Indoor Air Quality and Ventilation Systems

June 25, 2002

Operator: Good afternoon, ladies and gentlemen, and welcome to the Health Care Health and Safety Association indoor air quality and ventilation systems conference call. I would now like to turn the meeting over to Ms. Sandra Wilson. Please go ahead, Ms. Wilson.

Sandra Wilson: Thank you, Maxine. Good afternoon. My name is Sandra Wilson. I'm a consultant with the Health Care Health and Safety Association in the London region. On behalf of the Health Care Health and Safety Association, I would like to welcome all participants. Today our presentation is indoor air quality and ventilation systems. Following the presentation, we invite you to stay on the line for a question-and-answer period. Before introducing our speaker, I have a few reminders for the audience. Please eliminate all background noise or discussion during your call since this will affect the audio quality. Please come to the microphone if you are conferencing in a large room, please turn off all pagers and cell phones now, and finally, if your building has a PA system, please request that it be turned down or off if possible. It's time to get started, so let's proceed.

Our speaker today is Dr. Stephen Kwok. Steve graduated from Queens University in Chemical Engineering in 1972. He is certified by the American Board of Industrial Hygiene in Comprehensive Practices as a Certified Industrial Hygienist. He has been employed since 1977 by the Ontario Ministry of Labor as an Occupational Hygiene Consultant and in the past 10 years as a District Manager overseeing a staff of 30 in the enforcement of the Employment Standards Act and the Occupational Health and Safety Act. Steve also lectures at Mohawk College on occupational hygiene, air sampling and analysis. And to add a personal note, Steve tells me he's interested in downhill skiing, dragon boat racing and he is also a swim coach. Steve is an excellent speaker and an expert on indoor air quality. We are very pleased that he can be with us today. Welcome, Steve.

Stephen Kwok: Thank you very much. Hi, everyone. Okay, indoor air quality. So how would I know, Sandra, if people have questions?

Sandra Wilson: Steve, at the very end we have a question-and-answer period.

Stephen Kwok: All right. Let me start by... I assume everyone has a set of my printout here. Let's start by saying that indoor air quality starts to be a problem in the industrialized countries at the beginning of the seventies when the energy shortage — or that's what we've been led to know — the energy shortage, so in response to the requirement for energy saving everybody starts to weld their windows shut and trying to construct tight buildings, and from that therefore we have one of those variation of names called "tight building syndrome", TBS, or "sick building syndrome", SBS, which is largely related to indoor air quality problems and that leads us into this particular topic.

Let's talk about the typical symptoms of sick building syndrome due to poor indoor air quality. The problem with that is all the symptoms are kind of generic symptoms. It's not like having a cold whereby you have a fever, you're sneezing, runny nose - those are typical symptoms of a cold. The typical symptoms of sick building syndrome due to poor air quality are those very undefined symptoms such as tiredness, headaches, sometimes runny nose, sometimes not, dizziness, scratchy throat, watery eyes, lethargy, nausea, inability to concentrate and sometimes even respiratory infections.

The funny thing about the discomfort or the sickness due to poor indoor air quality is that it tends to happen at certain times of the year. So for instance during the change of the seasons when we first crank up the ventilation system, the air conditioning system at the beginning of the Summer or the end of Spring, or at the closure of the heating season when ventilation patterns that we have been so used to are changed. That's what sometimes triggers this poor indoor air quality complaint. I'm just wondering whether my tone of voice, talking like this, is fine? Okay.

So therefore we cannot really use those symptoms to pinpoint, to relate it directly to indoor air quality problems and that's why it makes such a tricky job for investigators of poor indoor air quality. Some points worthy of notice is the worst time for the complaints to occur is usually after lunch which unfortunately is also related to the tiredness after a meal. At that time the blood rushes to the tummy to help in the digestion, resulting in a slight dizziness or tiredness or natural fatigue which is associated with us having a meal. But from that it can also lead to poor indoor air quality and it is about after lunch, at that point, that the accumulation of a trace amount of contaminants tends to become a little bit more. Okay.

The specific causes are usually not well defined. Based on our experience of investigating poor indoor air quality complaints over the past 10/15 years, we can generally point our fingers to several known contaminants which are respirable particulates. This is the really fine, fine sub-micron particulates that tend to hang in the air for a long, long period of time and they simply do not settle. Secondhand tobacco smoke - luckily, and it's nice to see that this is becoming lesser and lesser of a problem because nowadays tobacco smoking is more of a taboo than a socially acceptable activity. So this tobacco smoke problem or related problem is diminishing. Asbestos fibers, it's really just included in there just to complete the list because asbestos fibers itself, or themselves, do not directly cause the complaint of poor indoor air quality, but it is still there, it is still a contaminant that is not to be neglected.

Allergens, this is highly seasonal, for instance like today with the smog alert. This can trigger a lot of complaints or an increased number of complaints in an office environment due to increased amounts of airborne contaminants in the environment. Apart from the smog alert, we also in the Springtime, especially in this country here, we have an increased amount of pollen, tree pollen, flower pollen, plants getting ready for the Spring, and it is during the Springtime that there's an increase in the amount of pollens that's floating around in the air.

Throughout the year though there is an overabundance of molds that are floating in the air, particularly in the Fall, late Fall when the tree leaves are decaying

or falling down and decaying. To round up to complete the list there is also this radon (inaudible) that are being emitted naturally in the basement from the earth, however I would caution that this is really a direct cause of the poor indoor air quality.

So what are the substances that are causing this poor indoor air quality? We have done exhaustive — we, and I'm talking about the Ontario Ministry of Labor and we are charged with the responsibility of addressing complaints from workplace parties. So we are right, front and center in dealing with these kind of problems. We have done exhaustive research into what is it that causes the poor indoor air quality complaints, and generally we can point, identify the following chemicals: Carbon monoxide - again, this plays a lesser role in the investigation into indoor air quality, a little bit more comments to follow. Carbon dioxide - this is a (inaudible) substance that we use for determining whether the indoor air quality is acceptable or not. Again, I'll be elaborating a lot of that particular one.

Formaldehyde and other aldehydes - this is a very common, very frequently identified substance that has led to poor indoor quality complaints. Oxides and nitrogen, this would be encountered mostly in a confined environment such as in a very small room, and we have investigated workplaces where they have fax machines, photocopiers, blueprint copiers located in a place where there's absolutely no ventilation. Upon investigation, the reason for that was that they want to cut down the noise from the machines. The net result from that is that the airborne contaminants emitting from these machines, however minute, would tend to accumulate in that particular room environment and oxides and nitrogen is one such thing. The other one is of course ozone. So the intense light that's generated from the fax machine, the photocopier would tend to oxidize the nitrogen molecules and the oxygen molecules into ozone and oxides and nitrogen which are intense mucous membrane irritants. Okay, let's come back to the carbon dioxide. Sandra, we have one hour for this whole topic?

Sandra Wilson: Yes, you have a half hour to speak and then 15 minutes for questions.

Stephen Kwok: All right. Because this indoor air quality, the notes that I have sent out is really an abridged version of a three-hour lecture notes. So I have to do some compression here. Okay, so let's zero in on the carbon dioxide. Carbon dioxide in itself is really not a huge problem in that it is the product, a natural part of human respiration. When we exhale, when we take in air, when we inhale, and then we'll make use of the oxygen and then we expel carbon dioxide into the air. So as we speak, we are all as human beings producing carbon dioxide in the air. When it gets into problems is when there is an overabundance of carbon dioxide. Okay, now I want everybody to be really careful about this carbon dioxide business.

Earlier on I mentioned that carbon dioxide is used as a surrogate to indicate the quality of indoor air. We have been doing this and using this as a surrogate indicator to pretty good success. If you are familiar with the American Conference of Governmental Industrial Hygienists, and if you were to look up the TLVTWA, which is the threshold limit values time-weighted average, you will find that the TLVTWA for carbon dioxide is 5,000 ppm. At least that's what it was when I last looked. However, we have been using the carbon dioxide as a surrogate at 1,000 ppm for indoor air quality acceptance. Based

on our experience, fresh air, which is something like air that you can find on the golf course, and probably you're not going to get any fresher natural air than air on the golf course, would typically contain about 300 to 400 ppm of carbon dioxide, okay? In a typical city corner you are going to find carbon dioxide in the range of oh, I would say between 400 to 600 ppm which you're going to find everywhere in the city.

In an office environment when you have an overcrowding situation, then you're going to get an overabundance of the product of human respiration, i.e. carbon dioxide. This level will keep on building up as the day wears on, the work day wears on. So therefore if you are purely just going to look at the carbon dioxide concentration first thing in the morning, the air quality would be the best. As occupants, building occupants come in, filter in to start the work day, and the work activities increase, the carbon dioxide level will gradually build up, and here is where the problem may occur. It would continue to build up until a point when it's about mid-afternoon - there will be enough accumulation to bring the carbon dioxide level to above 1,000 ppm. Our experience has been that when something like that happens, i.e. carbon dioxide in excess of 1,000 ppm, you are going to start getting increased incidents of complaints from the occupants.

But as I mentioned earlier, this carbon dioxide itself as a substance is not causing the health problems for occupants, okay? It is that meaning behind the increase of this level that is causing the problems, and what is that meaning? Well, we found that the increase in carbon dioxide levels in a building, in a commercial building environment, is directly due to lack of fresh air, adequate fresh air makeup. In other words, this 1,000 parts per million is used as an indicator of fresh air adequacy. If you have levels of carbon dioxide inside your office space consistently in excess of 1,000 ppm, it is time therefore to look at the HVAC system. This particular linkage is the most powerful linkage that we have from our Ministry of Labor experience, from investigating numerous, numerous number of cases.

You will recall earlier on I mentioned that due to the energy shortage we weld our windows shut. Okay. The net result of that is you cannot open the window to let fresh air in. So the only place where you can rely on air circulation and a supply of fresh air is none other than your HVAC system which stands for heating, ventilation and air conditioning system. As I mentioned before, in order to save energy and especially in the Canadian environment with the extreme weather, and on that note we have indoor air quality complaints both in the Winter, in the severe Winter, and in the Summer, and that is because of the severe temperature conditions that we have in this country. In the Summer we tend to have the air conditioning running full blast like today. In the Winter we have the heating system running at full blast. In order to save energy, to conserve energy, we do not usually have the fresh air dampers widely opened. In fact, a lot of the HVAC systems have the fresh air damper maxed out at 25%.

In a lot of the investigations that we have made, we have found that the fresh air dampers were actually closed shut tight. So the first thing that we would advise people to do is to open the fresh air damper to the maximum and, as I say, a lot of those maximums are just 25%. Recently in a number of city halls close to the GTA here, I've noticed that they have 100% fresh air makeup nowadays. So so much about energy conservation. And I guess this would be a natural development in response to complaints of

poor air quality and therefore fatigue and tiredness which then result in absenteeism or increased absenteeism.

Okay. So once again, this particular aspect of carbon dioxide being used as an indicator has no toxicological implications. If that were to be used, or that toxicological impact were to be considered, then the limit ought to be 5,000 and we have lawyers challenging us from numerous number of school boards and hospitals - why are you enforcing this rule of 1,000 ppm? Well, because of the reason that I just mentioned. Okay, so don't look for the 1,000 ppm CO2 in many of the ACGIH publications. In the Ministry of Labor-Ontario publications you will find that number being mentioned and it isn't enforceable.

Let us turn to the next group that I think... of chemicals, the substances that are of interest to us, and that is formaldehyde and other aldehydes. And I would lump the VOC into that same group as well. These contaminants are really not typically found in an office environment, okay? When you would find them is when you have new carpets laid and they would rear their ugly heads in the form of the glues, the glue cures. When it off gases, then those VOCs and formaldehydes would be given off. Another possibility is from new furniture. If you have purchased new furniture it's a good idea to recognize the fact that there will be off-gassing from this new furniture.

I guess the immediate question from my statement is then what are we going to do? Are we not going to use furniture from now on? Are we not going to replace our worn out carpet? No, we will continue to buy new furniture, at least that gets our economy going. We will continue to have new carpets laid because that is part and parcel of the good quality in the office environment. There are precautionary measures to be taken as follows: It is a good idea to first of all if you can get your supplier of the new furniture to store their furniture in a specific environment where the temperature can be cranked up and let those new furnitures be stored in that warm environment for a period of up to one week before they send it over to you. Okay?

When you have new carpets laid, you have no choice but to declare that particular area out of bounds to your normal office work activities, and at the same time if it's possible, increase the ventilation and increase the temperature as well to enhance the off-gassing of those chemicals from the glues. Oxides and nitrogen, as I mentioned before, it is a good idea to locate the office equipment not in a confined space. I know it cuts down the noise and the disruption to the office work activities, but it is devastating, it is definitely not healthy to have those office equipment in a confined space, okay? So when you're designing your office, make sure that you do pay attention to those things.

There is another very obvious source of these contaminants that needs to be complained of - IAQ, poor indoor air quality, and that is if you have a caulking done - again, the caulking compound would give off an acid fume, acid mist, or if you have new office renovations where particle boards or plywood or even drywall is used, because the sanding of the drywall will result in the emission of dust, and also from the painting activities as one of the very, very common things that we do in office renovations is to have a new coat of paint. Well, the new paint that's been applied on the wall will give off gas as well. One

particular footnote on paint - nowadays, see in the olden days we had been led to believe that the oil-based paint is the only kind of paint that there is that will resist moisture and will last longer. Well, nowadays that is no longer the case. We have water-based paints that are just as tough and as water resistant. So in your selection of paints, of course feel free to select any kind of colors which in itself would not release any chemicals, but choose water-based paints. It's much more environmentally friendly.

We will next turn our attention to the HVAC and its role in contributing to the poor indoor air quality. The traditional heating, ventilation and air conditioning system consists of several major component. One is of course the distributor that you can see in the office environment. And not far from the distributor which supplies the conditioned or the temperate air, is the return air which often shows up in the form of grills. For instance, in this room here that we're in here we can see the two air distributors there and this is the return air grill. The telltale sign that you are having some problems that are contributing to poor indoor quality is the discoloration around the grill, around the distributor. Very often in the office environment we see an increased deposition of dust particles leading to a gray or darkish coloration of those pieces or in the vicinity of those air supply units and the return air grills.

Do not wait for that to happen. You should, everyone should have an annual HVAC inspection plan, and speaking of that, there is really a specific set of guidelines for ventilation system inspection which I think I supplied to Sandra which I think everyone has a copy of. Now, you will find that it's all specified in that handout that we sent. I would like to follow, to draw your attention, your particular attention to that particular one. It's a chart there **[See "The Semi-Annual Inspection" in "MOL Ventilation Guideline" handout]**. You didn't get that chart? I'm sorry. Okay, I will promise to send you that chart. In that chart, that list that summarizes all of the things that you need to pay attention to in conducting your annual inspection and balanced annual inspection. I think there's an excerpt in here, in the handout that you already have.

Okay, let's get back to the HVAC system. The component that you see every day, as I said before, is the air distributor and the return air grill. Make sure that they are clean and they are not shut off. In the air distribution outlet there, inside there there is a local damper, supply air damper that's equipped with it. If any one of you should happen to reach inside that damper and try to move the damper to get more airflow or a lesser amount of airflow, please do not do it any longer because your HVAC system has been balanced by a qualified ventilation engineer. Okay, so all of those damper positions are set during the annual balanced inspection. If on one particular day you are having an increased amount of air supply into your office resulting in being very cold or very hot, the best thing to do is to contact your building management or property management or mechanical engineer who takes care of the system.

The next component of the HVAC system which has direct linkage to indoor air quality complaints is the ductwork, the integrity of the ductwork. Frequently the ductwork, the air which supplies the air to the air distributors, the integrity of them can be compromised during the year when there is maintenance work that needs to be done, the plumber can install an extra plumbing pipe in there and an electrician could be stringing some electrical cords there, the painters could be removing something to paint or

whatever, for whatever reason. Those ductworks are delicate pieces of equipment and can collapse on you. So during your semi-annual or your annual inspection the ductwork must be looked at very, very carefully.

At least once a year the balancing of the system should be checked. When a system is properly balanced, everybody is happy, all the occupants of a building are happy. The system can only be balanced by a qualified person who has a telemeter, who will check the supply air velocity and who will sit down and calculate and make sure that enough or sufficient air is being supplied to your workplace.

Carrying on with the different components of the HVAC system is none other than the sensors. The sensors are served with a thermocouple which senses the temperature difference. The sensors are typically located in the return air grill or not far from that point, and the reason is because it is linked to the heating function or the air conditioning function of your system. When it senses that the temperature is dropping for one reason or the other, maybe the environment has turned colder all of a sudden, then it will send a signal to the furnace to crank up the heater. In the Summer, on the other hand, for instance like today, between yesterday and today the temperature difference is quite drastic. The sensor will sense the temperature and send a signal to your air conditioner to say let's crank it up, let's crank up the air conditioner.

Now, why do I go to this length to talk about this? Because it is very important for us to realize that we may not open the windows, we may not alter those components of the HVAC system randomly. In those offices where you can, you have the luxury of opening your windows, please refrain from doing that because once you open your window, let's say you're lucky enough to occupy a window office, when your window is open it will provide a temporary relief to you and you only, okay? The net result is for instance in the Summertime when you were experiencing too much air conditioning and you're feeling very cold and it's scorching hot out there, the humidex is 40 degrees out there, it's well let me temper it, let me open just a little crack to let the warm air come in and it will mix it nicely. My temperature would then be brought up to about 25/27 degrees which is what I want. Your poor fellow workers elsewhere will be freezing to death. Why? Because that warm air that you let in will be sent by the sensor in the return air grill. The sensor will then in turn send a signal over to the air conditioning system asking it to crank up even more. So your air conditioner will remain operating more because it has received a false signal that it is hot, it is getting hot.

Well, it is not really getting hot, but only because of you who opened the window just a little crack. This is the reason and the same reasoning can be applied to the Wintertime when it's really too hot you just go and open a little crack in the window there to let the cold air in. Sensor senses the cold air, sends the signal to the furnace, the furnace kicks on more. So please do not. If everybody... there is a systemic fault in your HVAC system, then the best person to contact is none other than your HVAC engineer or some contractors who are qualified to handle the whole thing. If it's under capacity by opening the window for your own office alone, it's going to exacerbate the entire problem all together. So let's please remember that.

Getting on to the other components of the HVAC system. In this country here, as I said, we have the extremes of the weather conditions. We need the humidifier and the humidifier is often a culprit of the poor indoor air quality complaint. Why? If you live in a house and if you have a furnace that's forced air, hot air or air conditioning with a central air distribution system, you should take a look at a humidifier. And if you did not change it for the whole season, then at the end of the season you can just take a look at the humidifier, you will know how dirty it is. Now, that is only for a home environment.

For a commercial unit it is a gigantic system, okay? So in the Summertime it's dehumidifying, in the Wintertime it is humidifying. There is a chemical additive that we use in the previous days in the past. Nowadays we look at hygiene, we look at good pure air quality. The additives or the addition of these chemicals to freshen, "freshen" up your air is being exercised with great caution. In fact, personally, and I've seen people who are allergic to air fresheners, so the use of a lot of air fresheners in your humidifier or dehumidifier is not recommended. However, looking at just to humidify and/or the humidifier itself, it needs routine maintenance, okay? With the humidifier itself in the Wintertime it is supplying energy to the dry cold Winter air. One has to make sure that the filter in the humidifier is changed regularly.

Now once again, if you are the lucky one who has to maintain your home unit, you will realize how dirty the filter can get, okay? It gets 10 times dirtier in a commercial unit. It is also customary, it is recommended that in order to eliminate or discourage microbial growths in a humidifier that some chlorine be used, and there has been a percentage of chlorine that's been tossed around - I think it's between 1 to 5%, but don't quote me on that. I'm not an expert in that humidifying system. Talk to a qualified person to find out how much chlorine should be used to be added to discourage the growth of grime and slime and other microbial growth.

Apart from the humidifier/dehumidifier system, then there is the filter, the air filter which is another culprit of umpteen number of complaints that we have investigated. Once again, I would draw to your attention of your own home. If you are not in the habit of changing your air filter once every couple of months, then it may be a good idea to do so now for your own home. As for a commercial unit such as in a health care facility, a system schedule for maintenance ought to be established. What would be the frequency that I will recommend? Certainly inspection wise, I will start out with weekly, and if weekly inspection turns out to be too frequent I would do it bi-weekly and I would do it monthly. I would certainly not go less than monthly inspection of the air filter. The air filter is a small investment to make to make sure that you filter out all of those undesirable dust particulates and impurities in the air.

There has been some discussion about the use of an electrostatic precipitator to ensure that you have better fresher air. Personally I will recommend it, but with caution. The addition of an electrostatic precipitator, the incorporation of it into your HVAC system in a home environment has been proven to be quite effective. In a commercial system it requires special attention because along with the operation of the electrostatic precipitator there is a by-product called generation of the ozone and you do not want an overabundance of ozone in the air. Ozone in proper appropriate concentrations in the air

serves a useful purpose in freshening up, okay, because it's a intense oxidizer, very strong oxidizer, oxidizing agent. Unfortunately, it is also an intense irritant to the mucous membranes. So before you rush to put a budget on installing an electrostatic precipitator, I want you to really consult with an occupational hygienist to make sure it's properly done.

A record of your maintenance should be kept so that you will know when it is that you need to change certain parts such as the fan motors, such as the dampers, when it was last cleaned, and also you can then relate the inspection date to when it was last being renovated so you can track down whether there's any problems or not. Now, in the health care facilities we have also to grapple with the use of drugs or chemicals from either the laboratories or from the clinic. Those ought to receive special attention as well. They are to have special collecting devices and they ought not to be mixed in the general environment for obvious reasons.

The semi-annual inspection also needs to pay attention to a sudden addition to the ventilation system because in renovations, certain office renovations, people tend to add more air distributors or return air grills to the system therefore affecting the overall balance of the system. As well, there could be some kind person who says well, we always knew that there's a shortage of fresh air, let's bring some more fresh air into the building. Well, do not do that because the introduction of fresh air ought to take into account where the fresh air is coming from. So the semi-annual inspection ought to pay attention or ought to include in its inspection list where the fresh air makeup is coming from.

We have investigated fresh air makeups system that takes the air from the garage, the underground garage, and in fact one of the major city halls here in the GTA had that problem before which we investigated and we quickly have it rectified. The reason for it not to be desirable is really simple because a garage is a garage and in a garage environment you have emissions from the cars, the operation of the automobiles. In that kind of situation, if it's identified as the fresh air makeup system being located in the garage, you are typically going to find an increased amount of carbon monoxide. Remember at the beginning of our discussion here I said carbon monoxide is typically not a huge significant problem and that's because of that.

Nowadays we pay a lot of attention to indoor air quality and we take great pain in ensuring that our fresh air makeup sources are away from known sources of contaminants and the underground garage is one. The reason why initially, some years ago why people, why the ventilation engineers wanted to take the air from the garage is again because of energy conservation. Nowadays we pay a lot of attention to the intake, the air intake into the system, into the building, so therefore if you are charged with the responsibility of selecting where the fresh air intake is going to come from, you need to do an environmental scan of where the known sources of contaminants are and make sure that you do not locate it in close proximity of such airborne contaminants. I think we...

Sandra Wilson: Take questions?

Stephen Kwok: Yeah, I will take questions.

Sandra Wilson: Thank you, Steve. I will now ask Maxine to facilitate the question-and-answer period.

Operator: Thank you, Ms. Wilson. We will poll for questions today using our quick queue polling feature. If you have a question, please press 1 on your touch-tone telephone. If you are using a speakerphone, please lift the handset first and then press 1. And should you wish to cancel your question, please press the number sign. Please press 1 at this time if you do have a question. And our first question is from Debbie Bruney. Please go ahead, Ms. Bruney.

Pat Marquis: Yes, this is Pat Marquis from Sault Ste. Marie. You were talking about the 1,000 ppm for the carbon dioxide levels and it's not the direct cause of the SBS. Now, is this just a first indicator that other contaminants are increased and that that may be the direct cause?

Stephen Kwok: That is really linked to the fresh air adequacy. By simple extrapolation, if you have a increase in carbon dioxide because of the accumulation as a result of the increased activities in the office environment, and if such activities generate other contaminants then by direct extrapolation, you are going to expect an increase of other contaminants in the air as well. We attempted previously to quantify such chemicals and it's an exercise in futility. We couldn't detect any significant amounts, not to the point where it would cause a health problem. Does that answer your question?

Pat Marquis: I'm still a little confused as to the indirect cause of the SPS being the carbon dioxide when ACGIH levels are so much different.

Stephen Kwok: Because in the ACGIF level, which is 5,000, it is linked. If you expose a worker to 5,000 or more ppm of carbon dioxide, you will... the worker will experience certain symptoms that are related toxicologically to carbon dioxide. That's clear. Right?

Pat Marquis: Correct.

Stephen Kwok: If you expose a worker in an office environment, and I must qualify that, to carbon dioxide levels in excess of 1,000 ppm, it indicates that there is a fresh air deficiency and that is the only thing that we can interpret from these increased levels of carbon dioxide, bearing in mind that normal office air should really contain no more than between 600 to 800 ppm of carbon dioxide. If we were going to extend that argument further by saying okay, if that is the case let's decrease the amount of carbon dioxide from let's say 1,500 to 900, would the complaints stop? The answer is definitely not because it is not the level of the carbon dioxide that is causing the problem, it is the fresh air deficiency that is causing the problem. Do you see the point?

Pat Marquis: Yeah, I guess I do.

Stephen Kwok: If you need more, and this is the other thing - at the outset I said this is such a vast topic. If there are any points that I'm not successful in explaining in detail

to your satisfaction, send me an e-mail and I will spend a lot of time elaborating whatever points you may have.

Pat Marquis: Yeah, I think it's the fresh air deficiency, the definition of fresh air deficiency that I have trouble with.

Stephen Kwok: Okay.

Pat Marquis: I'm not sure.

Stephen Kwok: You're not the first one. As I say, we still have court cases with lawyers arguing that point.

Pat Marquis: Okay. Thank you.
Stephen Kwok: But if you want more, send me an e-mail and I will answer your points.

Operator: Thank you. Our next question is from Lynn Matthews. Please go ahead, Ms. Matthews.

Lynn Matthews: Yes. We just had a couple of questions about fragrances and that type of environment that causes air quality distress, and I just wanted to know do you have much research done on that?

Stephen Kwok: Not research but reactive response to such complaints. We have handled a number of complaints related to the use of fragrances. It is a tricky problem. We have established, and we have positions devoted to the investigation of such complaints and we have established a direct linkage that yes, certain people are so sensitive to certain kinds of fragrances and that would lead to complaints of being unwell. The solution to that, we invariably advise people not to wear fragrances, but we can only advise because there is no TLVTWA overexposure to the (inaudible). Now if that fails we would ask the person who is so sensitive to that particular fragrance to have a possible relocation of the work station or to get a different assignment all together. But we cannot enforce it per se because what law have they broken? It's not illegal to wear a certain fragrance. Does that answer your question?

Lynn Matthews: Yes, thank you.

Operator: Thank you. Our next question is from Cindy Pugliese. Please go ahead.

Cindy Pugliese: One of the things you had mentioned was about renovations, and now were you implying that the renovations would be... increase the formaldehyde and other aldehydes?

Stephen Kwok: If they use particle boards, if new carpets are laid, new furniture has been procured, that will for sure lead to the emission of aldehydes.

Cindy Pugliese: We are going to be undergoing some major renovations at a building, so I'm concerned about the painting and the particle board and the sanding and all those kinds of things. What is it that we should be looking at?

Stephen Kwok: Well, this is a huge topic in itself. And you being a health and safety person must be involved with every stage of the renovations including the planning stage.

Cindy Pugliese: Okay.

Stephen Kwok: Because you would have a rather intimate knowledge of the worker population, profile of the workers in your area. You would probably know if somebody is hypersensitive to certain things.

Cindy Pugliese: M-hm.

Stephen Kwok: And their allergies to things. If you don't know, then it may be a good idea to send out a survey to the workers and say look, we are going to do these renovations.

Cindy Pugliese: M-hm.

Stephen Kwok: Okay, it may result in an increased level of noise, increased level of VOCs, volatile organic chemicals, possibly carbon... I'm sorry, possibly formaldehyde and things like that. If you are allergic or have a health condition, to let you know so that special precautions can be taken.

Cindy Pugliese: Right. Okay.

Stephen Kwok: It may well be...

Cindy Pugliese: You had also raised about the carbon... the dioxide. Would not carbon dioxide indicators that, you know, people have in their homes, would that not be beneficial to be in the industrial environment?

Stephen Kwok: No, no. This particular 1,000 ppm is an indicator specifically for commercial buildings, not for an industrial environment.

Cindy Pugliese: Okay. Okay, that's my questions. Thank you.

Stephen Kwok: You're welcome.

Operator: Thank you. Once again, if anyone does have a question, please press 1 at this time. And our next question is from Mario Risolo. Please go ahead.

Catherine Wolseley: Yes, we're calling from Kingston. Catherine Wolseley. When you have a ventilation system in a closed environment and you've got a number of different offices within that environment, is there sensors in more than one location?

Stephen Kwok: The answer to the ideal situation is yes, there ought to be so that all the sensors will be integrated with a signal and with an integrated signal being sent to the furnace for the air conditioning. With a large number of different businesses or entities in the building, that share the same building, that kind of control could be disrupted in a severe imbalance of the system. So you're going to get complaints of temperature extremes, somebody complaining too hot in one area. Down the corridor somebody's complaining that we are freezing.

Catherine Wolseley: That's typically what we're experiencing, and what is the solution to that?

Stephen Kwok: The solution to that is for a ventilation engineer to be engaged who can take a look at the whole thing, the entire building, not just one occupied space that happens to be for a certain specific functional group. And this underscores my previous statement that us lay persons should not try to tamper with the damper settings, opening and closing of the windows and so on and so forth. Even renovations, everyone ought to take into consideration that you cannot just randomly go ahead and put a door, put a wall up because the ventilation system is very, very delicate. When you put a wall up indiscriminately, you are disrupting the balance of the system.

Catherine Wolseley: Yeah, I think it's very difficult to do that because in the setting I'm talking about typically there could be 10 to 15 people in one room and one or two people in all the rest of the rooms, and those sensors are going to be all giving a different story.

Stephen Kwok: Then again the person who can tackle this problem would be your ventilation engineer.

Catherine Wolseley: Okay, thank you.

Stephen Kwok: So that there is another piece of ventilation equipment that can be considered to be installed, it's called VAV, variable air volume control, VAV. That has a sensor in itself, in that system, so that when the temperature heats up, when there's an increased number of occupants in the room, it cranks up the circulation system therefore providing more air into that particular room. It's all available nowadays.

Catherine Wolseley: Is that able to be retrofitted in an older building?

Stephen Kwok: Oh, yes.

Catherine Wolseley: Okay. Thank you.

Stephen Kwok: It tends to be quite expensive though.

Catherine Wolseley: Right, right. Thank you very much.

Stephen Kwok: You're welcome.

Operator: Thank you. Once again if anyone does have a question, please press 1 at this time. And our next question is from Debbie Bruney. Please go ahead, Ms. Bruney.

Debbie Bruney: Hi, I'm sorry for busting in. I'm just wondering if Mr. Kwok would mind if he shared his e-mail address with us.

Stephen Kwok: Yes, my e-mail address is steve, S-T-E-V-E.kwok, K-W-O-K @mol.gov.on.ca.

Debbie Bruney: Thank you very much.

Stephen Kwok: Oh, you're welcome.

Operator: Thank you. Once again if anyone does have a question, please press 1 at this time. And, Ms. Wilson, we're showing no further questions at this time. I'll turn the meeting back over to you.

Sandra Wilson: Thank you, Maxine. I would like to thank Steve for taking time today out of his busy schedule to speak to us. I'm sure we all agree how informative it was. Thank you once again, Steve.

Stephen Kwok: You're welcome.

Sandra Wilson: Before we end I would like to remind you that our next teleconference will take place on November 25th, 2002, with Dr. Allison McGeer. We will be presenting the prevention and management of influenza. Please check the Safe Angle Newsletter for more details or contact the Client Services Administrative Assistant at 416-250-7444. I'll repeat that number. 416-250-7444 if you need further information. These concludes our presentation for today.