Hello and welcome to the presentation, "Data Driven: Utilizing California's School Pesticide Database to Improve Golfer Management." 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, Eric Denemark, an environmental scientist from the California Department of Pesticide Regulation.

Okay, thank you for having me today. A little bit of background about myself. I graduated with a Bachelor's degree in entomology from Cornell back in 2009, went on to receive a Master's degree in entomology and then promptly got my start as a commercial pest control technician on the south side of Seattle. Since then, I've worked for Pennsylvania Pesticide Education Program, and now here I am in California.

Now this is a project that I am very passionate about, but I would be remiss if I didn't mention that the overall goal of our program is protecting children's health, so everything that we do falls under that guideline of protecting children's health. There's my contact information. It will appear again at the end of the presentation. If you like what you see here today, please feel free to get in touch.

Okay, what you're looking at here is a database called CSPUR; that's the California School Pesticide Use Reporting, and this is a tool that does not fit in the bed of a pickup truck. On file we have paper records for 2015, all the way back to 2011, and what you're looking at here is just the past three years. And it takes a team of people to build and maintain this tool. At this time, the total number of entered reports is 444,405.

So these are the cool kinds of things that we can build with CSPUR. This is unique to California, as far as I know. But it really applies to the structural industry nationwide. And before I get into all this cool stuff, what I really want to talk about today is what goes into the tool itself.

Okay, so the first thing that happens is school pesticide use report forms arrive in envelopes at the mail room. They're checked by security, so they come to us opened. They're deliver today our mail stop. They're sorted by different department personnel. And then they arrive at the first desk, where they are opened.

So here's an example of one of those forms. This one's back from 2011. We've updated the form since then, but we still have some people who use the old forms. Now this is handwritten, and that is still quite common, so we have a paper-based system with a lot of hand-written reports, but we are working towards an online system. It comes up a lot, both internally and externally.

Now this is a pretty good report. As you can see, some of the reports don't really conform to the data entry system, and we call these errors. So the form itself -- and this is true for forms you know, around the world -- they often have design issue that is make them difficult to interpret for the end user. So we are working on this. We are engaged in a form redesign. We've got a new person on staff who is great at formatting, so I'm really excited to see a form that makes a little more sense for the person in the field.

So we do get in touch to correct errors. And I won't keep this slide up too long, but basically we have an error correction tracking file. It's shared. And what I've done is I've limited the fields to certain lists, and that way no matter who is entering, they have to enter the exact same word each time, and that way I can analyze this data like I would with a fancier database.

Okay, so back to the file cabinet. So what's in this file? Well we have error free but needs to be entered. We have the data that is entered. We have files that are waiting on error correction. And this is all the space we err allotted right now, so, to be quite frank, I stay away from the paper filing system as much as possible. There are five people who are currently entering data and working in the filing system on a daily basis. Two of them really have the filing down.

This year, instead of just receiving reports from industry and contractors working at schools, we also received reports from school staff. So this gives us a much more complete picture of the pesticide use, but it effectively doubled our number of paper reports, from about 50,000 a year to an estimated 108,000

a year this year. So the top two rows of the shelving system is 2015, and this brings our reports to well over half a million. And we do respond to public records requests for the past five years, and I can't tell you how grateful I am to the people who maintain this system to the point that I can get a public records request and do a search on the computer and then go pull the hard records basically with ease.

So this is how the data is entered. This is a web portal, sequel server is the background programming. It's maintained by IT. This is beyond my technical capability. And right now the team of five enters approximately 2,000 records a week through this portal. Sometimes errors come up when they're entering that couldn't be seen just by looking at the form. We call those hidden errors, and that's a big part of my day, is researching these hidden errors and figuring out why they're happening and how we can fix them.

Now this is how I talk to the database. So this is sequel server. It is a powerful tool. Right here you can see that I'm looking for the active ingredient. It's a rodenticide. I won't try to pronounce it and embarrass myself. In fact, it looks like I'm looking for multiple rodenticides here, the number of applications in different years. Now the reason that I use the number of applications is that we have volume reporting, but volume reporting is notoriously unreliable. So the way we look at it is the number of times the pesticide was applied is a great stand in for the volume data, which may not be as reliable.

Now I'm self taught at coding. I did not receive coding in public school. There's a lot more talk about that now, and I think it's a great idea, because it is a powerful tool, and I feel like I'm a bit behind. So how powerful is this? Well you combine it with Google Maps and all of a sudden we can look at data visually at the district level. So I can tell you what's going on with pesticide usage in school sites in California by region. We can get pretty in-depth here.

Here we have a heat map for the use of a product. This is either Fipronil or aluminum phosphide. I can do this by the active ingredient, as mentioned, or the number of applications by certain companies in certain districts at certain schools, or combinations thereof.

So let's take a look here at 2013. These are the top ten active ingredients used at California school sites in 2013. And of particular note is strychnine at the top of the list. And that is pretty much exclusively being used as a golfer bait, and I'm going to be talking about that quite a bit more through the rest of this presentation.

Now 2014 the data is almost completely entered. We're down to the last little bit. So what happens is these reports are only due annually, and they're due at the end of January for the previous year. So no matter what, we are always going to be one year behind. And we're just about to catch up and start entering 2015, and I think that will get us on a good cycle for the years to come.

So for this analysis I actually changed it from active ingredient to product name and then I modified the product names so that you wouldn't see exactly which brand name there is, but I broke it down a little bit so you could see what's going on here. And at the bottom there, that's all the code it took to generate this table, and I think it was actually more work to hide the brand names than it was to write the code.

All right, let's talk about golfers, the pest. Specifically these are pocket golfers. They are widespread. They live from low to high elevation, and they are subterranean burrowers feeding on roots, tuber, et cetera. A lot of people see them as cute and cuddly like this. But school staff and pest control professionals often see them like this, kind of the dark side of the golfer.

Okay, these are all public use images just in case anyone was worried. I looked at two peer-reviewed studies, and they were done in Colorado and Oregon, but we're going to assume that they're pretty much the same for California. And the size of the pest on the page here loosely correlates to the vector load that was found in the research papers. So the biggest one there on the left, mite in the genus Hemogamasus. Now these are, you know, very ambulatory mites, moving around, often preying on smaller arthropods. They can also feed on dandruff, et cetera.
Number two to the right, Ixodes ticks, particularly Ixodes sculptus. Number three, lice, and number four, flees.

So they do carry a diverse parasite infector load, but I think what happens to most people is that they do a lot of damage to the turf. And I have some examples of this. Here's one with quite a bit of cosmetic damage. Now what's going on here is that the golfer's main burrow is following parallel to the curb there so that you could imagine that underground the burrow is running from close to the bottom of the screen along the curb, up towards the top of the screen. And those mounds that you're seeing are the kick-out mounds for emptying dirt out of the tunnel; right, because a big engineering problem with tunnels is what do you do with all that dirt removed? Well the golfer makes it easier, it digs a lateral tunnel and kicks out all out up on surface. So it is easy to tell when you're got at golfer problem. And they're tough resilient, adaptable pests, and you could see here they've worked their way up into a raised-bed-type situation, and they have a particular taste for irrigation lines, and that's what makes them really expensive.

So how do we turn this pest here on the left-hand side into the half pound of fertilizer on the right-hand side? Well, in 2013, golfer targeting applications within the top ten most used AIs are strychnine bait, Diphacinone bait, which I broke down, you can see into which ones are actually in golfer-targeting products. And then closer to the bottom, aluminum phosphide, which can be used in tablets or pellets. This would only be tablets, so there's more use of that active going on that's not represented here.

So this is the real world of golfer targeting at California school sites A and if you break these numbers down, it works out to about 43 applications per working day year round across the state. So any given Monday through Friday about 43 golfer targeting applications are occurring at California school sites. And 2014 looks about the same, strychnine, a few more applications. Diphacinone, a few less although all the data is not entered. Aluminum phosphide about the same. So not too much is changing right now, and we're right on track to be at about the same number of applications per day, on average, throughout the year.

So this is what it looks like when a school district is using one of these pesticides and it's not working. So this is real data; the year, the district name, the school name, and the applications per year. So in the top example we've got district one at X middle. In 2010 they recorded 36 applications. That went up to 47 and leveled out at about 46 applications per year. That is quite a few applications per month for that period of time to not solve a pest problem. And the joke that I like to make at this point is if you're repeating your applications this much and not getting control, something is wrong with your IPM program. These are just two quick examples. There are many more that I could share.

This is a blank slide. Unfortunately I did some work on a Mac and what we lost here was actually a nice graph showing the total number of golfer applications, the golfer applications with strychnine; Diphacinone, and aluminum oxide from 2005 to currently. So I'll describe what this graph -- I'll try to paint you a picture here.

The total number of golfer targeting applications continues to rise, which isn't exactly what we want to see. Aluminum phosphide was the most popular from about 2005 to about 2010, and then it began a continuous steady decline. And I do believe that may be, in part, due the to the unfortunate fatalities of two young girls in Layton, Utah, when aluminum phosphide was over-applied to a burrow that was too close to the house, and the gas actually leached through the burrow system and into the house, and two girls were killed, which is very unfortunate. Acute poisonings like that are rare, but we like to avoid them.

So aluminum phosphide use has gone down since 2010, and Diphacinone has come up a little bit, but it's always been the third most used. Now strychnine is what really took the place of aluminum phosphide. Starting in around 2011, the strychnine use started to go up dramatically, and that is all baits. So when you think about golfer control, we're getting more of it across the state, more and more it's strychnine based, and we have declining use of aluminum phosphide, and a little bit of Diphacinone sneaking in there.

Okay, so I was asked to break down an analysis of golfer targeting by regions in California, so green is the northern region. This pale yellow color is central. Blue is the Bay area. And then we've got a reddish pink down there covering the south.

So the first thing I did was I looked at who are our top five school districts targeting golfers, and you can see why this is such a powerful tool. I the district name, the company name that's doing the applications, and then the number of applications. And if I remember correctly, this is a combination of 2013/2014 data. But I think the most incredible piece of this is that we have over 900 school districts in California. 20% of our recorded golfer targeting pesticide applications are coming from these top five districts. And if you look at the highlighted districts on the map you can loosely see the big agricultural valley that California is famous for. Keep an eye on that as the pictures progress.

One manufacture thing to note. For all the districts and the companies, I labeled them with numbers. But for that top company there, I labeled that Company X, and that is because there is one particular company who is doing a lot of golfer applications, so when I get to Central and Bay area, Company X is going to pop up quite a bit.

Here's the southern region, so the companies are more diversified: We have ten different districts. I've highlighted them on the map there. 28% of all golfer-targeting pesticide applications are happening in these top ten districts in the southern region.

Okay, here's what I was mentioning. Central region, company X, a lot of work going on out there for them, and they're doing the bulk of the golfer targeting pesticide applications at school sites across the state. So I have actually been in contact with this company, and I'm hoping that we can do some work with them. I don't want to exactly name what that work is yet, but it's definitely somebody that I'm interested in working with. And it's good that we've been in touch. So we kind of started the process.

Here's the Bay area, once again, Company X kind of dominating the scene. I've highlighted the top five districts. The reason that you see only five here and not ten as in the previous slide is that there's a lot less golfer targeting going on in the Bay area. If you look at the numbers, it's about 3% compared to the state total. So not as much going on here in the Bay area.

And last but not least, the northern region, and this analysis raised more questions than it answers. So in ten counties only one school district apparently contracted to apply golfer-targeting products, so why? Are golfers not a problem up north? That doesn't really seem to be the case, but maybe they're not as big an issue as they are everywhere else. Is pesticide usage different in the north in general? Well one of the problems with the database is that there is no requirement to report a lack of usage or any other type of IPM program, and so I couldn't really tell you from what I could see right now if there's a regional difference, but I can tell you this, Coastal California is very different, both culturally and geographically than northeastern California. So it's a big state. I really can't generalize for the whole north.

Okay, only companies were reporting this data. The data reported by school district staff didn't start until 2015, so it could be that school district staff in the north are kind of do-it-yourself types, they're doing their own golfer application and, therefore, they had nothing to report. Or is it maybe that Northern California companies are not really complying with the reporting requirement?

We do run into the situation a lot that people are not aware of this requirement. So one of the things that I've been doing for the past several months is touring around the state to the pesticide -- let's see, the Professional Applicator Pesticide Association, whatever the acronym is, I try to get at least once a month a talk in to that group and try to get the word out and put myself out there to answer questions. So right now, if I had to throw a number out there, our compliance is probably at about 60%, which is better than the flip side, 40%, and we're going to continue to try to improve that.

Okay, here's a look at all of the district's that I've highlighted here. So we have about 26 districts here showing, and look at how it outlines that agricultural valley here so nicely. So here in California we've got this big agricultural valley that basically heads south to north, the mountains, the coastal mountains are on the west side, and the Sierras are on the east side, and it looks to me that most of the applications are kind of happening on the perimeter of this valley. So that is interesting to note. That says something about pest pressure, and also reporting compliance.

And so, like I mentioned, we have over 900 school districts here in California. 53% of all of our golfer-targeting applications are happening with just these highlighted districts. And that's pretty incredible since golfer targeting is basically the biggest use of pesticides, at least by number of applications that we see at California school sites.

So this is the policy that dictates the work that I do. I'm going to go ahead and read it out because I do think it is quite important. "Is the policy of the state that effective least toxic test management practices should be the preferred method of managing pests at schoolsites and that the state, in order to reduce children's exposure to toxic pesticides, shall take the necessary steps pursuant to this article to facilitate the adoption of effective least toxic pest management practices at schoolsites." Now this is no enforceable language in this section. This is basically suggestive language. But except for the part where it says "It is the policy of the state that the least toxic test management practices should be the preferred method."

Okay, let's move on from too much text. That's quite boring. Okay, so how do we implement that? Well we do workshops, and this is one of the reasons that I was asked to regionate the data, because the workshops travel around. Now our workshops do a lot more than just these topics, but if a school administrator were to ask me, "What are the top four things I can do to reduce pesticide usage in my school district," these are the four I would pick: golfer trapping, baiting for ants, flame weeding, and door sweeps.

Now, between these things, we could knock out a lot the herbicide application and a lot the pesticide application, both in volume and in number of applications. The door sweeps would keep spiders out. That's probably the number one complaint coming from teacher, especially in childcare settings. There's just no insecticide that you can use that's going to stop a spider from crossing that open barrier and getting into sight of a teacher before it expires. And so door sweeps could really knock the spider out.

Flame weeding, really fun way to remove weeds. The way I pitch it is there's no paperwork, no posting, no notification, no reporting, and it's fun and effective. So I like flame weeding. Dating for ants, need not say much about targeted applications of low active ingredient concentration insecticides, and that's exactly the pest control we want to see happening. And I will say a whole much more about golfer trapping, so here we go.

So here's one of our very first workshops. And what we have here is an employee who at the time, was new to DPR, digging up a lateral tunnel, and one of our early school trainees. And I like the little thought bubble here, you know, "Do you think we'll catch a golfer?" The answer is, "Yes." Anyone can do it. The real trick is that you just need to be shown technique for both setting the trap and also for wiring two traps together, accessing the main burrow from the kick-out and putting a trap either way.

Now when I describe this to the professional applicators, I had one of them tell me a joke that that's not very sporting to block both ends of the tunnel with such an effective trap, which I thought was a fun comment. But my answer was I'm not sporting when it comes to golfers, so I would like to see the traps work. They are effective.

So here's what I show people when I go out and I talk about this. Okay, aluminum phosphide, what's the signal word? Danger poison. It's a very accuse toxin. Strychnine, danger poison. It's a convulsant toxin. Cinch traps, no signal word; okay.

What are the pros? Aluminum phosphide applied correctly can have great knockdown. So if you have a big problem going on currently, you can knock it out. Strychnine, easy to apply with proper equipment. Okay, that's a good pro. You know, you can probe into the burrows with either a special burrow baiter or just with a probe, but then you manually put the bait down, cover up those little holes and your baiting is done.

What's the pros of using those cinch traps? Well they're nontoxic. There is no Healthy Schools Act paperwork. The Healthy Schools Act that created this whole database. They are effective. And I would argue that they are more effective than the pesticides, which I'll talk about in the next column. And my personal favorite allows tracking or monitoring, which is a crucial part of the IPM process. When you trap you can count the number of golfers that you've killed and record that. When you're doing a fumigation-type or a baiting-type program, you're not going to be able to track your kills, so to speak.

Okay, what are the cons to these different approaches? Well, aluminum phosphide is difficult to dose correctly. Now I already talked about that unfortunate story out of Utah, but let me talk about this a bit more. The way that these tablets or pellets work is that you put them in the tunnel and they react with the moisture in the soil and the air and they release phoshine gas. Now that means your soil conditions dictate, really, how many tablets you should put into the burrow. So I mentioned this as a talk and I had an applicator come after to me and he said, "Well, you know, you can just add water to the tablets to make sure it releases all the gas quickly. So I told him, "Wow, that's interesting, I never heard of that." I like learning. I took that back to the office, happened to be looking at the label and saw in bold, "Do not apply water to the tablet." So while it may be an effective method of utilizing, it's not labeled correct.

Okay, many outreach publications on golfer control say that the gas is prone to seeping out of the tunnels into the surrounding soil, as opposed to working its way down the tunnel. I don't have any good data to demonstrate that. I'm relying on people who have done more golfer control than I have. But it seems like in certain soil types, especially, that is a problem. And golfers can actually detect the gas and block the burrow. One of their defense mechanisms is to pile a whole bunch of dirt quickly and of course they are well adapted to moving dirt, into the tunnel to block it. And so that is one way that they can avoid this type of application.

Okay, let's move on to the strychnine baits. Basic tenet of IPM, baits can fail in the presence of better food. This happens with ant, flies, and it happens with golfers. If there's a lot of good food around, why would I eat something that I'm not used to seeing. The other thing is that -- and this is new information to me as I prepared for this presentation -- strychnine resistance is documented in the literature in golfers. In fact, I can't remember the exact numbers. I wish I had written it down in my notes. I think it was something like a golfer in a laboratory from a possibly resistant population consumed something on the order of 270 milligrams of strychnine when the LB-50 should have been, you know, tenfold less than that. The number was quite surprising. But pesticide resistance is a problem. We often think of insecticide resistance. In this case we have a mammal that has developed a resistance to this bait.

So there were some loose numbers on the effectiveness percentage of both aluminum phosphide and strychnine. They were not California specific. They were surprisingly low. They were, you know, 20 or 30 years old, so I can't say much on that right now. But I can say this, since traps work, when they are set correctly in the main tunnel system, one on each side, you can catch golfers. Now they require more manual labor. And something that I hear a lot about is there's a chance of students digging up the traps. And so I would like to acknowledge that people are concerned about that.

The answer to that particular problem is shown in this photograph here. Now Phil, who is one of our contracted trainers for these workshops, is the one on the ground getting in with the golfer burrow there. If you look just past his shadow, tops of the top of the screen, you'll see an X, and that X is approximately one stride from where he's digging in the ground. This is Phil's answer to keeping kids away from digging up the golfer traps. He says -- and it seems to resonate with a lot of people -- "If you put your flag or you spray paint your X one stride away from where you dug your traps in the ground," people will actually not be able to figure out what's going on with the X. They expect whatever is important here to be directly under the X. So that's one solution.

So I asked Phil at our last workshop, in light of the fact that since trapping works so well, what does he think is the biggest impediment to implementing golfer trapping at the school district institutional level? And his response was, without hesitation, "Finding the right person." You have to find someone who's willing to do the manual labor and who is willing to deal with removing dead golfers from traps.

Okay, here's the picture that I use to demonstrate that idea. On the right-hand side, look at Mr. San Francisco there? He is smiling and having a great time. And it's a bit hard to see, but my colleague, Ashley, here, is holding a trapped golfer up front. Okay, let's look at the left side, Mr. Blue Shirt, not so much interest. And the man to his right, looks a little more concerned about the whole procedure. Plaid shirt behind Phil, he looks amused, could be a good golfer trapper. Plaid shirt behind a Ashley, maybe wasn't knowing the picture was taken, but doesn't look so much like the right guy for the job. So this really is the issue.

When I went and visited a school to do a cost of IPM analysis I took the opportunity to talk to them about their golfer program, specifically because there was some golfer bait sitting on the shelf in the office. And I feel like this district has a very good IPM program, and mostly what they do for golfers is trap. And I say "Why is it that mostly you trap?" And the answer was that it is the head custodians at the schools who are tasked with trapping, and at a few of the schools the head custodians were unwilling to do the interactions with golfers, and so those schoolsites have been allowed to use the strychnine bait.

Now that district started with a very large a aluminum phosphide knockdown treatment about five years ago and then switched over to trapping. And, you know, that's the kind of thing I'm looking for. If you're going to use a fumigant-type application, it's great to do a big knockdown and then supplement and maintain with trapping. What we really don't want to see, because of not good IPM, is those continued applications month after month, sometimes year after year, and just wonder, you know, why are we doing the same type of thing when we're not getting good control.

But obviously, you know, within the maintenance and operations departments it's not that hard to find people who are willing and able to do this. Look at the people's faces here. I'm sorry, I'm laughing just looking at it myself. So if you go down the row you can see that most of these guys are petty okay with what they're doing. Some of them are extra happy about it, and some of them are still showing a bit of concern. And so you can see just by the way they're holding the golfers.

So, at the institutional level, if you want to prevent golfer problems and the associated parasites and the diseases that they vector from hanging around, not to mention, you know, twisted ankles and whatnot on athletic fields, you've got to find the right person who is willing to implement the right kind of program to be effective. One last thing about this slide, the Hula Hoops are for a different project. That's for looking at the percentage of weeds. But everyone always asks, "What the Hula Hoop about?" It has nothing to do with golfer control.

Okay, we know what districts are doing the most applications for golfers. We know what they're using. We know what companies they're contracting to do it with. We know our goal is to reduce the number of pesticide applications, and we know the solution to this golfer problem is a well organized and maintained trapping program. So we have the capacity to make an impact here. We know who is doing the most of it, why they're doing it, and what a good solution is. And now what we really need to do is implement this and start doing outreach to the companies doing the most application and start targeting our outreach more precisely to where the golfers are a problem and who is having a big problem with golfers, which we can infer from our data.

So I'm very excited to be working on this, and one of the reasons is because I have never had a better opportunity to help track the impact of a program. This reporting requirement and all the work that the team puts into building and maintaining the database gives us a tool that we can actually see over time the use of these particular pesticides, and we're just at a jumping off point of having a great dataset, of having an idea of what's going on in the school districts, why they're having this problem. After we enter the data this year, we're not only going to know who is using a contractor to take care of their golfers but who is targeting golfers themselves. So we'll have an even more complete picture of what's going on. We can specifically target those people and then we can specifically track that change in the number of applications, these AIs, and these products over time, and see if we're making an impact or not. And as I mentioned at the beginning, it's all under the umbrella of protecting children's health, but also facilitating the adoption of effective least toxic pest management programs. So I'm excited about it. I hope that you're

a bit excited about it too. If you are, if you're interested in what I'm doing here, please feel free to get in touch.

Here's my contact information, and I'm going to go ahead and read this disclaimer, as required, while my contact information appears. "The mention of pesticide products, their sources, or their use is not to be construed as either an actual or implied endorsement. Mention is made of one or more representative products, but the Department of Pesticide Regulation does not recognize any pesticide as superior to any other."

Unfortunately my last slide with contact information for our program was one of the casualties of converting between PC and Mac and uploading to the Internet, but we have a great program going on here in California, and we would love to get in touch with other people doing similar things, share ideas, find out what's going on.

Oh, I'll flip back to my contact information for that slide, and once again, I appreciate your attention and you inviting me to speak here today. Thank you, Eric, and thank you everyone for attending today's presentation, "Data Driven: Utilizing California's School Pesticide Report Database to Improve Golfer Management." On behalf of the National Environmental Health Association and our presenter, thank you for joining us today.