** There is one important point. We are talking about the things that we can say about our program or about biocides. We have to be cautious because of the EPA restrictions on what we can put on our label and claims that we can make about biocides. They are very controlled documents. You can’t alter a dot on an “i” without going to EPA and asking permission. Now I guess EPA has a two-fold role now. One is through their control of the EPA language on the labels and the other is they are developing a separate position.

**Cummins:** Yes, EPA has had a position paper before. It is fairly old at this point but they are in the process of revising it now.
**Manley:** So EPA does have a role in what claims we can make. We have to be cautious; in fact, I think we have been overly conservative in making claims about effectiveness, the cause of our reluctance is overstepping that bound.

**Witherall:** I just want to put in one item because it is timely. The 1980 outbreaks that I mentioned at the medical center hospital, resulted in the first litigation that I am aware of with a cooling tower and water treatment company. The site on that is Brennan v. Mogul. That was a case of a university employee, Joseph Brennan bringing suit against the Mogul Corporation. He was successful and it was also successful upon appeal. At that stage in the late 1970's, there were several water treatment companies making statements, either written or the personnel were making statements in the field that their particular chemicals could control Legionella. That is not a position you want to get into unless you really have looked at that very carefully. You are absolutely correct on that Roy. You want to be careful what you say. You certainly have to be very careful on the treatment side because of the FFIRA (Federal Fungicide, Insecticide and Rodenticide Act).

**Manley:** As much as we might believe or want to say about a biocide there is that one caution.

**Witherall:** Yes, there are really two cautions. One is the common law approach of statements where you can put in disclaimers saying that although written and verbal statements are not controlling, that is not the way it works. You do not want people out there making claims that can’t be met. You certainly want to be aware of FFIRA. It is a regulators dream. There are so many potential booby traps. Very serious!

**Bob Burger, Burger Cooling Tower Company:** Yesterday, Jim Willa and I were discussing Legionella in cooling towers. Jim with 50 years experience is the oldest active member, I’m probably second with 45 years. Neither one of us know of anybody in the industry getting Legionella from cooling towers. Could I ask the audience does anybody know of anybody in this industry in all of their years of experience that they visited in the hospital that got Legionella from a cooling tower? One. Well, you are shooting me down because a couple of years ago the New York Times had an article in January that stated Legionella was discovered in a Macy’s cooling tower and withheld the information until January because they didn’t want to ruin the December shopping season. The whole month of November eight hands and myself were working in those towers one at a time, sandblasting, epoxy lining, refurbishing, one at a time while the others were working. Nothing ever happen to us. Even though people here know of people having Legionella, I think the cooling towers are being maligned and is it possible that this Legionella in cooling towers is a cottage industry aided and abated, fellow taxpayers, by the CDC, OSHA and the people servicing them. It seems like a very rare occasion to get Legionella from cooling towers.

**Jim Willa, Willa, Inc.:** I pretty much agree with Bob but he is speaking for him not for me. I do know one or two people like Jim Cuchens who has had Legionella. The only thing that I would like to add to the whole thing is, and Janet Stout and I discussed it before she came up, that I can condense the entire code and procedure into "carry two parts chlorine residual and forget it".

**Stout:** There is an awful lot in that commentary and we could spend the rest of the day on that. There are a couple of things I would like to say. First, you are right. However,
in some ways the cooling tower industry might be maligned. One of the things I try to bring out is the cooling tower industry is not the only one affected by this disease. What happens to cooling towers is they are associated with outbreaks of Legionnaires’ Disease. Multiple cases in short periods of times. That does garner a lot of media attention. You have to realize the vast majority of cases of Legionnaires’ Disease that are reported to the CDC are sporadic, they are not part of an outbreak and they might be associated with cooling towers and might not. In some ways their diagnosis is by chance. There might be 20% of the people in this room that have had pneumonia or an upper respiratory tract infection. They were not diagnosed with Legionnaires’ Disease but do we know that they didn’t have Legionnaires’ Disease? No we don’t, because in all likelihood they were never tested for that organism. So it is a multiple factorial issue and I think that you have to accept that your systems have Legionella in them, some not all. As a public health concern you have to deal with it.

**Witherall:** One thing I think that is important to keep in mind is you are going to be seeing more about Legionnaires’ Disease rather than less. The CDC issued guidelines on following up on pneumonia and is advocating more testing to actually identify what is causing this specific pneumonia. As Janet pointed out, most pneumonia is from an unknown origin. You come in and the doctor finds the blockage in the lung and they may or may not have the index of suspicion to go forward and test for *Legionella*. Because of the emphasis by CDC and others to do more diagnosis of what is causing the specific pneumonia coupled with more available and lower cost testing for Legionnaires’ Disease, I think you will see more cases being reported in the future rather than less.

**Fields:** I don’t know if we are going to see more cases. I know that CDC doesn’t get any profit off of Legionnaires’ Disease since it is part of the federal government. I don’t think we are any part of a cottage industry. There are 15,000 cases estimated annually in the US and as both comments indicated, we are probably under-diagnosing. The diagnostic tests are not very good for identifying *Legionella*. We don’t have any idea what the actual number might be. It might be just a few more cases. We do know that some are being missed. When you have a disease that is responsible for 15,000 cases a year CDC is going to investigate that and trace it to the sources and some of those sources happen to be cooling towers. There is no specific malicious intent there to target an industry and generate problems for them.

**Ken Mortensen, Marley Cooling Tower Company:** I wanted to comment on the question about the inserting of warnings into manuals, etc. Most of, if not all of the cooling tower manufacturers have such warnings in their documents, which have been essentially defined in terms of some specific language across the industry. The problem is what do you tell people. As Dr. Stout has said there isn’t necessarily one specific treatment that you can prescribe that says this is going to take care of your problem. Those generalized type warnings exist. I know from personal experience it doesn’t necessarily protect you from the legal problems that may come if something happens in a particular job circumstance. As you know from the ASHRAE studies, it is not going to get any clearer in the near future as to exactly what regimens to prescribe based on the latest study. You may want to comment on whether there is further studies planned in the ASHRAE Documents to define treating regimens that can prescribe with some certainty in terms of treating.
**Fields:** Currently we are funding studies, I’m chair of the project monitoring committee, where a model cooling tower was set up. It has a natural biofilm containing *Legionella* multiplying in a natural condition and is be used to evaluate biocides. The first summary of those studies hopefully will be published in the ASHRAE Journal June, 1999. If not, it will be sometimes within the following six months. It has been funded for a second year to look at combinations of biocides and typical regimens incorporating anticorrosives and surfactants. So there are some studies looking at different biocides and their applications.

**Manley:** Since *Legionella* has high visibility, sort of like the rare but very visible plane crash, it has a public stigma that generates an unreasonable fear among employees. Given that, is it a desirable goal to increase public and medical community’s awareness of proper treatment? Do they even know what to use? Should it be a goal to increase public awareness, medical community awareness of *Legionella*, including the treatment? Or would such a campaign create unnecessary hysteria given that more people die from colds and flu than from *Legionella*?

**Stout:** This sort of speaks to the part of my comments about public panic. My bias is toward providing information, not restricting information and let chips fall where they may in the interest of giving people information that they need to make informed decisions. For example, we know now that some people in rare cases can acquire Legionnaires’ Disease from home or residential water systems, or the water systems of apartment buildings or nursing homes. One possible simple solution is raising hot water temperature because others and we have found there is less likely to be positive when the temperature is higher. In my mind it would be good information. Say I’m 70 plus and I have chronic lung disease and on steroids. I would like to know that there is a potential for a pathogen to be in my water system and the simple thing I could do is to raise the hot water temperature to 140°F or so, knowing that my water is hot and theoretically I won’t scald myself. In my mind and this is my opinion, I don’t represent the views of the VA Medical Center or your government, but I think there is some validity and it is a virtuous goal to give more information to the community about *Legionella*. Public health officials, medical people are less inclined to do that because they are worried about the hysteria and who is going to answer the phone when 20,000 people call. The education of the medical community is well underway. The organizations that establish guidelines for treatment of respiratory illness, American Thoracic Society, Infectious Disease Society of American have issued guidelines that include anti-legionella therapy as sort of the first guess therapy or empiric therapy for respiratory infections in the community. They are moving in that direction.

**Manley:** Let me just mention this very quickly. In a flyer that came with my electric bill it says, “Danger, make sure you don’t keep the water temperature any higher than 130°F.”

**Stout:** Yes, there are conflicting issues. With certain people like children or mentally compromised persons, water very hot can pose a risk for scalding, but there is also the flip side that keeping your water temperature too low might promote *Legionella* amplification and unfortunately that is not discussed anywhere.

**Jack Bland, ChemTreat, Inc.** I would just like to say that I believe that the Cooling Tower Institute is certainly an organization that is really out front and up to date on the issue of *Legionella*. This is our third symposium in as many years. My question is from a liability standpoint is what more could the Cooling Tower Institute do compared to the
papers and position statements that we have out there. Our customers for the most part are informed. They don't enter cooling towers with operators without first going through some type of sterilization procedure. As Jim Willa said most of the largest systems are treated continuously with free halogens residuals. We have not set specific limits for, or recommended specific products. As you said once you start putting numbers on that you run into a dangerous area. Other than the position statements and informing our customers as to potential risk, that's what we as an organization are to do is to educate our customers on what we know to be best available practices to prevent Legionella. As Ian said, even to the point where most customers do have some type of protocol on a regular basis that they follow whether it is needed or not, just to try to stay abreast of state of the art and best available practices. What more can we do, from a liability standpoint that we have not done as an organization?

**Priestnell:** It is obvious in some of the written question that came in that there is a level of confusion, whether we like it or not, caused by various recommendations and codes of practices that are in the marketplace. I don’t think any of us want to see the confusion continue. It would help everyone in the room if the confusion could be eliminated. You say, “what more could CTI do?” I think CTI could probably be the catalyst for coming up with a universally accepted code of practice which doesn’t have to be cast in stone. Any code of practice has to be reviewed periodically in the light of new information and new evidence. I think CTI could be the catalyst and take the initiative to do that.

**Cummins:** I would like to add a comment here. I agree with comment about a code of practice and I would strongly suggest that that code of practice recommend or require that sampling be done to determine the efficacy. I think that is basically what ASHRAE has said. To demonstrate the effectiveness of the maintenance procedure or whatever you really need to sample. I guess it is like something people don’t want to talk about in the room, but if you look at some of the data from Australia, the good news is a very low percent of cooling towers have high levels of Legionella. I think that demonstrates, and I don’t know where they are going, less than 5% of the cooling towers, we’re talking about large numbers of samples, I know there are less than a thousand colony forming units per milliliter. The good news is that if you are following these good codes of practice there is a high degree of certainty when you sample that you are going to find that your numbers are reasonably low, well below that thousand. I bet that data is several years out of date now. It’s the fear of the unknown I sense and understand. But my belief is looking at this data is that if you follow good practice you can manage this problem and reduce the numbers. If your head is in the sand because you are afraid to look at it because you feel you can’t control this organism, I think the numbers prove you wrong. All you have to do is go out and sample and show that these things do work.

**Dave Veil, Air Products and Chemicals, Inc.:** Everything I have heard today is talking about outbreaks that have been caused by bacteria leaving a cooling tower, being entrained into either a manufacturing facility or a hospital air intake. The question I get from our maintenance people, our owner/operators, people that provide consulting to the actual person operating the tower is, what about the workers that go inside the tower for cooling tower inspections or go in to perform maintenance where they are crawling inside? What specific guidelines are available for us to review to form this Code of Practices?

**Cummins:** Are you asking specific guidelines to protect workers who maintain the systems? We probably address it in some aspects in our documents. I frankly would
recommend, not knowing the condition of a tower, that they wear a respirator. The N95 series is easy to breath through and is the one OSHA accepts for TB in healthcare facilities. That is probably an adequate protective device to prevent inhalation and overwhelmingly that is the risk. I think that is certainly a good idea to do that.

Witherell: I would like to follow up on what Kevin said. All of you who are in this industry should have a copy of the Chapter 7 that Kevin has mentioned. If you are in this field and you have people out there working on this, they are not regulations but you should be aware of it and you should have copies of this. OSHA has made it very easy to get. They will certainly mail it to you but also you can download it from the Internet. I have done this and keep it current. If you are in this and don’t have that it is the first step to take some control on limiting liability.

Fields: You often hear, “I think this is a good way to go”, but again I have to stress the point that there are no studies to support that any of these practices reduce the number of cases. As you have heard, there is no protection from litigation, even if you have a code of practice and adhere to that you are not protected. We need to focus on what reduces the number of cases and the information isn’t there. You don’t know that if you test, if you do this biocide or that one, it will do any good. The real impact that you are looking for if you take the high moral ground is have we reduced the disease. That’s what we are after. Those studies are not being done. CDC has allocated $500,000 this year to investigate Legionella, but is not a sufficient amount to do a good job. For example if water samples are tested for the presence of Legionella and we could eliminate the bacteria when high counts are found, does that prevent any cases at all? The bottom line is that nobody knows. These studies need to be done. This group, CTI, can be a lobbying body to push for those kinds of studies that will give you guidelines that mean something. But right now you get a lot of opinions.

Witherell: I agree with Barry to some extent but I think that he is coming at it from the standpoint of an investigator who rightfully wants to do more investigations, would like to do more studies, etc. Hopefully someday this will be black and white, and we won’t have meetings to discuss this issue. I don’t think it is going to happen for a long time. I think Barry is right in asking for support for further studies but I think that I would echo what Dr. Stout and what Kevin have mentioned, more testing! One can establish all types of programs, follow all kinds of guidelines; and whether in the final analysis you have controlled Legionella to below detectable levels can only be determined if you actually do testing. Frequency of testing is another issue and it is site specific but I do think we have to get beyond the hurdle of not knowing if testing would be effective and therefore it is not recommended. This is probably correct from a scientific standpoint but from a practical standpoint and a legal standpoint testing does provide a lot. Of course it has to be good testing, you have to know the laboratory, etc.

Veil: Just a comment, I have reviewed the OSHA information available on the Internet with our corporate lawyers, and it was not clear enough that we could come out with a black and white policy. It is still an issue for our company and I’m sure for a lot of other operating companies.

Torry Tvedt, Puckorius & Associates: I have several comments. First, I would just like to ask, if technology is permitted in this discussion. What is the relationship in the environment between the Legionella bacteria and the Protozoa? Is the presence of
protozoa a necessary component of the biota or do you find *Legionella* viable in sufficiently large numbers without *Protozoa* being present?

**Manley:** Before we answer that, since we are running short of time that was actually on our agenda to talk about the relationship of other organisms and LDB. If we could address the relationship between *Protozoa* and LDB and perhaps even the testing of that.

**Fields:** *Legionella* are classified as an facultative intercellular parasites and they do multiply in *Protozoa*. There is only one place they have been shown to grow outside of a protozoan cell and that is in the laboratory. So, yes it is required. There is no evidence that *Legionella* have ever grown in any environment without a protozoan host.

**Tvedt:** The other comment I would like to make is with the recommendation for testing. If you really look at the testing at a high level as recommended it becomes rather a formidable problem. Just looking at some simple numbers I could see that the test load for the very few qualified laboratories would exceed more than a billion samples a year, probably several billion with the associated cost. That is not really doable in today’s world. What this would speak to would be the development of comparable field level testing that would not require a graduate microbiologist that could be done in large numbers at a much lower cost where there is a magnitude level. Is such a test being developed?

**Stout:** The company that does the urine antigen testing for us has a rapid test for *Legionella* urine antigen that appears to be very good. If it was that good in the field, I have told them that the Cooling Tower Institute is desperate for just that kind of test. They are very interested in trying to find out if they can develop a better test for field application. Currently it doesn’t exist. I think the other point that you make is well taken in that not only are standards lacking in terms of cooling tower industry and water treatment industry it is also lacking in the laboratory industry. There are no standards in a hospital laboratory, doing clinical samples, or environmental testing that laboratories have to follow in order to give you a good result. So you are right in that there are only a handful that really have testing experience. The number of laboratories that provide reliable results needs to increase. The only way that can happen is if we have some way to make sure they using a proper testing procedure. The onus is on our microbiology group to bring the level of service up to a standard that we find acceptable. So your points are very well taken.

**Cummins:** You are right, it would be a big job. I also believe if that is done, in five years we will probably do less testing. My guess is that we will have learned a great deal in the process of testing and using different means of controlling the problem that the need to sample will decrease. It will be pretty clear that “this” works. Maybe I’m an optimist but it really seems to me that it would be the case.

**Manley:** We have inquired many of customers about doing field studies using different combinations of biocides, different programs, etc. to see does it work in the field as well as in the laboratory, of course looking for efficacy. The universal response was, “Not in my company you’re not.”

**Tony Dallmier, Nalco Chemical Company:** I want to thank the panel for a very interesting discussion. So far as sampling, I wonder what does that really tell us as the
gentleman from the CDC just related? All of the *Legionella* bacteria, which should be present in a cooling, water system or present within *Protozoa* or within biofilms. So if you were to pull a bulk water sample are you really getting an accurate sampling of Legionella in your cooling tower system? There have been some papers presented that imply that over 99% of the *Legionella* present in a cooling system are contained within protozoa and within biofilms. I caution against just using bulk water counts as an indicator of *Legionella* infestation.

Another point is that a lot of the biocides which are registered during the FFIRA were tested on planktonic microorganisms and as was related this morning, is that the biocides are much more effective against planktonic microorganisms than bacteria which are contained within biofilms or within *Protozoa*. In fact 2 to 1,000 times more biocide on active ingredient basis is required to kill bacteria contained intercellularly. That is also important to keep in mind as far as the whole treatment program. Throwing more biocide at the problem is not going to get you there. You need to get the deposits out of the system, you need to remove the sludge from the basins and take whole system approach. As far as what the Cooling Tower Institute recommended a few years ago, the statement is simple but really hits home as far as the root cause of the problem. Clean out the system and keep it clean.

*Witherell:* I think you are absolutely correct on the biofilm issue and that is an area that is probably the most important in this. This is the first time that it has really been mentioned and a lot of very good work is being done on that by the biofilm research group at the University of Montana. Your statements are important and I think that this group should be looking into the whole issue of biofilm because I think that is where the control needs to go.

*Stout:* Actually I’m really not in a position to address this particular issue. But my guess is that in any of these outbreak investigations, when they have gone in and identified a particular tower as a source and have taken a bulk water sample, generally they find *Legionella* in that bulk water system. Granted there maybe more *Legionella* in the biofilm but because of the mechanism of transmission which is presumably aerosolization of that bulk water into the air that having an appreciable numbers of *Legionella* in that bulk water is not a good thing. Even though there maybe better ways of doing sampling to find out where *Legionella* might reside we can expect that it is in the biofilm and in the *Protozoa*. But if the conditions within that tower allow for large numbers of *Legionella* to be amplified within the bulk water, then knowing that you have 2,000 or 3,000 colonies forming units of *Legionella* in that bulk water per milliliter is good information. Case in point, in one investigation that I was involved in we sampled a number of towers in one small area and there was only one that had greater than 3,000 colony-forming units per milliliter of *Legionella*. Now if they had known that they would have been able to modify their treatment for that unit. In fact they were using a biocide that I know now is not particularly good against *Legionella*. If they had known that information, it’s like feedback it would have given them information. From an academic point of view you are right, *Legionella* is in *Protozoa*, *Legionella* is in biofilm but it doesn’t mean that taking a bulk water sample can’t give you useful information.

*Fields:* If tests are negative you can do periodic slug dosing in a tower and you are right you kill off the planktonic phase and the biofilm hanging in there. When we go and do an intervention in an outbreak investigation just blasting away with free chlorine will almost always reduce the platonic down to zero but in two weeks time they inevitably recolonize
and the working theory is that they begin breaking off from the biofilm again until there is a substantial number in the flowing of the water. Although detecting them can lead to important information like that, missing them doesn’t mean that in a few days time they are not going to be there. So it can be a false sense of comfort that I’ve looked at my water and I didn’t find any. If you happen to sample it the day after you slugged it with chlorine that’s probably not going to be the way it is before it gets the next dose.

Witherell: – There is another phenomena that you really need to be aware of. I have known instances where people treated towers with microbiocides that are also surfactants slugged dosed. For example with gluteraldehyde the counts go up. The reason is biofilm has been loosened and there are more bacteria in the water. There is a lot more to this than just simple answers. It was quite surprising when something as effective as gluteraldehyde did that but once we thought about it we realized what was happening and now recommend if it is used as a slug feed they also feed chlorine. I don’t want to go off on the intricacies of treatment that is just an example of unforeseen consequences that can arise.

Manley: I regret that our time is running out and there are several other topics that I wanted to discuss so Doug you have the honor of the last comment.

Doug McIlwain, Union Carbide: I just wanted to ask about the testing of biocides against Protozoa. I hear you talking about testing of various biocides against Legionella and in most cases a lot of biocides are good against Legionella but not a whole lot are good against a Protozoa. Is that going to be incorporated as the next step for CDC or ASHRAE or academics to start looking at biocide efficacy against the Protozoa?

Fields: Yes it is. In the study that ASHRAE is funding now, we mandated that it have a natural biofilm that was put together in the laboratory. It has Legionella in it, we have looked at it, it has Protozoa, and the Legionella is multiplying in the Protozoa. They have been stable in this thing for over a year now. This study is looking at both Legionella multiplying in the presence of Protozoa and is looking at biofilms. Coupons coated with biofilm are part of this study. The other point to that is that Protozoa are more difficult to kill than Legionella. They can encyst where they form a spore like heavy walled structure to survive bad times. Eradicating or attacking Protozoa is probably a tougher job than getting rid of Legionella. But the studies that are being sponsored now, at least the ASHRAE studies are looking at Legionella that are growing under those conditions, so if anything works it will account for the Protozoa.

Manley: In closing panelists, the membership of the CTI and the attendees here and my team of John, Delisa and Helen offer you our sincere appreciation for your presentations. It brings home the old saying that the more you know about a subject the more you know that you don’t know. In spite of that we realize that we have to press on to develop our ability to advise customers and our own staff with information. Again on behalf of the Water Treatment Committee – thank you.