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Bed Bugs\_What are the Health Risks?

Welcome to the presentation. Bed Bugs, what are the health risks? To ask questions about this presentation, join the presenter for a chat hour in the networking lounge. I would now like to introduce our presenter, Ron Harrison, director of technical services at Orkin.

Hi folks. I enjoy this opportunity to be with you. As technical director of Orkin Pest Control, I deal with pest issues, meaning bed bugs, and cockroaches, and rodents. I have a PhD in Entomology, and a lot of my time is spent specifically with commercial customers. Bed bugs have been an interesting pest, because it's, well early in my career that we had no issues associated with them. And, then over the last ten to 15 years, it's become a major pest, and all of us are concerned of that. Today we'd like to specifically talk about the concerns, about help in reference to bed bugs. I don't think anyone would enjoy getting bit by a bed bug, but it compounds the issue if there happens to be health risks. So, fact or fiction, do bed bugs transmit disease? We're going to pause there for just a moment and talk about this. Of course, just like humans, have diseases on them. But, transmitting them is a very different situation. All of us are concerned about Zika virus. That is being transmitted by mosquitoes.

Now, we know it can be transmitted by sex, and other things, but the primary way is that an infected person gets bit by a mosquito, and the mosquito moves to a non-infected person, and transmits that. In reference to bed bugs, we have no evidence to support that bed bugs have transmitted any disease to a person. There were some recent studies done in Pennsylvania, which it looked like that a mouse got Chagas disease through a bed bug, but it was all laboratory based, and clearly bed bugs don't even bite mice, so at this point we still feel pretty strongly that it's fiction in reference to bed bugs actually transmitting disease.

But, I want to comment just a little more about that, because there's other health concerns associated with bed bugs. For instance, if you have a extremely high population of bed bugs, they have cast off their skins, we know that when insects get bigger, they molt and leave behind their exoskeleton when they lay down a new one. And, heavy concentrations of these exoskeletons can cause respiratory concerns. So, we know that would be a health issue. Also, there are mental health issues associated, that aren't just disease based. Those concerns could be that if you think you're getting bit, and you're not because of worry of bed bugs, there could be mental health concerns. And, so certainly that could be an issue, but actually what it comes to disease transmission, then it is not something to worry about.

There was a recent study, well in 2009, a study that was published in the Journal of American Medical Association, and that confirmed this issue of, from a medical standpoint, that they don't transmit disease, that they don't pose a serious health risk to humans. There's a couple of studies out there that say people who maybe got bit extremely a lot, in high, high infestations, that may have a little bit more hemoglobin, or iron content, in their blood. But, it is good for us to know, that when it comes to disease transmission, then there is not something to worry about. Let me ask another question, when it comes to bed bugs. Bed bug problems, are they going down, are they going up, or they leveled out? You know, many of us probably don't hear the real hype that was going on in the media a few years ago. But when it comes to actually bed bug problems, they're on the rise. So, for the last 15 years, year over year, more people have bed bug issues. And, therefore, there's a lot of things that we're going to talk about in this presentation that, even though there may not be disease transmission, there are lot's of problems associated with bed bugs. And, that it, in our country, the tolerance level for bed bugs is zero. Now, recently I was in foreign countries, and some of them say, "What's the big deal, we don't know why the US and other countries are so upset about them, we've had bed bugs for a long time." So, there may be a cultural shift over the years, I don't know, but currently threshold level of one, is too many when it comes to bed bugs.

In 2014, we did a survey at, that talks about, kind of, where we're headed with bed bugs, and I think it's really valuable to look at. The bed bug counts grew 50 to 75 percent, year over year. So, we're in the very first part of 2016, so this is a year and a half ago data, but still we're seeing that same type of, of increase. Some locations report a 100 to 200 percent increase, year over year. Now, I think what's valuable to pay attention, it's just not in New York City, or it's just not in Ohio, it's throughout the United States, and throughout the world, as the last bullet-point therefore indicates, that they've been reported in all 50 states, and not just reported, but are serious concerns to people in those locations. As you can see there, where are they most common, well 30 percent are in single family residential homes, apartments are

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next, so where people are dwelling, day in day out, is the most common, over 50 percent. Next would be hotels, then motels, which would be kind of together, and others. The point that we need to understand is that bed bugs, and we'll talk a little bit more about this, are hitchhikers, and therefore if you take things from an apartment, or a home, or a hotel, and then go somewhere else, and they happen to be in your purse or your backpack, then you can re-infest another location.

So, what happened with bed bugs? And, I think it's really valuable to think through that first of all, 23 years ago this country had very few incidents of bed bugs, but through the continued world travel, the resistance of this bug to products that were being used, the severity of some infestations. What we mean, we have been in homes and apartments that have had tens of thousands of bed bugs in them. When you have that many, the chance of going out in public with a bed bug in your purse, or even in the cuff of your pants, or the pocket of your jacket, is very likely.

And, of course, as I mentioned earlier, in the United States our threshold level for bed bugs is zero. Now, I want to chat a little bit about extended infestation, because what sometimes we may have the notion that bed bugs are living on us. Bed bugs suck our blood, that's all they feed on is blood, but we're much too hot for them to live on. So, once they've had their blood meal, they get off and go to a cool, quite dark space, which therefore could be your purse, or your backpack, or your suit case. So, rarely do we find bed bugs living on people. On the occasion kids may come to school with bed bugs on their coats, or hats, and what happens is their home is infested, bed bugs may be in that coat or hat, because it's at room temperature, then when they put it on, the body heats up that coat or hat, and the bed bugs will come off, which leads to, of course, infestation to schools or other environments where they may be.

Well, have you ever seen a bed bug? And, so I think we want to talk about that, and get a good feel, because too often people send me a piece of lint, or an ant, or a cockroach, and ask "Is it a bed bug?" Adult bed bugs, is it true then, or false, that they're too small to see with the naked eye? As you can see here on this penny, it's a pretty good size there on the chin of Abraham Lincoln. They're about a fourth of an inch long, some people have equated, particularly a full bed bug, one that has just eaten, to the size of an apple seed. If they haven't fed, this third ball point fits them very nicely. That they're very, very thin. But, when they have that blood meal, they will swell up about five times their body size. So, with the naked eye, you bet, you can see an adult bed bug, whether it's a male or a female. But, having said that, the immatures are much smaller, and I'm going to talk about that as well. From a color, brown color, usually dark brown, reddish brown after they feed, because they have that blood meal. We alluded to this, the only thing they feed on is blood. This is important, because it has no impact of how clean or cluttered your location is, cause all they eat is blood. Now, someone may say, "Well, from a control standpoint, it makes a big difference." and that is true. If there's lots of clutter, it's much harder to be able to find all of the bed bugs. But, from a standpoint of survival, all they need is that blood meal. In fact, it's always ironic, I give presentations to hospitality industries, and I say, "You know, you're business model is exactly what the bed bugs want." Of course, the business model in apartments and hospitals is filling all of the rooms, the hotel rooms, all of the apartments, all the time. And, if that happens, then bed bugs have that meal as often as they would like.

The last bullet point I think is important, is that bed bugs are attracted to three things. The first thing they're attracted to is CO<sub>2</sub>. Within about four to five feet of a host, they can smell you. Next they're attracted to heat, if they're hungry. And, that would be a few inches. Last of all they're attracted to body odor. This is an important point to, kind of, understand, because you often wonder, "Well, why if go to a hotel, and then they have bed bugs, OK I don't want to get bit, I get that, but why do they come home with me?" And, our belief is that as the bed bugs are wondering around at night, they smell your dirty clothes that you put back into your suitcase. They're attracted to that, and they get stuck inside your suitcase, and you take them home. So, no one wants to get bit by bed bugs in the hotel room, but worse than that, taking them home and infesting your home, it's a significant problem, because then that leads to all of those mental concerns, and of course the expenses of making sure you eradicate them.

This is some new data that I want to talk about here a little bit, on this feeding process. It takes about three to ten minutes to be able to feed. That's not new, but the new thing is how often they feed. We used to think that they would feed every five days, or something like that. What we're finding out now, that

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when they are hungry, they'll feed every day or two. And, so we're find, kind of, interesting situation where if they have the blood meal, they're going to feed more regularly, if they don't have a blood meal, as the last bullet point indicates, they can survive a long period of time. And, what is a long period of time? If you're an adult bed bug, I have kept individuals in my colony alive over six months, about nine months. So, I'm hoping PETA isn't too unhappy with that statement. On the other hand, in mites like what you're seeing right here, we can keep mites alive a couple of months. The reason this is important for us to understand is that, you can say, "Well, I'm just going to go on a vacation for a month, and they'll be all gone." Well, unfortunately you probably need to be gone for over a year. If you keep the temperature warm, then they go through their cycle much faster.

When a bed bug sucks your blood, we really don't have any red associated with that feeding, but after it has fed on the blood, it will usually defecate the previous blood meal in kind of a dark ink stain looking material. This is what, this is on cloth or lint paper, it will actually stain it. And, so these are things that we would look for is black ink stains on edge of, mattress and box springs along the top of the headboard, behind pictures, we would not expect to see red blood stains. If you find red on the sheet or the pillow, more than likely what's going on is that someone has scratched a scab, or something like that. Most, or you have rolled over and squished the bed bug, which from my perspective is not very common to actually happen.

So, another fact or fiction question. Bed bugs are found only on the bed. Well, they have that name, bed bugs, but the point that I think is interesting for us to pay attention to, that any place where people are sleeping or resting, particularly at night, we know that bed bugs like to feed between midnight and five, that's their most, when they like feeding most. And, we think that's because people are in REM sleep, and wouldn't notice it as much. So, I have, not too long ago, heard a complaint, a customer we went to visit. We looked all over the bed, we looked around the bed, and couldn't find anything. And, the bed was, I said to the person, "Boy, you have a perfect made bed." I said, "I need to learn how to make my bed that way." And, she said, "Well, I don't sleep in the bed." She said, "I sleep out here on the Lazy Boy." Well, bed bugs were all over the Lazy Boy. So, again, just because it says bed bugs, doesn't mean it will be in the bed. On the other had, the chances of having bed bugs at school, or at the office, are, is pretty high, but the chance of that bed bug to, coming into an infestation, is pretty low, because people don't usually sleep there, particularly between midnight and five, and therefore survival abilities would be significantly lower in that type of a situation.

While most are discovered in the bed, the point is they don't have to be there. But, if you recall, I mentioned earlier that bed bugs can smell you about five feet away, so when I do an inspection, I usually look particularly five, four to five feet away from where people are sleeping. And, I'm going to look in cracks and crevices, behind the baseboard. We do know that when people go to bed, they pull the blankets and sheets over them, and usually their head is exposed. And so, CO<sub>2</sub> works its way towards the top of the person. And, we said bed bugs are used as a cue to find people to get their blood meal. And, so we find more bed bugs towards the top of the bed, towards the headboard, towards the picture, than we do towards the bottom. So, if you're doing an inspection, we would encourage you to pay attention to the top part of the bed first, rather than the bottom part. Now if reference to, kind of, some tips for you, I think the most important thing is to catch the bed bug early, or what we call, at introduction. And, so I wash my sheets each week, rather than just quickly put them back on, I always do a cursory inspection around the edge of the mattress, the edge of the box spring, kind of look behind the bed board, to see if I happen to find one of these bed bugs, or the fecal smears that they've left behind.

So, thinking of them only as bed bugs, that's a problem. Blood suckers wherever they get the opportunity. So, let's talk about this. We talked earlier that bed bugs, do they transmit diseases, we said they don't, but lack of visible dead bug bodies means no bed bugs. Is that fact or fiction?

Well, we get some very interesting [inaudible] in reference to this, and I'd like to talk about that for just a moment. Most people do not notice getting bit. Well, first of all, and here you see an actual indicator of someone that did, but the studies that we have done, over a thousand people have fed bed bugs for us, and we find out that less than three point seven percent of people react when they're getting bit to the bed bug. Now, you say, "Well, they're getting bit, what do you move around?" What we're talking about is that

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some people have a delayed reaction, and about one percent do. But still, all people that react once they're bit is less than five percent. That's important, because you can say, "Well, I haven't ever had bed bugs. Never had any signs on me." Well, if it's the first time you're bit, you probably won't. Now University of Kentucky and Orkin did some work and say, "Well, what about if you get bit on a regular basis?" And the data that we generated there was that if you live in a bed bug infested location, your chances are of reacting go up. At 65 percent. So, still you've got 40, 35 to 50 percent that never react. So, I particularly say our hospitality or health care, that please don't rely on people complaining, due to some kind of skin irritation about having bed bugs. And, one caveat that I would like to share, is that particularly older people react less than younger people.

So, if you're at a nursing home, or a elder care facility, or something of that sort, be particularly vigilant in inspecting and looking, and not relying or hoping, that the customer will complain. Because often they will not. The study results, and just so this is a little bit of science for anyone that's interested, we had, we had 1400, over 1400. Three point eight, and three point seven percent had the immediate reaction. One point one percent had the delayed. I like this slide, and I like this point in the parenthesis, we had one person take 18 days, and I was just at him being three weeks ago that somebody told me it took them three weeks, rather than 18 days to have a reaction. So, just kind of as a heads up that you might have been exposed to a bed bug in your hotel room, and nothing happened, and then three weeks later recognized that, "What's this?", and had forgotten what, where you actually were.

So, there are a few people, quite a low percent that can have, somewhat of a delayed reaction. Kind of in that same line, I think it's valuable to realize that if you did an introduction, meaning that you bring in a male, or an unfertilized female, you could be bit quite regular, maybe even have a reaction, and then after two or three months, they would die without having reproduced. Well, I think sometimes, I've been bit by something, and really when it stopped they may have died. The second thing is I'd like to share with you that we have individuals that say, "I'm getting bit.", and others that say they aren't, and sleeping in the same bed. And, this is not completely unheard of. Bed bugs like hairless types of situations to feed. And, so we usually see that, hear that women who have usually less hair, will complain more often than guys, and it isn't just because women may, you know, be fantasizing differently, it has to do with probably that the bed bugs are selecting locations that have less hair on them. So, as I indicated earlier, I'd like to, that there was a low percent of the reactions in the volunteers, but this third, second bullet point, I want to chat with just a little bit. What is that reaction?

And, so it is not consistent, and so I share this, and I put this slide in here to our presentation because, if you think you can go to a physician and say, "Look at this, is this a bed bug bite?" There is no way for a doctor to be able to confirm that. We don't because people have a very different reaction to the bite. Much greater than even mosquitoes. I have had people, myself I don't have a reaction, but I have seen people have, you know, a little reaction like a mosquito bite, I've seen people have a little red dot, I've had people have somewhat of a rash. And, two weeks ago, someone fed a bed bug, and felt like, actually there was an increase in temperature from the feeding, and he felt like maybe he was even a little bit woozy. So, I put this slide in that the reaction, or the sensitivity to the bites, is not consistent. And, one other take home lesson is, that if a physician says, "That bite is a bed bug bite." I would go to a different physician, because there is no current method to a hundred percent assess that skin irritation is from bed bugs or not. If you were to say, "Well, in the last month I've got all these bites on me." and you brought bed bugs to the physician, then you might have more confidence that, that's what it might be.

Let's talk about this bed bugs, is it true or false that they, that there are signs of unsanitary conditions? And, I chatted, a little bit earlier, about this. And, so let me just, kind of, circle back. Bed bugs eat nothing but blood. But, on the other hand, if I come into your home to conduct a service to control bed bugs, and there's a significant amount of clutter, then the treatment will be much harder to be successful at. So, there's kind of a fact and fiction, just because you're unsanitary does not meant that you'll have bed bugs, but from a treatment standpoint, that's pretty challenging. It's very easy for us to control bed bugs in a hotel room, because there's not much in there. But, going into a teenager's room, which is highly cluttered, with lots of types of things in the controlled air, could be significant, could be a much bigger challenge than in a situation that is nice and clean. Now, bed bugs are brought in by us. This is our pet. We can't blame a raccoon, or a fox, or a squirrel from bringing in bed bugs. They are transmitted in

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luggage, furniture, personal belongings.

Now, I want to chat with you, I put this bullet point number four in there, because there a few years back that it was put on the Internet, that when you get clothes, wash and dry them because then they won't be infested. Why would new clothes have bed bugs in them? There's no reason for that, there's not. There's no blood associated with them, they wouldn't be attracted, they don't have an odor associated with them. So clothing, if you have an infested home like a hat or a coat, or something like that. Sure, there could be bed bugs in it. But, new clothing you would not. But, remember when a bed bug is hungry it's attracted to heat. When the bed bug is full, it's repelled by heat. And, that's why often we see bed bugs getting off of coats, and hats, and jackets, because it's getting hot now that it's on the person, and therefore bed bugs are looking for a cooler spot. We believe that they initiated from caves, and if you've ever been in a cave, usually it's quite cool in there. And, so therefore bed bugs traditionally would like to be at about 65 to 75, in a dark cool spot, after they have fed, and they just kind of chill there.

So, fact or fiction, two bed bugs can create that big of a problem. So, it's an interesting question, and I hope you smiled a little bit at that. If you're two virgin females, or two males, that is correct. But, if you're a pregnant female, this is the potential that you could have in 90 days. So, interesting if I was to overlay this slide with an example of cockroaches. A cockroach can have an egg, a German cockroach can have an egg capsule that has 30 to 50 baby eggs, babies in it. And, when that egg capsule hatches out, then you could have that many running around. On the other hand, a bed bug female will lay maybe an egg a day, and therefore she can lay for a hundred days. So, so and then it takes her babies about a month, month and a half to develop right in again. And, that's why you have these factorial numbers. But, the point is you don't wake up one morning, and have hundreds of bed bugs like you might do the same thing with cockroaches. They reproduce quickly, I want to show you then, their life cycle here is about 21 days to a month, somewhere like that.

Starts out at eggs, which is on the top left, hatches out and the term we use is, is in stars, and they have five of those, and then they mature into adults. Every stage has to have blood. The female to produce ten eggs has to have another blood meal. So, they're constantly going back to that blood meal, which is us. Now, some might say, "Well, there's other animals that have blood." and certainly that is correct. But, challenge of the important thing to pay attention to, most of the other animals have a lot of hair. So, if you want them to feed on your cat or dog, just shave the cat or dog off. Most of the time they're going to direct themselves at us. Now, on occasion I have seen older dogs losing their hair underneath their bellies and on their arms, or legs excuses me, and I've seen bed bugs feed on them very nicely. You can see on the very top how much bigger and extended that bed bug is after it's actually had it's blood meal.

Now, what we'd like to talk about now, is what is the future, or what is the further the direction of bed bugs, and where we are actually going. We started out, I guess it was 15 years ago, with a pest that we knew very little about. I remember in graduate school, my major professor saying, "Here's a vial of bed bugs, you really don't need to look at them because you'll never see them." And, then I remember 15 years ago, getting a phone call from Orlando, Florida, and the branch saying, it's an Orkin branch, "We've got a bug that is biting people" and I says, "Well, it's probably jumping, isn't it?" and they said, "No, it's not jumping." Well, it must be flying. No, it's not flying. And, the reason I picked those two was because an animal that has wings, like a mosquito, might suck your blood, you can see this picture here, we have no wings associated with this pet. Then the next question is, is it jumping? As you can see these are not good jumpers, like a flea would be. So, here we've the typical things that would be sucking your blood, like mosquito's or flea's, this wasn't happening.

So, the question then is, what's the next step, or where are we going to go with this pet? Couple things I wanted to, kind of, comment. We do five times more bed bug work in the Midwest and the northeast, than we do in the south and the southeast. What's that about? Well, we don't know for sure, because bed bugs are an interior dweller. But, we think in the south, and the southeast, temperatures traditionally are much hotter there inside people's homes, because if they kept them as cool as the north, then your air conditioning bill would be just astronomical. So, we think that may have to do with it, but also there's a lot of air conditioning that is blowing air over them as well, and that may lead to bed bugs, just not being as comfortable, not reproducing as fast. So, what will happen in the future, we don't know, in reference to

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spread, but we know that those of you that are living in the north, and the northeast, have a lot bigger challenge with bed bugs.

Now, some of you may have read recently in the literature, and I'll talk a little bit more about that, the challenge of resistance to bed bugs. Now, you look at this bed bug, you see the different ones, and you think, "What do I mean by resistance?" They have three highly technical abilities to become resistant to pesticides. They're cuticle is unique in that, that helps it. Genetically they can quickly make a change, and last of all metabolically. And, we see that happening. And, so some of the recent work that was done is, there's a like, well we see it happening. Bed bugs are becoming resistant. therefore it is important that when we control your bed bugs, that you make sure all bed bugs are actually killed. If you don't do that, if you just kill part of them, then you breed a population that may have individuals that are somewhat resistant to that pesticide that has been put out, or that product that has been put out. So, we, we strongly recommend that when you do a service, that every bed bug is killed before you leave. If you do a service for, let's say ants, or cockroaches, or something like that, or even rodents. We may put out baits, insect growth regulators, or other things like that, that have long term impact on the control of that bed bug. But, we don't have that luxury when it comes to bed bugs, and so therefore our goal is to kill every single bed bug before it dies.

Another historical question that I'd like to talk about, that I think valuable. In this country, in the United States, North America particularly, there isn't a lot of class living situation. We all, kind of, live together. We also, kind of, go to church at the same place, we go to the same theaters, which is a little bit different in other countries, where you might have folks, kind of, congregating with like economic conditions. The reason that this is important, is that I don't know where everybody lives when I go to church, we're worshipping. So, the point is, could the person next to me come from a bed bug infested home, put their purse down next to me, the bed bug crawls up and goes in my pants. The point is I think because we have somewhat of a classless society, we're all at risk to be exposed to bed bugs. And, so therefore, what do we do? One thing is, is we make sure that we inspect our beds on a regular basis. Number two, if we find ourselves somewhat in a traveling situation, go to hotels and you go to visit friends in other locations, There are some techniques that I practice that I think are very important, that we may want to pay attention to. First of all, when you go to someone else's home to spend the night, or you go to a hotel, always inspect, now let's step back, what are going to inspect for? We're going to actually inspect for those fecal, or those cass skins around the edges of mattresses, box springs, headboards, and pictures, and things like that. So, please don't stay in a room that has bed bugs. Next of all, living out of your suitcase is much better than emptying your suitcase into the drawers, and into the closet, and places like that. That exposures your belongings to more locations.

As I mentioned, bed bugs typically are movers around at night. And, so therefore, if you put your suitcase in the tub at night, probably much less likely that bed bugs are going to move in and around there. If you can't do that, take a garbage bag, and sealing it up around the suitcase will prevent bed bugs that are wandering to actually get in it. Number four, when I go home, rather than put my clothes in the hamper, I immediately was and dry them. Bed bugs that are exposed to temperatures of 122 degrees for a second, will be killed. So, we ought to get in the habit of, when we return home, immediately putting your clothes in the dryer, or wash and dryer to take care of it. And, the last thing is our suitcase. Storing your suitcase, that possibly has a bed bug on the edge of it, by the zipper, next to your bed, under the bed, or the closet next to the bed, is just asking for that bed bug to smell you out, because remember how many feet away from the host can the bed bug smell? Right, so it was four to five feet, so if your closet, or under your bed, is certainly fits in that realm. So, storing your suitcase in the attic, in the garage, in the trunk of your car, you know, a ways a way from where people sleep, will help if you do, if you have come in contact with a bed bug, to actually reduce that chance of actually them coming to you.

Those are things then, being aware, can significantly help. The other thing is that when you do have a bed bug problem, follow the steps that the pest control company asks you to follow. There's going to be some preparation, and cutting corners on that preparation often will lead to problems in the long run, meaning that the bed bugs were not completely controlled, they were not actually in the first place, and then you continue to have that nightmare. So, there are extremely good techniques out there in controlling bed bugs, that isn't the problem, but sometimes when you're asked to do preparation activities,

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and you're too busy, or well we probably don't have, we don't need to do that, that often leads to potential challenges where bed bugs can be a significant issue. So, from my perspective, I think bed bugs are, pretty much, here to stay. I think they're going to be part of the environment that we have. A lot of folks have said, "Well, we had bed bugs in the 20's and 30's, they disappeared by the 50's and 60's, why did they come back?" And, just a very quick, I know our time is short, but if you go back to that period of time, in the late 50's and early 60's, it was the availability of products like DDT, when I say that chlorinated hydrocarbons, kind of fit in to that, you could go down to the drug store, and get a product, and spray it all over your house. That, therefore eliminated the problem. Now, the environmental protection agency says that the products that would be uses would be more serious than, if not used properly, would be more serious than the bed bug bite, and so I don't see there being a product that's available to the consumer that is going to be able to eradicate, or eliminate this bed bug. So, I think it's stopping them from, become, that introduction from becoming an infestation, and that's done by caution where we stay, and regular detection and inspection in your own home. So, at that point, I will pause. Are there any specific questions, and I think we can do that in the chat later. Bed bugs do not cause disease issues, but certainly can be a health concern.