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ENVIRONMENTAL PROTECTION AGENCY

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

SB 673:

CUMULATIVE IMPACTS AND

COMMUNITY VULNERABILITY SYMPOSIUM

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

AUDITORIUM

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Janet Whittick
California Council for Environmental and Economic Balance

Florence Gharibian
Del Amo Action Committee

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INDEX

INDEX

--* = In the interest of time participants were invited to reach out to presenters directly.

PROCEEDINGS

9:10 a.m.

MR. ALATORRE: Welcome, hi. My name is Derrick Alatorre, I am Deputy Executive Officer for Legislative Public Affairs and Media here at the South Coast AQMD and we want to welcome everyone here this morning for this really important symposium here.

We have worked very well with DTSC in the past; I think this is just another good opportunity for folks to learn about cumulative impacts and how it's affecting communities. We work closely, like I said earlier, with DTSC on Exide as well as our air toxics investigation in Paramount and in Compton.

So at this time I'll just turn it over to Ana Mascareñas; she is the Assistant Deputy Director for Environmental Justice at DTSC. Thank you.

MS. MASCAREÑAS: Hi, good morning, everyone. Thank you all very much for being here and thank you to South Coast Air Quality Management District for hosting us all here. You are all here to bring your expertise and your creative ideas on how we can address cumulative impacts and community vulnerability in our work together as communities, as environmental regulators, as researchers and everyone in the state to protect public health and the environment.

My name is Ana Mascareñas; I am the Assistant

Director for Environmental Justice and Tribal Affairs at DTSC. I would like to share - I know this is part of the conversation today - that we all have responsibility in our role in the state of California to use our best available science, information, value community knowledge and use all the legal tools and expertise we have to best serve the people of California.

So today this symposium is part of a partnership with Environmental Justice and the Permitting Division to address cumulative impacts and community vulnerability in informing permit decisions for hazardous waste treatment, storage, transfer and disposal facilities. This is in response to Senate Bill 673, which became effective on January 1st, 2016, and this particular symposium and related meetings are really unique opportunities to examine and improve the protectiveness of DTSC's permit criteria; at the same time enhance transparency and accountability and communities as the Department updates our regulations and practices for hazardous waste permits.

Thank you again to South Coast Air Quality Management District for hosting us today; for logistical and audio/visual support as well.

This symposium is being webcast live as well as recorded later for those who want to see it online. Additionally, a verbatim transcript and minutes will be

prepared and posted on the website as soon as they become available.

Thank you all for being here.

Next I would like to introduce a representative from the office of Senator Ricardo Lara: Jonathan Flores would like to share some remarks and we are very appreciative that he has come here today. Thank you.

MR. FLORES: Good morning, everyone. My name is Jonathan Flores; I am a representative for State Senator Ricardo Lara.

As many of you know, Senator Lara authored SB 673 and it was signed into law back in 2015. The over-arching goal of this bill was to improve the DTSC permitting process by establishing clear standards and criteria that the Department must follow and they must consider when issuing or renewing a hazardous waste facility permit.

Senator Lara represents southeast LA, so cities like Maywood, Huntington Park, Paramount, you know, they're all right along the 710 corridor, as well as Long Beach. So it's an area where residents who are predominately Latino and low-income live alongside heavy industry, freeways, rail yards, metal processing facilities and other toxic-laced facilities. For years his constituents have dealt with crisis after crisis from Exide to Paramount. Just a couple of days ago we knew that -- our office found out about the

release of hexavalent chromium in Paramount.

So a couple of years ago he recognized the need to restore the public's faith and confidence in the agencies that are entrusted to protect public health and the environment and that was the reasoning behind SB 673. He thought it was important for stronger and transparent permitting criteria around a facility's compliance history, financial assurance and the community's demographics and profile, especially the presence of sensitive populations and multiple pollution burdens and vulnerabilities. You know, like I mentioned before, we see what's happening in Paramount and it is more important than ever right now, you know, the importance of this symposium.

I know from Senator Lara's perspective robust public participation and the involvement of all stakeholders, including industry, is critical for the success of this effort. Our office looks forward to being engaged and serving as a resource and partner in the state legislature.

Thank you for the opportunity for having me here today and enjoy the symposium. Thank you.

MR. GHAZI: Thank you, Jonathan.

Good morning. My name is Rizgar Ghazi; I am the Acting Deputy Director for the Hazardous Waste Management Program at the Department of Toxic Substances Control.

On behalf of Director Lee and the Department I welcome you to this symposium today. As you know the first symposium was held in March of 2017 in Northern California, this second symposium is being held here.

The intent of this symposium is to delve deeper into the data management and how we collect data so that information can be used for determining what kind of -- what is the -- to state this problem and to look at the cumulative impacts based on the data generally that we have out there.

So we have a full agenda today. The full agenda talks about a lot of details of the data itself and then we have speakers from a variety of agencies and communities that have come out here to discuss this with us.

Cumulative Impacts: Vulnerability, Risk, and Health

I want to jump into the agenda right away. I want to introduce Dr. Gina Solomon, our first speaker. Dr. Solomon is the Deputy Secretary for Science and Health at the California Environmental Protection Agency. She has been on the faculty in the Division of Occupational and Environmental Medicine at the University of California, San Francisco since 1997, where she still holds the title of Clinical Professor of Health Sciences at the University.

Dr. Solomon served as the Director of the Occupational and Environmental Medicine Residency Program at

UCSF from 2008 though 2012, the Associate Director of the UCSF Pediatric Environmental Health Specialty Unit from 2003 through 2009, and as a Senior Scientist at the Natural Resources Defense Council from 1996 through 2012.

Dr. Solomon received her bachelor's degree from Brown University, a Doctorate of Medicine from the Yale University School of Medicine, and a master's degree in public health from the Harvard School of Public Health. She is board-certified in both internal medicine and occupational and environmental medicine and is licensed to practice medicine in California.

With that I want to welcome Dr. Solomon.

DR. SOLOMON: All right. Thank you, Rizgar. It's good to be here and thank you all for coming. I have some slides which I think will be coming up in a moment. But what I am going to be doing this morning to kick off the discussion today is to talk about some approaches for looking at cumulative impacts in a very sort of broad overview kind of way, looking at some of the pros and cons, and then giving a hint of what I see as some potential tools to come in the future. It may not really be ready for prime time yet but I think one of the things that I'm hoping to convey is that there are some things that are emerging scientifically that could be very useful for this discussion.

One of the things about environmental justice that I think is sometimes not articulated fully is how data driven this field has been since the very beginning. Since the very old -- this is the version on the EPA website, you can see it just looks old and curled around the edges but it's only 1983, which isn't that old for me.

The General Accounting Office put out this report on the siting of hazardous waste landfills and that was soon followed up with the United Church of Christ's really, you know, ground breaking and very -- the report that kind of kicked off the movement on toxic wastes and race. And these were done looking at mapping and associations between the siting of hazardous waste landfills and the race of the communities where these landfills were located. So it was data that drove this field and this movement and it really also did start with this issue of siting and hazardous waste and so we are really standing on, sort of building on this movement and this basis of science.

And of course as you all know, the science has moved on dramatically well beyond single sources of pollution and looking at multiple different sources of pollution and finding similar types of notable associations with both race and income of the communities.

And then moving on in more recent years to start looking at the interactions between all of these different

multiple effects and finding that when you look at health endpoints there are clear, based on multiple different studies, clear interactions between socioeconomic stressors, pollution stressors and health effects. So we have got the full circle now but it is a dotted circle with gaps in it, so that we know that there are these effects, they are scientifically clear, but how do we actually turn that into something that we can use for clear action? That's the challenge.

I am going to be talking about a number of different concepts and they are based on a couple of papers that were co-authored by me and a couple of folks from the Office of Environmental Health Hazard Assessment, Lauren Zeise and John Faust as well as Rachel Morello-Frosch from UC Berkeley on cumulative environmental impacts. These are available online if you are interested in digging into them further. I don't know if you can quite read the citation there and it's an annoying, long, difficult web link but you can pretty easily pop them up on Google.

So what we did there in these papers was we just sort of laid out the step-wise logic here.

That first of all, health disparities are linked to both social factors and environmental factors, right?

Then there is this clear significant set of inequalities that exist in the exposures to the

environmental hazards.

And then there is the identification of both intrinsic factors that can sort of modify our responses to these environmental hazards.

And extrinsic factors that can modify or amplify our responses to the environmental factors.

And that is sort of represented in this diagram, which is actually not published yet but it will be soon, I hope. But it sort of looks at all of these different extrinsic factors that have been shown to influence our health over our life span as well as all of these intrinsic factors and the way that they are now shown to interact with each other.

And you can sort of see the seesaw or balance of increasing resilience and ability to tolerate, for example, potential stressors, versus decreased resilience. As resilience decreases and the stressors pile on it ultimately results in disease, disability and ultimately premature mortality, which is what exactly we are trying to avoid here.

So we really need to think about this balance of all these intrinsic and extrinsic factors. And instead those of us in government agencies are working within our what some call silos but certainly within our areas of mandate and those are limiting so it's hard to figure how to

do we deal with all of these, so that's the challenge.

So today we are struggling with this issue of how do we correct environmental injustice? We need to measure it.

How do we measure it?

Well, we need some information and tools to do that and those tools should be as participatory as possible, they should allow comparisons and should be somewhat quantitative, as quantitative as possible.

And so we looked at these types of analyses and really, you know, identified the different types of decision contexts that they can operate it and it turns out that there really isn't a one-size-fits-all. That's sort of the bottom line message of this slide because it depends, you know. Do you have a sort of a project-based question that you are trying to answer? Are you trying to look at a specific chemical and make a decision around that chemical? Or a program. Or are you looking at a geography, a specific area for some reason or a population such as people who engage in subsistence fishing? All of those are different decision contexts and you need different tools for those different decision contexts.

So that means that there is probably no single answer for all decision contexts but fortunately, at least, DTSC is facing a somewhat specific decision context here so

that may be a little easier in this situation.

So we identified in our papers six primary existing approaches currently to looking at cumulative impacts: biomonitoring, cumulative quantitative Risk assessment, ecological risk assessment, health impact assessment, the primarily European version known as burden of disease or the disability-adjusted life years technique and environmental mapping.

I am not going to really talk about them all here, partly because of time and partly because I don't think they all apply and also partly because you are going to be hearing about some of them.

So, for example, Health Impact Assessment is going to be discussed later today by another speaker so I won't talk about it this morning except just to mention that on the scale of level of community engagement it's at the high end, so that's one reason that that's particularly interesting and worth delving into more deeply. On the other hand it tends to be a little more qualitative rather than quantitative and so that's a tradeoff to consider.

There are other versions that are much more quantitative such as the Burden of Disease approach, which is in fact so quantitative that it becomes almost impossible to really capture most of the things that I think you want to capture, and I think we should capture, and so for that

reason I am actually going to nix that right now, though if you want in the Q&A I'm happy to talk about it more.

Health Risk Assessment I will talk a little bit about even though it's quite quantitative.

Also Cumulative Impacts Mapping, I'm sorry, you're going to be hearing quite a bit about that, you've already heard a good bit about CalEnviroScreen, you're going to be hearing about EJSCREEN, so I won't be covering that.

And I am not going to talk much about Ecological Risk Assessment because I think that that is a - again, I can do that in the Q&A - but I think it's not quite, we haven't figured out quite how to do it right. Again, it was a time question.

So let's talk about some of the others on that previous slide.

Biomonitoring can be fairly participatory and quite quantitative and it's a good way of measuring hundreds of chemicals in people so it gives us very relevant information about individuals in communities.

It allows us to compare people in one geographic area against a national average or against other populations.

And it can allow us, most importantly, to look at change over time. Are our interventions actually making things better? That's key.

And then the most important area in biomonitoring, the most exciting part is the new and emerging ability to do non-targeted or semi-targeted testing. What I mean by that is that in the sort of standard biomonitoring you're looking for a panel of chemicals and you know what chemicals you want to look for. You're checking for PCBs or PBDEs or, you know, a certain list of pesticides or phthalates, whatever you're looking for at a given time. Heavy metals.

In this non-targeted approach you are actually asking a much more general question. What is in this sample from this person? And that in some of the new emerging methods and some of these most exciting areas are being developed out of the Office of Research and Development at USEPA so let's hope they can keep their budget for this, but we are also doing a fair amount of it here in California including at DTSC itself where their lab is doing semi-targeted and non-targeted testing.

And it can be quite surprising what you find when you start doing broad scale testing and it can help us identify, for example, chemicals that are being substituted in. New, emerging flame retardants, new, emerging phthalates that are replacing some of the older ones start to pop up and we kind of go, okay, we need to be aware that this is coming, so that's an important potential.

But there are some real problems with

biomonitoring. One problem is -- well, I didn't put this on the slide but it tends to be fairly slow but it's pretty expensive. And part of why it's slow is you have to go through all of these protections for human subjects, right? You're doing research on individuals, you can't just run out there into a community and start drawing blood or grabbing urine samples, you have to do it through a very careful process and you have to return the results to the individuals before you can release them publicly. All of that takes time and money.

There are a bunch of chemicals we really care about that can't be biomonitored. I'm looking at Carol and I'm thinking, yeah, fumigants. You know, we can't measure agricultural fumigants but we really care about those, right? And there are quite a few of the more short-lived volatile organic compounds that DTSC cares a lot about that are really not easy to biomonitor for and they don't last very long in people's bodies even though they do a lot of damage during the time they're in there so we might not pick them up.

You don't know where the exposure is coming from. So you pick something up in someone's blood or urine but did it come from a consumer product, did it come from their work place, did it come from their home, did it come from the facility that they're living next door to? You don't know,

it all looks the same.

And then it doesn't evaluate all those other factors that I just put up on that earlier slide, all the other intrinsic and extrinsic vulnerability factors. How do we wrap those in? Some of the tools I'm going to be talking about in a few minutes may give some hints but we are not there yet. So this is something to consider and talk about but it has some disadvantages too.

So Cumulative Risk Assessment, okay. You all know what risk assessment is, that's basically how we are going out and evaluating "Is this level of a chemical considered acceptable or safe in some particular decision context, whether it's in soil or air or water?"

And it's usually -- you know, this field has correctly been blasted really, criticized for looking chemical by chemical and not looking at cumulative impacts and there have been some efforts to start trying to figure out how to do cumulative risk assessment.

Well, it's been done in some areas. So, you know, organophosphate pesticides as a group. EPA tried to do cumulative risk assessment on those. Obviously classes of chemicals like the PCB congeners or dioxin congeners have been looked at.

And then chemical mixtures. South Coast is doing more than anywhere else on diesel exhaust and that is

because of OEHHA and others looking at the complex mixture of diesel as an entity that needs to be evaluated. And so you can look at some mixtures.

And they are starting also to really better incorporate intrinsic vulnerabilities. In other words, the genetic factors, age factors, in some cases sex differences, that result in some people being more vulnerable than others. And so that can also -- I put an X because I don't think we fully have captured that yet but we're getting there in risk assessment.

But what about all the other exposures or what's called the "Exposome" which is the full set of things that people are exposed to.

And then you pile on top of that all the exposures and all those non-chemical stressors, the psychosocial factors and so forth, those are not captured.

And then you try to pile all that together and risk assessment kind of crumbles.

That is not to say that there is no way to deal with that but it is to say that we have got a long way to go in that field. So trying to use a standard risk assessment approach might be useful for some things, it is quantitative, which is sometimes helpful for speaking as a regulator. I know that if we have numbers it makes it easier for us to move on the issue and so that's something

that we are thinking about a lot.

So let's think a little bit more about the exposure side. I know that Melissa from Aclima is going to be talking about some of this type of stuff too but this area is going to completely change how we see our communities and I really think that within a very short number of years we are going to have, you know, pretty much everybody out there measuring all kinds of things in their day-to-day lives. Jesse is laughing because he's already doing it. This is going to be a game-changer.

And so how can we position ourselves so that we are ready and able to use that kind of information when it comes in because it is going to be -- you know, right now when sensor technology data comes in to a regulatory agency we have sort of had trouble figuring out how to deal with it and whether we have enough confidence in the information to be able to use it. How do we get past that?

South Coast, again, since I'm here at South Coast I just want to give them a shout-out because they are really doing some cutting edge work here on really -- so here actually is the South Coast lab where they are actually testing out these sensors and figuring out, "Okay, are these reliable and under what parameters?" and testing them head to head against standard air monitoring equipment to basically -- I mean, it's like Consumer Reports here for all

of us who might be using them. Are they actually going to give us reliable information? And if so, how do we need to handle them in terms of some of these are very accurate early on but after a few months they kind of lose their level of accuracy so we need to know that. So that kind of information is something that is going to be very helpful.

So getting to Future, since I already started some Future with the sensor technologies. I want to get more into the health biomarkers because what we are basically talking about here are how do all of these factors, individual genetic vulnerabilities that we all have in one way or another, plus all of the social stressors that some people are facing far more than others. Plus all the negative environmental factors that can occur that just kind of weigh some people and communities down. How do we measure that?

So down the left hand side are three terms that I am going to be digging into: Allostatic Load, Telomere Length and Epigenetics that I want you to, if you are not familiar with, I want you to be familiar with because I think that they are going to pop up again.

So what is Allostatic Load? Some people call it Toxic Stress. It is a term that basically describes the multi-system response that we all have to chronic stress. Now, stress is not a bad thing. Our bodies normally respond

to stress, all animals do, we are supposed to have stress responses to stay alive. But the problem is when it becomes chronic and persistent day after day after day.

And those hormones, those primary stress hormones like cortisol, epinephrine, norepinephrine and dehydroepiandrosterone, all of these hormones just like end up being like constantly secreted, not in a normal pattern because of the fact that we are dealing with something that is not supposed to be a day after day. You're not supposed to be chased by a lion every day of your life, right? You know, if you're living in the desert you might be chased by a lion once or twice and you really want those hormones to kick in.

But some people are basically being stalked by tigers and lions every day, okay. That's what their lives are like and they are secreting these stress hormones all the time. When that happens there are all kinds of secondary effects that can also be measured just like those hormones can be measured in people, inflammatory mediators like C-reactive protein, tumor necrosis factor, interleukin 6.

We all talk about hypertension as if it is completely different but hypertension is caused by many of these types of hormonal changes so that is a marker, a secondary marker of allostatic load so we can think about it

like that. Heart rate variability. All of us, our heart rates are actually supposed to kind of bounce around a lot, it's normal. But people whose heart rates don't, it's actually a really important marker, basically a risk factor to disease.

And a lot of other things that we have often thought about, insulin, cholesterol, triglycerides, even waist-to-hip ratio, all of those kinds of things we think about them in different bins, normally. We think about them as markers of cardiovascular risk; they are. We think about them as, you know, markers of diet; they are. But they are also markers of allostatic load and toxic stress.

And then tertiary markers, which is, you know, tertiary markers is kind of too late, right? That's when people are already sick and that's what we are trying to prevent in our communities. So can we measure those things?

So then this amazing woman, Elizabeth Blackburn, whose photo you see in the upper right, just shouting out to her. She was a faculty member at UCSF for many years but she has moved on now to bigger and better things. She got the Nobel Prize for this so yay for women scientists. She discovered this issue of telomere length.

So what are telomeres? They are basically little caps on the end of all of our chromosomes and we all have them, we are all born with them. But what happens is every

time our cells divide and the chromosomes split like they do in cell division a little bit sort of comes off of those telomeres so they get a little shorter; and they get shorter and shorter. And then at a certain point the cell can't divide anymore because the telomeres are too short and the cell is basically senescent, you know, it eventually dies, it never replicates again. This is normal, okay, it happens to everyone, it's part of the aging process, it's fine. But it turns out that it happens at different speeds and to different degrees in different people. Hence, life expectancy, right, differs according to in significant part the length of our telomeres.

And so when you look at telomeres you also see not only life expectancy, which has been well-developed, but also a lot of different diseases. This is from the huge Nurses' Health Study which shows that - this is actually from just a small subset group, this was a pilot study within it - that looked at women with dementia compared to healthy controls, same age, and controlled for a whole lot of other things, and found that the telomeres in the women with dementia or mild cognitive impairment, sort of in the middle, have much shorter telomeres, and they found the same kind of thing with -- I didn't put up a whole slew of slides on it but you can see the same kinds of patterns with osteoporosis, cancer, diabetes, heart failure, coronary

heart disease in general, so we know it's associated with a whole variety of illnesses.

And so yes, I told you before, our telomeres shorten with age, it's normal, right, so you see the line there. But look at all those dots; they are all over the place. And what that shows is that at any given age there is a huge, huge variability in telomere length. So you take a whole bunch of people in this room who are the same age, you test them all and they will not have the same length telomeres. And that is an important indicator of health likely or potential health outcome and the ability to measure this is now becoming -- it is not quite a day-to-day thing, you can't run into your doctor's office and get this test done; I think in the not-to-distant future you will. And this is the kind of thing where if we can start to look at this in communities this is a marker of combined effect of all of those stressors on people of a given age. So we are starting to get a cumulative impact right there I think.

Epigenetics, another exciting way to maybe start measuring cumulative impacts in the future. So we look at these two mice. These are agouti mice, they are absolutely genetically identical. They don't look it, do they? That's because they are epigenetically very different.

I learned in high school biology that our genes make us and then I learned that we share almost the genome

as the ape and we all are almost identical genetically but we all look different, right? And all the cells in our bodies are all genetically the same but, you know, our eyes function differently than our hearts which function differently than our skin, right, but they are all genetically the same.

Well why is all of that? Well, it's because our genes are basically our piano keyboard and the epigenetic markers on our genes are the score to the music that each cell plays, right? And so there are little -- those little purple things are supposed to represent the methyl groups that attach to our DNA and there are various different kinds of epigenetic changes. Some are methylation, include methylation of DNA, others have to do with histone modification, which are these things that basically kind of cause the DNA to roll up, it's like a spool for the thread.

And so what you'll see is that depending on where the DNA -- and those little changes basically turn on or off different segments, different genes of our DNA, so a gene is either silenced or activated. So you can have the exact same genome but this part is being transcribed, this part is not, this part is, that part isn't. And that's what makes up the whole, you know, amazing difference in life but it also leads to all kinds of vulnerabilities.

What about those cancer genes? What about those

genes that are associated with chronic stress and all of the changes that just talked about under the allostatic load slide. Those are genetic and actually epigenetic changes that represent genes that are being activated and chronically activated in our cells and in our bodies that are then resulting in this whole slew of changes, which can be either changes that increase our resilience or that make us more susceptible. So that is a key marker.

And the other thing that is kind of creepy about epigenetics is that it turns out that they can be transferred generation to generation. So the stressors of our parents or even our grandparents can actually affect us and our children. And this has been seen in studies, for example, of people who were in war kinds of situations and their kids and grandkids are more susceptible to a whole variety of stress-related diseases. It has also been shown in laboratory animals exposed to chemicals including diethylstilbestrol where I think the great-grandkids of the animals are at increased risk of breast cancer. Bisphenol A has multi-generational effects. All of these are now being shown either in laboratory studies in animals or in some human studies in human populations, so you see these changes that can get passed on really through epigenetic modifications in our reproductive cells in both sexes.

And all of these different factors, including

toxic chemicals and including stress states, all can have effects -- and our diet, very strongly can have strong effects on modulating our epigenome.

So Ken Olden, who is pictured on this slide, who was for many years the Director of the National Institute of Environmental Health Sciences then went to EPA and was the Director of the Office of Research and Development for many years and on the left is Rachel Morello-Frosch from Berkeley who many of you know. But Ken came up with this idea that he published in the *American Journal of Public Health* a few years ago called *The Neighborhood-Specific Epigenome*. And this is my last point. And I think that this is brilliant but again it's a future, I'm talking future here.

He is hypothesizing that all of the multiple stressors, or positives if you happen to be wealthy and live in a really lovely neighborhood, all of those things mark our genome with epigenetic changes and modulate the expression of our genes and result in changes that stick with us for our entire lives. In other words, we are marked by where we grew up, where we live, and potentially given what I said in the previous slide, where our parents grew up.

And if that is true, then you ought to be able to go measure that, right, to actually evaluate the epigenetic modifications in people's genes and start identifying

markers that will differentiate between more advantaged neighborhoods and more disadvantaged neighborhoods.

Now I can see all your brains working and thinking, oh my gosh, this is kind of scary, right? And so that's why it's sort of the last point. I think it's kind of cool but kind of scary because this is very intensely personal stuff so do we want to start getting into looking at genetic information? I personally am super-curious whether this will pan out but I am not sure I want to start getting into this area and I don't think we as a state do.

But I think that it is probably coming in some way, shape or form in the research realm and it will be very interesting because my guess is that Ken Olden is right and that there will be different genes that will be turned on or off in some kind of systematic way. And once those genes are identified it may be possible to without looking at all the other personal information in the genome to just look for, for example, a specific marker that can be an indicator of this cumulative toxic stress from our environment, the social situation and all of the other factors that people are facing.

And if we can figure that out maybe we will be able to move that marker because the whole point here is -- I mean, the whole point of measuring this kind of stuff is can we help improve it? Can we make changes that will

actually mean that there will be fewer and fewer differences, right, between people who are living in a more advantaged neighborhood and a more disadvantaged neighborhood? And as we bring those neighborhoods together can we show that we are actually improving what is going on out there? And I don't know if we can but I figured I'd just give some vision there.

So basically my bottom line is all the existing approaches to cumulative impacts all have serious limitations. It is like almost impossible to capture all of these different exposures and intrinsic and extrinsic stressors. A lot of them aren't quantitative enough to really help guide decisions; some are getting there and I think some of the mapping approaches do. Some are very technical and very tough for communities to engage in and that's also a problem.

But some of the newer markers may start to help us as we go forward in the future with better measuring exposures and toxic stress and overall health.

So I hope that's a helpful way to start this discussion. I just put up -- I love this CalEnviroScreen slide so I use it. In case there's time. I don't know if there is time for questions or should we move on? Time for just a few questions if anybody wanted to just sort of jump in at this point.

MR. GHAZI: A reminder to the viewers through the webcast, there is an email that you could send your questions as well. Right there.

DR. SOLOMON: I'll start with Jesse.

MR. MARQUEZ: My name is Jesse Marquez, J-E-S-S-E, Marquez, M-A-R-Q-U-E-Z, and I am Executive Director of the Coalition for a Safe Environment. I live in the city of LA and specifically the Port of Los Angeles Harbor community.

Well, I love hearing Gina speak because I always learn something new. So now my little question is, can I now go to my doctor and tell him I have Allostatic Load Stage-1 and Stage-2?

DR. SOLOMON: You know, I think that there are already in the Allostatic Load arena some -- there are some tests that are already being done and used by doctors, I mentioned c-reactive protein. That has now just in recent years become a reasonably standard medical test. So if you wanted to go to your doctor and have them test for that, that would be easily done by any laboratory.

What it would show is whether you personally had an elevated c-reactive protein and if you did your doctor would say, "Well, you're under too much stress, Jesse, you've got to reduce your stress and take it easy" and would probably give you some dietary advice and so forth. You know, it's an option.

But it is something where at a community level as opposed to at an individual level we could start seeing systematic differences. That's where it starts to get really interesting because that's where we start to identify the stressors that go beyond the individual and so that's where my thinking is. You know, obviously you could decide to do it, go to your doctor at least with that. There are a lot of other tests out there that are not yet available that I talked about but what I want to see is more studies looking at different communities and how they compare.

MS. WHITTICK: Janet Whittick with the California Council. Thank you for the very comprehensive and educational presentation.

One of the things that I struggle with, though, in looking at these new tools coming in and then thinking about regulatory decision making by the agencies is the role of causation and trying to show that when we are thinking about permits and projects. And I noticed that it really wasn't part of your dimensions when you were looking at the different tools and where they fit in so how are you grappling with this idea of causation or is it just are we moving beyond that?

DR. SOLOMON: I think causation is important, I alluded to it in the biomonitoring area where that has definitely been a problem where you pick up something on

biomonitoring and don't know where it's coming from. And it is also true in many of these emerging areas where you have measures of integrated effects; as you get more and more into the integrated effect you can sometimes get further and further from any individual source. And so that can be difficult and you sometimes have to balance those two or identify sort of an approach where you're coming in from both ends. Where you might, for example, you know, just sort of throwing out ideas here, I'm not necessarily recommending this. But, you know, if you're concerned about a specific community or a specific facility, do you see an association that is associated with any of these markers in proximity with that facility that you don't see in areas that are further away? That could be one way to approach a question like that.

So I was basically more looking at tools that can help us begin to get a handle on this complex area. Doing the studies that would try to show associations or causations with any individual source will be difficult but are not impossible. And sometimes what you're looking at is if you are trying to establish sort of a background and you're looking at a source over that background you certainly want to know what the background is.

Okay. Well thank you very much, great audience.

(Applause.)

MS. MASCAREÑAS: Thank you.

At this time I would like to invite Robina and Jesse up to the panel.

Thank you very much, Dr. Solomon.

Addressing Community Vulnerability Through Collaboration

So this next panel is focused on -- it is our community panel with these amazing community leaders we have here today. Thank you very much Robina and Jesse for coming. The topic is Addressing Community Vulnerability Through Collaboration and they just have a breadth of knowledge and experiences to share to help inform and help guide our discussions and how we can work collaboratively on these very important topics where there is still a lot of research but a lot of reasons to act and use our information that we have right now. So I will start with introducing both Robina and Jesse.

Robina Suwol founded California Safe Schools in 1998 and it is a children's environmental health and environmental justice coalition. California Safe Schools achieved national prominence by spearheading the Los Angeles Unified Integrated Pest Management Policy, which is the most stringent pesticide policy in the nation for K-12 public schools and the first to embrace the Precautionary Principle and the Right to Know. The success of the policy led to the California Healthy Schools Act and today the LA Unified

Integrated Pest Management Policy serves as an international model for school districts and communities.

On October 6, 2005, Governor Schwarzenegger signed AB 405 sponsored by California Safe Schools. The bill bans experimental pesticides, whose health effects are unknown, from California K-12 public schools. As a result more than 6 million California children and hundreds of thousands of school children are protected from experimental chemicals whose health effects are unknown.

The Coalition continues to be a leader on children's environmental health with an emphasis on schools and environmental justice communities. Under Robina's leadership the California Safe Schools has facilitated changes at the policy level as well as at the grassroots, which creates lasting institutional protection.

Please help me welcome Robina.

(Applause.)

MS. MASCAREÑAS: I will also introduce Jesse since they will do their presentations one right after the other and then we will have time for some questions then from the audience.

Jesse Marquez is the founder and Executive Director of the nonprofit community-based environmental justice organization the Coalition for A Safe Environment. The Coalition was established in April 2001 in Wilmington,

California to eliminate, reduce and mitigate the public health, public safety and community socioeconomic impacts caused primarily by international trade marine ports, freight transportation corridors, petroleum industries and energy industries. The Coalition is involved in community organizing, family assistance, public education, leadership development, community empowerment, urban planning, community sustainability, emergency preparedness, economic development, public policy and program evaluation, public right-to-know, public safety, environmental, social justice and civil rights. The Coalition represents the public's best interests, supports social equity, prepares and distributes public information, conducts community-based research, supports public health, safety, zero emissions, emissions capture and hazardous materials treatment technologies, evaluates environmental impact reports, investigates environmental incidents, prepares public policy and environmental impact report public comment documents and attends governmental agency public meetings.

Thank you very much for joining us here, Jesse.

(Applause.)

MS. MASCAREÑAS: And so Robina and Jesse are going to share some examples and provide guidance and advice and then we'll have time for questions, thank you.

Go ahead, Robina.

MS. SUWOL: Good morning. Thank you very much for having me here today.

California Safe Schools believes strongly that children and adults have a right to learn and work and live in a healthy environment.

For the past two decades we have been working very closely with communities and school districts throughout the state and country in supporting them and protecting their health and the environment. Exposures to toxic chemicals, they threaten all people. Those living in communities with multiple facilities that emit toxic chemicals, they face a greater threat of cumulative impacts.

A perfect example, I think, for today's discussion that we worked on very closely is Paramount, California. The year was 2013 when our involvement began, and it began as it does quite often, with concerned residents or teachers or members of the public just calling us. And in this instance there were multiple calls from teachers and parents and others that worked in the area regarding harsh odors of metal that caused their throats and eyes to burn. And calls were quickly followed up with emails to us with lists, actually quite long lists of residents of various ages who were suffering from cancer and other illnesses. And most haunting to us, especially to me, was the significant number of very young children under ten years old who were ill or

who had tragically passed away.

I didn't waste any time in contacting two of my closest colleagues, Jane Williams of California Communities Against Toxics and Cynthia Babich of the Del Amo Action Committee. Together we have cumulatively almost 80 years of experience working on different aspects involving environmental health and safety. We frequently work together and this just seemed a really important opportunity.

Soon after Jane, Cynthia and I, we met with the residents and teachers and toured the city and provided them with information surrounding a list of the agencies and their jurisdictions because quite often people are uncertain of what role different agencies have and what they can assist them with. This meeting and discussion at their request led to my issuing and requesting and filing Public Record Act requests for more information.

And so after meeting with the parents and their children and speaking to medical experts and reviewing these documents that they had provided and anecdotal stories we had talked -- Jane, Cynthia and I had talked together and with some medical experts and had thought, "What about doing some hair sampling?" Not that we were looking for some definitive, medical, scientific data but just as a fingerprint.

And so with the permission of parents we ended up doing ten samples, nine children, one adult. Protocols were followed to the T with oversight by a very reputable doctor. And again, the purpose in performing these tests was for a fingerprint. Nothing could have prepared us, though, for the results; they were just unbelievable. Uranium, tungsten, arsenic, gadolinium, rare earth metals that one would not ordinarily expect to find in a child as young as two.

And so this data was immediately provided to all agencies. And even though these results appeared to be unusual and to many alarming it was just one single hair test. And so to follow up Jane Williams talked to one of the -- a very prominent, very reliable and knowledgeable environmental expert to test dust in the homes of many of the people where we had done the hair test and curiously what came up, very rare earth metals. So it was extremely upsetting and also curious to find out where were they coming from.

In the interim concerned residents and teachers continued to file complaints. Through our direction they had met with and talked to individuals from AQMD and other agencies, and LA County and DTSC also began to come in and look, and things begin to move more forward. But it was really when things began to change drastically was when a

management, someone in management from AQMD went to inspect a facility and came out and said the following: "I nearly choked to death on the nickel in that facility."

That monitors were placed and there became to be more investigations and inspections. There were many facilities during this time that were not known to the agency that were kind of under the radar and without permits. One of the companies where the monitors were placed, at least at first, was Carlton Forge, a forging company in Paramount. Soon after these monitors many months later began to show hex chrome and that resulted in a full out investigation by multi-agencies, which is something that was very successful and that I hope will be a model for other communities throughout the state and country.

Test results from these investigations and monitoring were placed online. There were town halls, they were ongoing weekly and they continue today to have calls where the community can ask questions. Materials were uploaded online, as I said. There have been workshops addressing these issues and some abatement order issues. I think the key here is that when we all work together that great things can happen.

I especially again want to thank the leadership at AQMD, ARB, LA County, DTSC, County Health, Mr. Bellomo and his staff, and to the CUPAs and USEPA. And most of all I

really want to thank the phenomenal community of Paramount, the teachers, the families and all of the residents and people who work there who were committed and patient and are working all together to protection their community. Again, when we work together great things happen, so thank you very much.

(Applause.)

MS. MASCAREÑAS: Thank you, Robina.

If we can get Jesse's slides up, please.

MR. MARQUEZ: I want to start by thanking everyone for coming to our presentation because it is an opportunity where we can share and exchange information and then have a better understanding of where some of us environmental justice organizations are coming from, what our communities are experiencing and then what happens in the daily life of some of our residents.

(Director Lee joined the panel.)

MR. MARQUEZ: So today I put together 11 slides. You can consider it something like a little bit of a case study because I am going to walk you through a scenario.

In this case we are talking about how a business policy, in this case the Port of Los Angeles, decides to do a business policy change and how that particular change that they make in a policy then turns out to become an environmental justice community nightmare.

So we have a new Senate Bill 673 that discusses hazardous waste facilities, the definitions, things of that nature, so we understand that there's laws, rules and regulations in place. But then now how is this new law and the existing regulations going to apply to a case study that I am now going to present to you of information.

So what happened is that the Port of LA and the Port of Long Beach decided that they were no longer going to be having their tenants store empty containers on port tidelands property.

So each port has approximately 20 different tenants that are there that import cargo. So what happens is that when cargo is picked up it's delivered to distribution centers, warehouses and directly to customers; and then you have an empty container and then that empty container is then returned.

Well, the Port decision to no longer store it then forces these tenants to have to store them somewhere else and that somewhere else is going to be the local harbor community. And even that has changed in the last couple of years because one of the Port of LA storage yards has a 50 acre facility up in the Antelope Valley now, so it has even expand beyond the local range.

Prior to a couple of years ago the City of Los Angeles and also every city did not have any type of a city

ordinance or planning criteria for container storage yards. Because you have to realize, 40 years ago there was no such thing as a container so therefore there was no such thing as a container storage yard.

What brought it to the light in the City of Los Angeles was that in Wilmington we saw a proliferation of these container storage yards popping up everywhere in our community. And at that time we had a new election, a new mayor came in, Villaraigosa, we had a new councilman Janice Hahn come into the picture, and we told her we have a problem of these container storage yards being everywhere. And since some of them are physically located in the middle of the community we now have truck routes coming into our community.

So what happened in the City of LA? She did a fantastic, innovative thing. She went before the city council and asked to get a moratorium in the issuing of permits for container storage yards. At the end of one year they found out that there were 31 of them in Wilmington; 17 of them did not have any business license or proper permits.

So then they created new conditions now. The basic condition was starting with the form. So now if you go to the City of LA and you are going to open up a storage yard there is a checklist now and that checklist is: Are you going to open up a container yard?

So right here you can see photos of what a container storage yard looks like in a residential community. They can be anywhere and they can be everywhere.

So what are our issues? Well, over the 15 years of our life now we have identified over 20 different issues:

Number 1: A lot of these businesses are not licensed, they do not have permits and they have no approved Certificate of Occupancy. So from the basics there, you know, we have a problem.

And then what happens is that when you have empty lots becoming container storage yards in residential communities then we have truck routes that are leading off the main roads through community residential areas. So in one case like Pacific Coast Highway, you have to make a right turn on Eubank, which is a residential community, to get to the container storage yard. Well, you cannot make a right turn, what happens is you run over the curb. And there happens to be people that live in a house on that corner so you can sit there on the porch every hour of the day and you're going to hear that ka-chunk, ka-chunk as they run over the curb. It happens every day.

Even when we do have signs posted "no trucks over 6,000 pounds" trucks are still going down there.

Also what happens is that most container storage yards are dirt lots. So then what happens is as trucks go

in and out they are generating dust, which is PM.

Then trucks that are going in and out typically have been older trucks and the older a truck gets then it leaks its motor oil, its brake fluid, its transmission fluid and it is on the ground and it is dripping on the streets and it is dripping onto the sidewalks.

Then what's emerged from container storage yards, they have also been storing other things besides containers. Containers are transported by being placed on what they called a chassis, which is like a trailer. Well, they now store chassis, they now store containers, and they are now maintaining them and repairing them like a garage out there.

And then you have your TRU, which are your refrigeration units, generator units, there. They are also being maintained and repaired there.

Then you have your truck AC units and they can have anywhere from 15 to 20 pounds of refrigerants in there. and then you have your TRU units there that are, you know, being filled and being leaked.

So then when you have rainy season or things of that nature happening then you have the water runoff that goes into the sidewalk, it goes into the gutters, it goes into the streets and into the sewer system. So then we're talking about hydrocarbons and other types of things.

Many of these containers have held different types

of toxic chemicals or they have been fumigated with methyl bromide. They're there and they are being washed out or they are being swept out to be cleaned.

What happens too is that you have to remember, most of these containers are being manufactured and fabricated outside of the United States, mostly in Asian countries. Well, it creates thousands of jobs for people over there so they don't want the containers coming back because then they lose jobs. So what we end up with, like Wilmington, having a half-million empty containers that are never going to leave Wilmington, so they become container graveyards, they are just there deteriorating. Well, as a result of deteriorating they become blight in the community because they're an eyesore, they look ugly being there.

Wherever there is a container storage yard, because it's fenced around there, they become trash dumping magnets. People go dump trash there. Companies that are -- trucks that you see at the Home Depot wanting to pick up your trash that you want to get rid of, they'll dump it there, so we have to deal with that.

Some of these are refrigerated containers and so they have the refrigerants. And if they are in a container storage yard and they are never going to leave then they're rusting and deteriorating. And then you have these chemicals which are greenhouse gasses escaping into the

atmosphere daily.

Now, since many of these containers are manufactured overseas they have been painted and they have coatings on them. Well, what are the toxic composition of those coatings because now you have them peeling and you have them pulverizing and then the truck dust is blowing them out and on windy days they're blowing across the street into the communities.

Then since we are talking about thousands of containers that are being stored there, when it rains they become vector havens for mosquitoes. I was in a hospital because of an emergency for my family seven years ago. And I'm sitting in the emergency room - and there were two emergency rooms side-by-side - and a woman kept on looking at me. And I'm looking at her and then she smiles and I smile back at her, then she waves at me and then I wave at her, then she comes up and comes up to me saying, "Sir, are you the resident that has that organization that's always fighting for us?" I go, "Yes, my name is Jesse Marquez, la-la-la." Well, I'm here because of my niece and my sister. My niece is 11 years old and she has the West Nile Virus and she is in critical condition in emergency right now."

So one thing leads to another. She asked me "What can I do?" "Well, good thing that, you know, doctors have been researching it and so she'll probably recover and be

okay. But there is something else you can do. Come this Thursday night to the Port of LA because they are going to have an evening meeting of the Board of Harbor Commissioners and explain what happened to your daughter -- to your niece. Because see, that mosquito did not fly across the ocean, it came on a container or on a ship."

So then when we're talking about mosquitoes then we talk about other things. Rats; big rats. They run across the street into the residential neighborhoods looking for food to eat. And so naturally if you have dog food and cat food outside, that's what they're looking for too.

And then you have your possums looking for food.

You have raccoons looking for food, coming into the residential areas.

And then some of these container yards are 20, 30, 40, 50 acres so then they become drug dealer sites and drug user sites, which then presents other problems for the community.

And then some become homeless encampments.

So now you understand that, well wait a minute, this was a simple policy by the Port of LA; how could it have any type of other negative impacts? Well, you don't know if there's negative impacts if you don't do an assessment. So that's where we're talking about a cumulative impact assessment to be able to identify what are

all the negative and potential impacts in a community. So once you identify them then you can assess what is the degree of severity of that impact. And then if you also do another thing, which I see is on the agenda, a health impact assessment where you do a public health survey, then you can determine what have been the public health impacts to a residential community.

So that is what I wanted to share today, in a nutshell, so you have a broader understanding of what environmental justice communities go through and I thank you for this time.

(Applause.)

MS. MASCAREÑAS: Thank you, Robina and thank you, Jesse.

I am going to sort of combine just into one panel question and then make sure to take questions from the audience. And if you're watching from the webcast, if you email Permits_hwm@dtsc.ca.gov, we have staff who are watching that email address and we can field questions for folks who are watching from a webcast as well.

Before jumping into the first question to kick off the discussion, though, I would like to acknowledge Director Barbara Lee just joined us at the symposium. Would you like to share anything?

MS. LEE: I don't need to take up any time right

now other than to say I am really happy to be here. I apologize for being late, I had some travel challenges this morning. I am very happy to see both Jesse and Robina here on the panel. I've worked for many years with them and have very high regard for the community work that you both do. Glad to see all of you here as well and I understand we have quite a number of folks who are participating via the webinar. This is an important effort DTSC is undertaking and we are looking to collaborate with everyone as we move forward trying to better characterize our community vulnerability and cumulative impacts and to find ways to have that characterization better inform our decision-making when it comes to permits. So, thank you.

MS. MASCAREÑAS: Thank you.

So you both covered an example of -- Robina, an example of agencies working together to address an issue that is broader than just one exposure; and Jesse, some of the challenges with decisions that are made that perhaps have a whole slew of impacts.

I was hoping you could share your thoughts on examples of how or what advice you would give for communities working with agencies and with government directly in a more collaborative way. You both have a lot of experience in this. But if there is some advice you would give, and especially looking at cumulative impacts,

community vulnerability, what would you want to share as we are undertaking this effort around permits in particular?

MS. SUWOL: I just would suggest that when you have these meetings, initially with regulatory agencies, to be very honest and direct and to be a good listener on both ends, the agencies as well as the community. I think spinning tales or just misrepresenting facts, when you start off on that kind of footing it really leads nowhere; you really need to be working on a basis of trust. I think beginning with that is a really good beginning.

MR. MARQUEZ: So I'll talk on two little points. If you're a community resident or organization listening or watching then you need to do what I have done in my example. I made a list, 1, 2, 3, 4, 5, 6, of all these impacts. That way when we go to an agency or we go to a city council member or another elected official we can say, here's the things that we have identified and here is our list of concerns that we think need to be addressed.

From an agency perspective, when residents and organizations are describing impacts and concerns then okay, well what tools do we have that can then help identify them and help assess them? Because by identifying them we now recognize that there is an impact. By assessing the degree of impact then we can determine, okay, then what is needed?

Now, you might be DTSC, you might be ARB, you

might be EPA. Whatever agency you are you have to look at it: Well what role do I have? And if we're talking about SB 673 and we're talking about hazardous waste and hazardous waste facilities then does a container storage yard fall into that criteria? And you would not know that if I didn't mention that trucks are leaking oil, transmission fluid and brake fluid and you focus on that.

If you are in the regulatory arena then you can say, "Okay. City Planning Department, I need you to come here because I'm a council member and I think we need to now update a city ordinance or city zoning criteria."

So in the Wilmington example what happened was that when you checked off the little box "container storage yard" new things then applied to you. It absolutely had to be in an industrial zone, you had to have a six-foot block wall, it had to be recessed 15 feet with a sidewalk, it had to be landscaped and maintained, you cannot stack more than four containers tall. And if it was a dirt lot then you had to have a street sweeper to clean it and if it generated a lot of dust then you had to water down the lot as well.

So you can see where residents brought up an issue, a city council member listened, she took a proactive effect of getting a moratorium, planning, police, public safety jumped in and they came up with a solution and that exists today. And if we're talking about hazardous waste

then, then what permits apply? What needs to be done and are there other agencies you need to team up with? And it just turns out that is exactly what is happening now. There is a special task force with DTSC, ARB and EPA that is going to now investigate these container storage yards.

A good thing is also getting ready to be released, the Harbor Community Benefit Foundation has just completed what is called a Land Use Study, the first of its type for a port community. Actually, another title would be The Port Community Nexus Study where it identifies not only these container storage yards but numerous other off-port impacts. So in the next 90 days it will be released to the public.

MS. MASCAREÑAS: Thank you. We are going to go to the audience for questions; if anyone in the audience has questions for Robina or Jesse at this time?

(No response.)

MS. MASCAREÑAS: Are there any questions that have been emailed in through our webcast?

MS. RODRIGUEZ: No.

MS. MASCAREÑAS: We really appreciate, for everyone in the audience, let us know. We learned a wealth of information from the examples and the case studies that you both provided. If you would like to share anything else we are going to -- as you referenced, a lot of these decision-making tools, we really appreciate that having

these conversations you have to start from a place of honesty and trust in order to share what we know and what we don't know to bring that information together. And I think we have some more remarks over here.

MS. LEE: Since there aren't a lot of questions right at the moment from the audience I have just a little bit I'd like to throw out there for us to discuss for a moment and maybe that will prompt some questions in the audience as well.

It strikes me especially, Jesse, listening to your presentation, right off the bat I would imagine the folks from DTSC's permitting shop who are listening to you talk about container storage went to the position we have been trained to go to through years of regulatory work of staying in our lane. We say, "Oh, well, container storage yards, that's not a DTSC issue" and then the ears go off. I think that has been a huge frustration for communities, that you talk to DTSC and DTSC doesn't listen about container storage and you talk to AQMD and AQMD doesn't listen about hazardous waste storage. There isn't anybody who is listening when you're talking about everything that is affecting your community.

One of the things that we are trying to do at DTSC through our Office of Environmental Justice and Tribal Affairs, which Ana is heading up, is to change that paradigm

for us and to do a better job of connecting with community members in understanding what is it actually that you are experiencing because there may be things that you are experiencing that even though we don't offhand think we have anything to do with that there could be things that we could do that would have a positive impact, even on something like container storage. But if we are not paying attention, if we don't have our - as someone once said to me - our '"listening ears" on, then we don't ever get there.

And so what I want to ask you now is having spent decades of your careers asking us to do something and we have all been deaf to it and now we are coming to you saying, "Hey, we've got this great idea; we'd like to do this thing that you have been asking us to do for 20 years. How do we bridge the gap of your frustration with our blindness, our deafness to these problems for so many years, and help us approach this in a way that is fresh and collaborative and productive, especially since we don't yet know what we're doing.

I don't yet know what I can do to help you with container storage and I don't yet know whether the impacts that stem from container storage layer into impacts that stem from hazardous waste management in a way that I can positively quantify it or characterize it or bound it in some productive structure that allows me to use it in

decision-making. I have an instinct that says I can get there and that there probably is something because everything is connected in some way. I just don't know what it is yet, which is going to be really frustrating for everybody. So how do we do that? How do we create that space where you can say again what you have been saying without being angry at me for not having heard it for so many years and I can listen to it and hear it in a different way after having had it immediately go into the "that's not my swim lane, I can't do anything about that" space. How do we get there?

MR. MARQUEZ: I'm a very unique organization and individual. I did not come from a background where I had numerous other organizations that I could go to. When I started my organization back in April of 2001 I was not an environmental activist, I didn't even know what agencies were out there. The things I have been discussing with you today has been over 15, 20 years of learning.

But at that time -- let's even bring it to more reality. I was not even working with DTSC until three/four years ago. And what happened in the last three/four years ago was that my colleagues, Robina and Cynthia and Jane, their world had been involved with DTSC, you know, toxic chemicals, hazardous materials, brownfields, and I was learning from them. And as I was learning from them that,

you know, I needed to now learn more about DTSC.

Then what happened is that they introduced me to a good friend out here working for DTSC whereby in developing a one-on-one relationship I could then speak with him in confidence so that, you know, I could begin to learn. And then what I needed to learn was what was the purpose of DTSC, what things could they get involved with and how could they help me?

So one of the first things that I did was, okay, can we have a water testing class? So DTSC came to our office and did a demonstration of how to take water samples. Now, it seems kind of innocent at that time because we were not doing any water samples but I wanted to start somewhere and something to learn; and then I was being told, "Well, we can do this." I jumped on it, okay, I'll start somewhere.

Well it turns out nine months later I'm in San Diego at the Brown Field Airport where we went on a field trip. My organization said, "Jesse, can we do something fun besides fighting ports and oil refineries?" so we found an owl called the burrowing owl and it is the only bird on the planet that makes a nest underground. So we went to take pictures. And it was also a day owl so it comes out in the daytime. So we went, took photos and we're all happy about it. We come back home.

Two weeks later we had an HD movie camera donated

to us. "Well let's go back and do a little documentary." Well, it turns out we show up two weeks later that Saturday morning at a murder scene, we couldn't find any owls anywhere. As we walked up to the burrows - in this case a lot of them were under helicopter pads which were never used - we could smell a chemical trace in the air. And when we looked down into the burrows a watery substance had been poured into the holes. So like two/three gallons of poison had been poured in the holes and in some cases someone with a shovel or hand had covered up the holes to kill the owls. What I did not know at the time was that in the next couple of weeks was going to begin a series of public hearings for an $800 million airport redevelopment project.

So by developing a relationship with Roger and having this water class we knew, let's take a water sample. So as a result of that we also called Roger, "Well, we need a laboratory to go to." Because what happened is that we took the water sample to a laboratory and it came out negative. So then I called up Roger, "It came out negative." He says, "Well, what were you looking for?" "Well, pesticides." "Well maybe it's not a pesticide, you know. What else did you find when you were out there?"

Well it turns out that there was a truck, there was a sprayer and there was a brochure. There was a chemical brochure and I copied down the name, Krovar by

Dupont. Well it turns out it's not a pesticide, it's a herbicide. So then I go back to the lab, test it for herbicide and they came back negative.

So then I talked with Roger again, "Roger, it came out negative again." "Okay. Well, some labs cannot test for that chemical so look at the chemical list and see was that one of the things that they have the capability of testing for" and it turns out, no. So then Roger gave me one of the labs that the government agencies use and they use, DTSC uses; I went to them and it came out positive. So here was one little example where we learned from it and we learned from the laboratory. We did the testing on our own to be able to do that.

Since then we have attended other DTSC seminars. So you heard me in my presentation, we know oil is leaking so I know there's hydrocarbons in the ground. I know paint is peeling and pulverizing that could be lead-based, we can test for lead.

I just realized right now I could have had another slide in there. One day I'm driving by one of them and all of a sudden by the gutter and the curb is this oily, gooey stuff, you know, all along there leaking from the container storage yard. And I couldn't see because it had a fence there and there was no way I could look over the 12-foot fence there but it was leaking from there but I don't know

what it was. So here we had a leaky, gooey substance now that was now being poured into the street, over the curb, into the gutter, which could be another DTSC example.

One night I got called on a Sunday night at 9:00 p.m. from one of my members. The lady across the street came over saying that a truck pulled over and it had a trailer with this 10,000 gallon thing there and it had a liquid in there and they turned the spigot and it was now going into the gutter and the curb right there and they wanted to know, were they allowed to do that? So I run down there with a camera and a bottle and I took a sample and they were dumping a toxic chemical right in front of -- right in a residential area in front of someone's house in the darkness. So again I called up at that time the fire department, police department and I think DTSC came down also and, you know, took samples of it and they issued a citation.

So again these are just a few little examples where it's a learning curve when we don't know an agency. We take advantage of a class that is being offered, never realizing we were actually going to do it, and then nine months later we're doing it for a good cause.

And so you know what happened? We attended the public hearings, opposing the project and declaring, "Hey, here's what happened, they killed the owls." And we took

several teams back and we documented.

I also have a hobby and that little hobby is called archaeology and we go on archaeological digs. And when you do that it's like doing research in the field so you learn to document and photograph things. I put a 60 page report together.

And then I met other organizations from San Diego that were attending these public hearings; we teamed up. And then we got a law firm, the Coast Law Group from Encinitas, to represent us and we sued the City of San Diego because, you know, you know no vendor is going to do that so the word had to come from airport management and it had to be upper management.

And I am happy to report that this past January that just passed a few months ago we did a settlement and they purchased three plots of land for 122 acres that's adjacent to the airport that is now going to be a burrowing owl reserve and protected area. And so you know when you do that you have to have burrowing owl food for them. Squirrels were the ones digging the burrows so now you have to plant squirrel trees, squirrel food and a water fountain for the squirrels because they need them to dig the holes.

And then it turned out another great thing occurred in destiny. San Diego Zoo created a conservation institute a few years ago and two young women in the last

couple of years had graduated from Cal State University San Diego and they did their dissertations on burrowing owls - two different perspectives on their dissertations - but are now the proud little godmothers with the director who are going to oversee this whole little protected, biological reserve and the relocation.

So you know, this was the last large remaining colony in Otay Mesa, it was the last remaining colony in the city of San Diego and the last remaining colony in the county of San Diego. And no, they were not an endangered species. But when it's the last of it there then it becomes a point of concern and a high priority, protect the little species. So now, you know, you will hear probably another year from now a grand opening of this reserve and the relocation. And I welcome any of you to come down because you're going to be able to say that DTSC, a government agency, was part of that effort, indirectly but a significant part, that made it happen. Thank you.

MS. LEE: Do you have anything you want to add, Robina?

MS. SUWOL: I just want to add that I think when you speak from the heart, Director Lee, people are going to know that. We've also done a lot of toxic tours. So I think it's one thing to have one thing to have community or environmental groups talk to you about a specific situation

and then maybe when inspectors go out it's a subjective review and information provided to you. But I don't, I can't imagine that there would be anyone that wouldn't want assistance and working together.

I think one of the things that I found in the 20 years working with LA Unified, which I don't think is celebrated enough and is definitely criticized more than celebrated, that I think you begin to find that we all, regulatory agencies and the public have a lot more in common than not. And I think that even if there are situations where we may appear to be on other sides of the table that there are respectful dialogues and discussions that have taken place and that do take place and we are grateful for that. I think if DTSC is interested in approaching -- you know, I can't speak for everyone clearly but I can't imagine that anyone is not going to want to grab your hand and say "thank you" and move forward for a common goal in protecting health and the environment.

MR. MARQUEZ: The other thing is by working with government agencies, so you know me as a person, I have no AA, no bachelor's, no master's, no PhD. I never went to law school, I never took a law class. But in the lawsuit that I just mentioned that we just settled, I prepared the petition for writ of mandate for the attorneys, which is the lawsuit. And in our recent lawsuit against the Port of LA over the

BNSF railroad project I prepared the petition for writ of mandate, which is the lawsuit, for our attorneys.

When we do get involved with our communities into looking into some of these issues of concern it is what is now being called and what we recognize as community-based scientific research. We may not have PhDs or we may not have fancy degrees but we can also have the capability to learn. DTSC worked with us in helping us, giving us a grant and then supporting us with a CalEPA grant, a small EJ grant, to create in LA the first air quality monitoring system. So by giving us some money to purchase a little unit that started this off.

And then by helping us with another grant we were able to team up with another organization, the IVAN, which was doing, you know, community environmental reporting. Because then I was thinking, well I'm going to do my reporting. I don't have an incident reporting-type software program. Why not incorporate their program into mine, which created the Los Angeles Community Environmental Enforcement Network so that you can go online, report an incident and then we're measuring the air pollution at the same time.

So by combining grants from different agencies and working together we got this monitoring system up and running and to be able to prove under a pilot study that we could do it. Yes, it was only a $600 little monitor, it's

not a $500,000 monitor; so no, it is not going to be accurate to point-this-this-this-this-and this. But that is not the issue. When you see tons of pollution coming out of a flaring unit at a refinery that's all we need to know, that there is an issue, there is a concern there.

We teach our residents because then once we started recording the data and seeing the data I now had a new light come on in my little brain. What was the experience AQMD was going through? Now what was that experience? The needle was going like this (gestured - took forearm from parallel to the table to a 90 degree angle). It was exceeding the state standard. So now I understand the situation of AQMD, the air quality monitor, because we were thinking, "Okay, every time it exceeds it we are going to notify the people on our mailing list, on our text message list.

But then what happens when it's exceeding every hour and every day? We can't be contacting them every hour, every day. So now we're learning what some of the government agencies, the inspectors and their managers are going through; how do they deal with something like that? Which puts it back into a bigger picture of the bigger policy and legislation and rules and regulations. That arena. But at least now by doing the air quality monitoring we understood and can now have some sympathy for AQMD as to

what they were going through because now we were going through that. Now, we were capable of having complaints filed in English and Spanish. Well, we also got them coming to us in Chinese and in Russian and I had to look for colleagues that spoke and could read Chinese and Russian so we could see what the realm of the things are.

And then another reality related to AQMD, since we're here, is that we have people that were complaining three, four days a week, every week, so in one month we could have 30 complaints from one person. How do we now respond to that person, you know, so that they are not going to be upset with us saying, "Well, you're not doing anything." So we have to explain to them that, you know, this is a pilot project, we are learning from it. We now understand that, you know, you have filed 40 complaints in the last 30 days, we understand that. We understand that in talking to the regulatory agency AQMD, the EPA and ARB that, you know, we are getting that volume of complaints and that we still need to deal with the big policy.

Which is why we also got involved with the EPA in Washington DC where we have the new oil refinery regulations coming down and being implemented. Where now there is going to be for the first time, you know, fence line monitoring at each refinery. Well see, we've learned that and then we teach our members and then we go to other organizations and

then we're invited by other groups to do presentations there. I was in Palm Desert doing a presentation over there because they read a story that came out in the LA Times and they tracked me down over the Internet. I've been down to Mexico.

I was in Russia four years ago and I did a presentation on our work on the petroleum industry and one on the ports and goods movement. Because in a town called Taman in the Taman Peninsula, it's in Southern Russia and it doesn't freeze there. Well, they want to build a new port there and they want to expand a refinery there. So they contacted us in a cultural exchange grant where I did a presentation. When I was putting the presentations together I sent them to them in advance. They got back to me and they said, "Mr. Marquez, you talk about California ports and California refineries and US stuff. Can you put some Russian stuff into it?" So now I had to go on the Internet looking up Russian oil refineries, Russian oil refinery explosions. You know, train derailments going to the ports. Port explosions.

And then all of you, many of you may know Andrea from the USC Keck School of Medicine. She has a little PowerPoint where Dora the Explorer is in China where they're making little dolls and they get shipped to the United States. They go to a distribution center and then delivered

to Walmart, K-Mart and all those stores. So what I did, I found a little Russian girl doll, Mushka, and I put her traveling with Dora the Explorer. And so we had it -- and then it was all translated into Russian so there was a translator with me doing it.

And then they told me, Russians love certificates. So if they attend a class, you know, they love to get a certificate. And if you ever go to a Russian's house -- to us, getting a certificate is no big deal. Well, they hang them in their hallways. So what happened is I made a certificate, you know, that you took the class and it was translated into Russian and English. So then I signed it from the English side and then our partner organization, Acute Accountability and the two Russian groups, they also cosigned on it and we passed them out to everybody there. So that is where our little organization, we are on an international scale.

MS. MASCAREÑAS: Thank you very much for sharing your experience. Please help me in thanking our community panel today. Robina, Jesse, thank you for being here. If you want to share anything else let me know but we would really appreciate you also weighing in on the further discussions that we have from our presenters later this afternoon. Thank you so much.

MR. MARQUEZ: And I will just mention, things I

talk about we all have documented so, you know, we have reports, we have studies. I'm more than happy to give you copies of these PowerPoint presentations. We have in our library over 40,000 photos. So say you're looking for a photo of something, we probably have it.

MS. MASCAREÑAS: Thank you.

(Applause.)

Case Study - Paramount

MS. MASCAREÑAS: Next we have Mohsen Nazemi. Mohsen is DTSC's Deputy Director for the Brownfields and Environmental Restoration Program. I will just read a short bio, Mohsen, and then welcome you up to the podium to share a case study.

Mohsen Nazemi is the Deputy Director of Brownfields and Environmental Restoration Program at DTSC. Governor Brown appointed him on September 16, 2016. Mr. Nazemi has thirty-eight years of experience as an environmental regulator at the South Coast Air Quality Management District (SCAQMD) where he served for eight years as the Deputy Executive Officer for the Office of Engineering and Compliance. In that capacity he was responsible for strategic planning and program implementation and organizing, directing and overseeing operations of a staff of more than 300 staff.

Mr. Nazemi's career spans 40 years of regulatory

agency, private sector, academic, and research experience in engineering, air quality, and environmental fields. His experience includes more than 38 years in permitting, compliance, and enforcement as well as rule and policy development and implementation, with more than 25 years at executive and senior management levels at South Coast.

Throughout his career, he has served as Chair, Co-chair or member on numerous statewide and national committees and task forces on issues ranging from permitting, multi-media enforcement, energy, petroleum refinery regulation, to pollution prevention, oil spill prevention and response, and environmental justice, to name a few. He is a registered Professional Engineer with a Masters of Science in Chemical Engineering from UCLA and holds certificates in Hazardous Materials Management.

We are very lucky to have Mr. Nazemi as our colleague at DTSC, thank you.

(Applause.)

MR. NAZEMI: Thank you, everyone. If you don't mind I'll just speak from here because I'm closer to the audience.

Thanks everybody for coming to this symposium and welcome. This is kind of my old home. As Ana mentioned I am Deputy Director for the Site Mitigation and Cleanup Program at DTSC and I'll pay Ana for all the things she said

about me, later.

I think Barbara framed what DTSC does really well, in terms of how we go about doing our work. I just want to give you a few examples. I know we are running behind schedule so I'll be really brief.

One of the things that DTSC does, we work very closely with the US Environmental Protection Agency and our sister agencies under CalEPA, the Water Board, and perform a number of investigations. One of them is the type of investigation where we look at agency files, records, we do searches, do site reconnaissances and we use what's called a Spatial Prioritization Geographic Information Tool or SPGIT, which is a geographic information system developed by DTSC that shows known underground contamination plumes and properties that may be likely sources. And you will hear a much more detailed presentation on that later on this afternoon from Rick Fears so I will not get into any details there.

But the reason we do these investigations is to identify sources that may be included as a National Priority List, NPL, which is the same as Superfund sites under the federal program. Identify sites for the state program that need to undergo cleanup, but then undertake emergency actions if there are needs to abate hazardous releases immediately and order responsible parties to clean up soil

and groundwater as they become engaged in the contamination.

So to give you a new examples: Recently - and when I say recently I mean as recent as this month - the North Orange County Groundwater Basin was a site that if you are familiar with the Orange County Sanitation District plant in Fountain Valley, they process about 250 million gallons per day of sewage from various parts of Orange County, and right next to it, behind it, is the Orange County Water District plant which takes the effluent and runs it through numerous reverse osmosis and deionization systems and converts that effluent into drinking water rather than dumping it into the ocean and then pumps it back up into the North Orange County area, Fullerton, Anaheim area, and then they pump it into underground water reservoirs for supplying water to 2 million users.

Based on the studies that we did with USEPA we found that there are threats of contamination in the actual groundwater system. We worked with Regional Water Board and USEPA and this month the Governor actually approved to list the North Orange County Water Basin as a new, one of the latest National Priority List or Superfund sites. What that does then is it allows funding to be used for the cleanup. But it also, more importantly, would allow the EPA and the state agencies to go after the responsible parties and have them pay for the cleanup of the contamination that they have

done.

The other example is the studies that we did with USEPA, again, in the Paramount area; it was called the Paramount Site Discovery Project. I am sure you have all heard about Paramount issues with hexavalent chromium recently. While DTSC did not have any permitted facilities in Paramount, it was all regulated through the local CUPA and local agencies and the air district, but what we did is we again used the SPGIT system and developed some preliminary investigation work for USEPA because there was some arsenic found in some of the water wells in that area and some metals and volatile organic compounds found in the soil. So that jibes well with some of the work that South Coast Air Quality Management District has done and other agencies, local agencies that have been involved as well as DTSC in the investigation of where the sources of hexavalent chromium are in the Paramount area.

The other example is we did work in the West Pomona area. Based on the SPGIT analysis we found groundwater contamination in the western Pomona area and we are working with EPA to identify facilities and sites that may have been potential sources for those contaminations.

The other example is -- you may all have read a story at *US Today* last year or maybe a little longer than that about ghost smelters. What we did is worked directly

with EPA Region 9 on identifying lead smelter sites in California and whether or not they were active, whether there were any emissions associated with contamination of both soil and groundwater. And we are working on other areas under battery fee regulation to identify other sites besides Exide that may have done battery recycling in the state of California and may have contaminated the surrounding communities with lead and other pollutants.

And then finally the study we did, again with USEPA, an I-710 Corridor study. Which we not only realize that there is all kinds of emissions coming from the mobile sources that go through the 710 corridor from the ports but there was also identifying actual stationary sources that may have caused contamination in the soil and groundwater that impacts the vulnerable communities in that area.

So these are some of the types of work that we are doing relative to identifying new sources besides our regular activities on permitting, enforcement, hazardous waste facilities and doing site mitigation and cleanup of various contaminated sites. We have over 1,600 active sites in the state of California, believe it or not, that we are working on and there may be many more that we are not at this point working on but they are in need of restoration and cleanup.

And then finally, one outcome of it is obviously

to protect the communities and the health of the surrounding neighbors that live next to these sites. But in addition to that, which also is a side effect or a side product of the cleanup is that all these brownfields are redeveloped, help the local economy and create jobs for the residents and municipalities in that area.

So that was just a brief overview of what DTSC does in terms of the site mitigation and cleanup program. Due to the schedule being so far behind I'll just leave it at that.

So thank you very much and I am glad to be back in this auditorium where I spent many, many years of my life here. Thank you.

MS. MASCAREÑAS: Thank you, Mohsen.

And in the interest of time we are actually going to shift to have a short break right now and then return with Dr. Melissa Lunden.

So we encourage you to -- if you have questions for Mohsen, Mr. Nazemi, please feel free to approach him during the break.

We will convene in 10 minutes with Dr. Lunden's presentation on the West Oakland Air Pollution Monitoring Project. Thank you.

(Off the record at 11:07 a.m.)

(On the record at 11:22 a.m.)

MS. MASCAREÑAS: If everyone could take a seat, please, we are going to get started. Thank you so much.

West Oakland Air Pollution Monitoring Project

So our next speaker will be discussing the West Oakland Air Pollution Monitoring Project, Dr. Melissa Lunden Chief Scientist at Aclima.

Melissa's research career has focused on the transport and fate of pollutants in the environment. She received her PhD at the California Institute of Technology with an emphasis on aerosol formation and structure. As a staff scientist at Lawrence Berkeley National Laboratory she directed investigations of environmental processes in a wide variety of locations including the Sierra Nevada forests, traffic tunnels, and the Washington, DC and Boston subway systems. A specific focus of Melissa's research efforts has been indoor air quality and underscoring the need for pollutant characterization on the local, personal scale. She is excited to be working with the team at Aclima to bring the vision of ubiquitous environmental monitoring to fruition. Please join us in welcoming Dr. Melissa Lunden.

(Applause.)

DR. LUNDEN: Thank you. It's really great to be here. I've got some slides and I am going to try to go through them very quickly so we can all have lunch and hear some other things.

So I'm going to broaden what I'm going to talk about. I'm going to get to Oakland and actually talk about some measurements within Los Angeles.

But just a little bit of introduction to Aclima. We are sort of talking about the promise of these large-scale sensor networks. Not like 10 measurements or 100 measurements but thousands of measurements in regions and what kind of transformative things we can understand about our environment with that kind of data.

The problem that I don't think I have to explain to anyone in this room is that we really can't manage what we can't measure. Air quality is a global problem. It's increasingly being recognized as sort of like just not even like a social risk but a business risk. Let's get the business communities involved and really get everyone involved in trying to solve it.

And so Aclima as a company was sort of founded on the thesis that, you know, ubiquitous environmental measurement will help us understand what we call environmental intelligence. Being able to act on that. What we understand about the environment to make sort of people and the planet healthier.

And to do that we have a platform that takes advantage of what's happening in the sensor world. There is a great book by Peter Diamandis who funds the XPRIZE on sort

of abundance and part of what he sees as abundance is this sort of trillion sensor movement. Not just the hundreds, probably, of sensors I have on my phone but all the different sensors that we have that help us that are, for the most part, sort of moving through the world a little bit easier and really moving toward trillions of sensors.

And many of these are low-cost/high-quality sensors that support information technology. We've got cloud-based processing, we've got a lot of good database tools. And so with all of that information together we can really start to, with analytics, turn these sort of complex systems and complex signals into actionable insights.

And this is going to lead to a new transparency; Gina already mentioned that. The data is coming and people are going to have it and we just have to understand how to give them the best possible data and the best possible tools that we can act on it. So stationary sensors, building sensors, personal experience sensors. What's happening at utilities, what's happening in transportation systems.

So a lot of awareness, a lot more information sources and rising expectations on sort of really getting a handle on all of that data.

The Aclima platform starts with a sensor, A, getting the best possible reading from the sensor that we are talking about and we are really focusing on air quality

and sort of environmental quality sensors.

But then you need the data infrastructure and the engineering to take all of those sensors and coherently sort of stream them into a back-end data system that can handle billions of data points coming into the system on a regular basis.

And then you need to be able to query the data sets, be able to do analytics, machine learning, artificial intelligence, use those tools on this data set.

Interfaces to translate what all of this data actually means, which is a challenge, a big challenge I think in the air quality field on its own.

And then take that and turn it into insight so people aren't just looking at a time series of what the pollutants are.

But what does that really mean? What does it mean over weeks, over months, over years? What kind of changes can we see as we act on the data?

And so Aclima is not just a company that is making a thing and giving it to you but really kind of helping all the way along the line from all of these measurements to the actual insights. Our first deployment was actually in Google's indoor -- an indoor deployment at Google with 500 different measurement location streaming a half-billion data points a day. They built that up through 2013 to 2014.

It was one of the major things that led me to join Aclima. I was trying to do research with small sensors, understanding how it could really transform our understanding of exposure to people. And they were already doing it and it was just great to sort of take the science that I knew and move to a company like this.

And so what we are looking at is not just the multitude of sensors but the fact that we are getting large cost reductions. And so, you know, reference equipment, the kinds of things that EPA, you know, certified or we use in the laboratory cost $10,000 to $100,000; and sensors can be much, much less, less than $100 in many cases.

And you can see here some carbon monoxide measurements where we have three sensors that we have co-located in a car in a mobile platform with a high precision reference equipment. And you can see we are really able to engineer our system and the sensors and sensor models to get what we feel is really very good performance of these sensors. And that's the key is the science that underlies all of this is really getting data from the sensors that we believe is of high enough quality that we can act on it. That doesn't mean it has to be like plus or minus 10 percent or 5 percent but we need to understand the quality and then the additional information we can get from the multitude of measurements, the tens or hundreds or thousands of

measurements.

So Aclima is working in three different regions -- three different areas, sort of indoor, outdoor both stationary and then mobile, and so that sort of helps understand the whole pollutant experience. We're thinking about exposure and multitudes of exposure. We are indoors a lot of the time. Of course, outdoors is where there are many very important sources. So the way to best sort of understand that entire sort of exposure pathway is mapping outdoors and indoors at the same time.

And then we are hoping to sort of have impact across multiple scales. As a company we have got a pretty grand vision to not just be able to get like a personal or a city-wide sort of understanding but really a global sort of presence down to the city and then to the personal in buildings or with people. Because while air pollution is a system and there's a lot we understand about it, a person's exposure is unique. And so getting down to that unique exposure is something that -- exposure and just possible exposure and so we can alter it is something that we are really very passionate about.

So if you'll let me just briefly go into the indoor atmosphere because this is where we have some great data that speaks to the power of networks.

And we sort of think of this environmental

measurement specifically in the indoor environment; it's like a missing meter. We measure our electricity, we measure our water, we measure a lot of things that come into our house but we don't really understand the air and in many ways some other things and so we like to think of this as a new tool needed to understand environmental conditions.

So one of the tools, one of the ways we are hoping to use this took is protection. Buildings are -- we build walls and put them around us for a purpose and one of those purposes is to protect us from the outdoor environment. Whether it's initially wolves trying to get into the door but now sort of weather and pollution and protection.

Understanding air pollution affects cognition. There is some really interesting research lately about levels of CO_2 and cognitive performance and how it can significantly degrade at levels around 100 ppb.

So this is a network we have put into a school, a school deployment that we have, measuring carbon dioxide over several weeks and those concentration peaks are as high as 3500 ppm and sometimes get as high as 5,000, which is the OSHA limit. So in some of these this is a naturally ventilated room in the summer. We're getting some CO_2 concentrations that are really something that everyone should be concerned about in terms of like a place where kids are trying to learn.

Similarly in the work place - conference rooms. This is a big one but small rooms don't always have great ventilation. We put a lot of people in there and we are often putting people in there to make decisions.

This is from a network in a building in the DC area and you can see -- we get the power of looking across all of these different rooms and you can see the CO_2 concentration sort of variability as a function of room and there are some rooms that clearly stick out as places that we might want to go into as a building operator or someone that is working in the space and have some action done in that space so it becomes healthier for us to do our own performance.

And so this is focusing on sort of commercial and home spaces but home spaces and other places like that are probably equally as important.

And then you can get some really interesting information, just simple information on comfort. This is a GIF about temperature in a number of places around this building and you can see that when the day starts around 9:00 o'clock there is like one point right in the middle basically that never really gets much warmer than 19 degrees Celsius, that's really, really cold, and then just a few cubicles away you've got places that are on the order of 24 degrees Celsius during the day.

So we all know that there are these extreme temperature differences in work spaces but we can't do much about it because we don't have the data. With these kinds of distributed network systems inside spaces with this kind of like distributed measurement you can understand the space, you can maybe do some action on the space or you can also say, "I choose to work best in a hotter area, maybe I want to have my desk be over on that side of the building versus this side of the building." So really helping people to make personal choices about their environment.

And so now I'm going to speak to sort of our urban region. So today we have Broad Spatial Prediction. This is a AQI estimates forecast for the San Francisco Bay area into the different regions and it's a great tool for understanding what might be happening, what you might want to do tomorrow in terms of exercise or staying indoors, especially if you're a sensitive population.

Here is a map from, a GIF from some of the driving that we did in the West Oakland region, as was mentioned. And so you see over the course of a year we drove in just this region about 14,000 miles and you can see that there's a significant difference between parcels, between neighborhoods, between individual streets.

And so with that we hope to get this kind of detail for a city, what we call "hyper-local." This is a

map of $PM_{2.5}$ for the San Francisco region based on individual drives on these streets. These streets have different levels of driving. Sometimes we repeated a drive across a street as many as 10 to 50 to 100 or more times and with that repeat driving we get sort of more statistically powerful information about what the pollutant concentration in any one street is, in any one neighborhood. That was over time and space -- time -- within the day. Time with a function of the year and then space. So really, really exciting to get this level of detail about air pollutants.

So just some detail on our mobile platform. We are partnered with Google Street View. Amazing partner because, I mean, Street View. It's really pretty cool. It's the first thing that I got to work on when I first came to Aclima and it was like a dream. I got to buy instruments, I got to put them in a Street View car. I got to drive the Street View car around Mountain View and have people like wave, take pictures and be happy or do other activities and not be happy that we were there but it was still like really, really neat how technology can bring some of these ground breaking things to the public.

So with the car we have sort of location and meteorology, GPS, wind speed, wind direction, car speed, et cetera.

And then we have been measuring ozone -- sort of

focused on the criteria pollutants and other pollutants important to health: Ozone, nitrogen dioxide, nitrogen monoxide, black carbon, particle number 2.5, so we're measuring number and then converting it to mass for those that are familiar with that. And then ultra-fine particles is sometimes that we have kind of been focusing on of late.

The platform. The instruments are plug-n-play. We've got a very great flexible system so if we identify a new sensor, a new instrument that we want to work with we can immediately sort of incorporate it into our system and start streaming data from that instrument very quickly.

We provide the drivers with maps on where to go for a particular day so operationalizing what at one point might have taken a graduate student all of their hours in the day for a month to something we can do day in and day out. Every day is a challenge but also something I think we are really making some good effort on and good inroads on. So basically we'll say, "Here's a square, drive every street in that square. Or here is a loop with some streets, drive that loop three times. Stop at this particular location for a few minutes." Sort of a combination of mobile and stationary if you will.

And then that data streams back in real time to our back end. We can look at what's happening on a map in real time and then we've got tools that can take that data

and start to do different sort of visualization analytical tools with it.

So with this we hope to drive science, health, urban planning, lots of other things that we think this data can inform.

So from the data, from the driving that we performed in West Oakland from May 2015 to May 2016 was recently published in a paper in *Environmental Science & Technology*; the primary author is Joshua Apte. His group at University of Texas at Austin really was driving the analysis, the work, the science behind it and has been a great partner along with EDF, a co-sponsor in this work and the Street View team.

So our approach was, as I sort of mentioned, repeatedly drive every street.

We calculated statistics for each pollutant by 30 meter road segments, so every 30 meters we have sort of an average or median or what have you.

And then the results sort of demonstrate consistent spatial patterns with high precision of the medians. So you can see the number of unique drive days there and for most streets we have at least 30 for the most part. Thirty times that we drove on that 30 meter segment stretched over a year.

I should say the driving happens, this is a job

for the driver so it's a 9:00 to 5 job right now so these are daytime averages. We are now working on sort of extending that measurement over more time periods of the day, morning, night, evening, overnight perhaps.

But still even with this data we get some great measurements showing that pollutants do really vary sharply by space. And if you look at this map - and you can see it in the paper, it's free to download at *Environmental Science & Technology*, it's not behind a pay wall - within 30 meter differences you can see changes in pollutants on the order of five to eight times and that can be on just one block.

And that comes from local sources. You know, local -- oftentimes just nearby sort of emission sources. Traffic can be industrial, it can be other things. And those mix with the overall sort of area-wide sources to give you this great sort of mixture and understanding of what's happening with the pollutants.

And then the star there on the map is the nearest sort of ambient air quality site in West Oakland. And you can see that if you average the data over the area we're driving - this is a year average by the way - that the measurement on like the non-highways if you will, the residential streets and the sort of major thoroughfares.

If you average all that data you get a number or value that is actually very close to what is measured at the

central site. So what I think is really exciting about that is not only are you getting this hyper-local information, but by properly averaging and sampling a space you can also get something, a number that is relevant for that region or that air basin, if you will.

So I think that the platform is really flexible, it is not just giving you that one point in time for that one day but done properly you get local and sort of regionally relevant measurements.

And so I am going to just move forward quickly onto 2016 with some of the mapping we have been doing in California. We have used two cars.

We drove in Los Angeles from August through October, San Joaquin Valley from November through March. And you can see we tried to cover a lot of the San Joaquin Valley, the northern San Joaquin Valley. We drive this from our base in the Bay Area so those are sort of definitely daytime measurements but still a great place to really start getting some of these detailed measurements.

And then we have been driving, of course, all around the Bay Area. Not just this hyper-local measurement but seeing what we can use these measurements in these different regions of the Bay Area to support perhaps land use regression modeling and other types of models that you could build from the data sets that we have.

And we are right now -- actually, we have returned to the San Joaquin Valley. We are doing that kind of hyper-local mapping in the Modesto area for, I think, two to three months and sort of seeing what we can kind of look at in a different city that is very different than these larger urban cities.

So just to kind of dig into a little bit of what we see:

In Los Angeles we still significant variability in black carbon levels. We drove in regions of Los Angeles that were important. We spoke to the City of Los Angeles and some other stakeholders down here. Focused on Boyle Heights, Wilmington, North Long Beach and then a couple of areas on the west side. We could drive the car the same day both in West Los Angeles and Boyle Heights so the overall change in the atmosphere on that one day wouldn't overly influence the actual differences we would see between these two places. You do see similar levels of variability that we saw in West Oakland. We only drove here for three months so we don't have the same level of statistical sampling but we still see some things that we feel are statistically pretty valid.

And then, of course, the degree of variability varies as a function of pollutant. This, again, is the Boyle Heights region.

NO is very highly variable because it's such a primary -- it's a primary emittent from most of the sources.

Black carbon is similar.

NO_2, there's still some variability but it's also formed regionally and so you get a difference in sort of source mix when you start to pick apart the data here.

And then you can start looking at statistics. Not statistics, distributions.

So we picked apart these four different areas, Boyle Heights, North Long Beach, Wilmington and Westwood or West LA, and here are the distributions of those 30 meter averages that we took in those regions.

And so you can see that sure enough Boyle Heights, which is surrounded by freeways on almost, I think, most sides for the most part, has a lot more black carbon in the region. Not only in the region, like the whole city is a little bit higher and then it has a lot more of these higher concentration sort of outliers out there on the tail.

Interesting, North Long Beach and Westwood are sort of similar and then the Wilmington region is a little bit lower. I think Wilmington, while it is certainly an area, as we have heard, that has significant concerns and problems with environmental justice, it doesn't have the same truck/black carbon sorts of impacts that we see from the 710 corridor which influences the North Long Beach

region and some others.

And so you can start to pick apart like areas of concern and areas where you might want to focus, especially for high emitting sources where if you can change -- you can really alter that area of a region you will have a more significant impact than if you sort of try to attack everything at the same time.

And then we have done some interesting things in terms of data aggregation like averaging the black carbon concentrations around 500 meters around a school and that's the data that I am showing here. As a caveat, we wanted to make sure that these concentrations were at least somewhat representative of multiple drives so we had to have driven past the school more than 5 times, 1,000 data points. And we couldn't have just zipped by the school on the freeway back and forth on the way to, like, you know, the South Bay.

So these are relatively, we think, representative of the differences between the schools. And you really see a lot of variability between sort of West LA and South LA and the Downtown region and then, you know, you see some differences in the san Francisco Bay Area and then what's happening in the Central Valley.

Just to give you some close-up look on the Downtown LA and Boyle Heights region:

Black carbon is highly variable and, of course, it

is elevated around areas where there are freeways or areas where there are a lot of truck traffic. And even between, you know, just on that sort of -- what is that -- the right side of the graph. Over the space of like maybe a mile or two you go from like a blue school, which has relatively low concentrations, to a school that has moderate to high concentration. So just over, you know, a few miles. Perhaps not a surprise if any of us have visited all these schools but with this broad scale tool you could really start to investigate that.

And of course the trends for NO and NO_2 are slightly different and you can, you know, pick apart. With these sorts of measurements and multiple pollutants you can get these fingerprints that can tell you like, okay, is it diesel we're worried about, is it general traffic, is it an industrial emission source? You can start to get at sources that might be of particular importance for, again, these schools.

And then you can do the same sort of statistics.

The Central Valley, on average, the schools had lower black carbon concentrations. Of course we were driving in rural and, you know, areas that were right next to 99; they're going to have very, very different impacts. We still identified areas where the concentrations might be higher than you would want to have at a school.

Los Angeles on average sort of higher distribution of concentrations and then the Bay Area was significantly higher. "Significant" isn't the right word but definitely higher concentrations. But we were also really focused, again, with this driving in West Oakland and some other regions where we knew goods movement was of particular concern so that reflected, you see that reflected in the data in terms of the types of way that we have been looking at an aggregate of the data.

So our next steps are scaling with high-performing low cost sensors.

The measurements that I showed you were collected using reference grade equipment mounted into these cars. So very much like a mobile laboratory, giving laboratory grade, high -- like, you know, within 10 percent accuracy of these measurements. WE calibrate routinely, we really keep an eye on that data quality.

At the same time we're driving with this high quality reference equipment we also have a sensor development system that we have been doing over these last couple of years. Understanding the best way to calibrate and engineer and sample with these small scale sensors to get data quality that is, we hope, similar to what we get from the mobile laboratory. We can't scale the mobile laboratory to hundreds and thousands of vehicles but we can,

with a lower cost, a sensor-based platform.

We feel like we're getting some good performance with CO, it's in the top left; ozone is the lower left; PM, that's a particular number on the upper right; and then NO on the lower right. We are getting really some good performance. This was some older data. We have really just continued to improve the system. I should say we are also getting some good results with NO_2, CO_2 and -- I feel like I'm missing some pollutants we were trying to measure.

So what we have right now that we are working on, actively engineering, is a system that is about -- we call it two shoe boxes or what an old desktop computer might look like, if people remember desktop computers. So something that's about that big. It fits in the shoe well behind the driver's side seat. It's engineered to sample air from the moving system just like these do.

And we have really been proving that out for the last few months and we are in a place right now where we are starting to build tens of these and think about scaling to many different regions with the Street View fleet and then moving on to other fleets. There is no reason why we can't do this with taxis, busses, trams, trains. One community even contacted us and asked us to instrument boats. So a lot of places where we can really use the mobile system to sample wide scale areas and at the same time we are taking

that same technology and developing an outdoor stationary box.

So you can imagine a heterogeneous network where you have outdoor locations that are in one place sampling all the time and a mobile network that is moving around through that that is providing us a large scale sort of spatial measurement and combining those two and really starting to get sort of a picture of our cities. Filling in the pixels, if you will, of what we already know about our cities from the regulatory network which already exists and I think that what we are able to do sort of complements that.

So we are hoping to take -- this is a map from the World Health Organization report, I'm sure you've seen it. $PM_{2.5}$ annual means for every place that has a measurement that they could find. I think there's about 5,000 on here. And there's a lot of measurements. The US has got great coverage and Europe has got great coverage. But there's almost entire continents and certainly many countries where there are no measurements.

So we are sort of hoping to overlay the world with, I don't know, a wearable is what we sometimes call it, wearable for the planet. We can kind of really capture not just pollutants but climate change gasses and then moving to other sort of modalities as we can find good ways to measure

them.

And Silicon Valley. We're in the region of Silicon Valley. Perhaps you have heard the term "Moonshot." Google uses it a lot, even the *Silicon Valley* web show on HBO used it a lot. It's like let's go to Mars, let's build a train that's going to go through a tube between Los Angeles and San Francisco. So we're trying to call this an "Earthshot." Like, let's measure everything everywhere with really trying to help change the conversation about understanding our environment, our exposure and helping make strides towards improving our planet and our health.

So with that I'll thank you and if you have any questions.

(Applause.)

MS. MASCAREÑAS: Thank you very much, Dr. Lunden. We'll turn first to the audience for questions. We'll probably have time for about two questions so who would like to go first from the audience?

MS. GHARIBIAN: Florence Gharibian, G-H-A-R-I-B-I-A-N, with the Del Amo Action Committee and I want to ask you two things that I'm interested in.

First of all I want to say what a tremendous contribution this could make to evaluating climate change and what it looks like across the globe, which is definitely a missing piece in the puzzle.

And then I want to talk about how I am looking at the benefit of trees in reducing pollution - and it is not the only thing I'm doing at all. But we are building a park in the community that I represent and I would love to have the ability to measure on kind of a mini-scale to get an idea of what it's all about. What happens when you do have trees and what it looks like when you don't have trees? Because looking at LA's EJ communities, presenting an opportunity to make those communities better by greening them up, which makes a lot of sense to me, and then be able to demonstrate that that really does have an impact on air pollution, would be tremendous; so that could be one application of this.

And another application would be monitoring indoor vapor intrusion in homes where there is a risk from pollution and the fact that that could be a problem in a home.

And so I don't know if you feel this system would provide applications for with trees/without trees or vapor intrusion in the homes. I would be happy to know that it would.

DR. LUNDEN: Thank you, those are some really excellent comments and observations and we are thinking exactly as you are. These kinds of measurements, we are even now sort of digging into the data to look at existing

locations on a street with similar traffic or a neighborhood with similar traffic mix and meteorology but one has different tree cover than another.

Looking at even before and after, trying to look at statistically what do we see in there that can help us identify what a good path might be towards that kind of mitigation. A lot of our built environment is where it is. We can build new schools away from freeways but we have schools that are near freeways now so what can we do?

We have also -- I should mention we have a cooperative research and development agreement with the USEPA through the Office of Research and Development. And one project that we are actually helping them with on was there is an elementary school next to the 880 freeway in Oakland and we did some pre-tree measurements and then they are going in and putting in a barrier and then we are going to go in afterwards and help them assess, did that barrier help, how much did it help? And not just tree barriers but other types of barriers.

And there's a number of places where we really could think that this data could help community groups and mayors and cities say, let's put a bus rapid transit route down this street and they won't be stopping as often and we should see this kind of net decrease in overall pollutants. With this kind of measurement intensity we can see the

difference there. And then the city can say, "You know what, we did this and here was the difference and here is how much it cost and you're welcome." Well, maybe not. It can help you sort of really see like this intervention was great, this intervention probably didn't work as well as we wanted to and overall just start to really help with our impacts on the environment and on health in particular.

Right now we're focused on larger-scale sensing systems through sort of commercial, educational and outdoor platforms where we can work with larger organizations to do a large-scale impact on like a student population in the Los Angeles Unified School District or something.

I am personally very passionate about individual exposure in homes and I think that we definitely have that in mind, it just might be a little bit further down our pathway but it's super important. Not just what's intruding from the outdoors into the home but then also what are you emitting in your house and are you aware of it and are you aware that it might be significantly more important towards your health than perhaps what's happening outdoors.

MS. MASCAREÑAS: Thank you. Are there any questions that are coming into the webcast, Evelia?

MS. RODRIGUEZ: Nothing.

MS. MASCAREÑAS: Okay. And just for planning purposes so folks know, we can do another question from the

audience here. We are going to adjust the schedule a little bit to actually get back on path so we will return from lunch at 12:50 and then start with Charles Lee from USEPA. So we can take another question before we break for lunch. I see a hand raised out there.

MR. McKEE: Okay. Duncan McKee, last name M-C, capital K, double E.

And my question is a lot of the compliance with regulations is based on these averages, whether they're 12 hour, 30 day, whatever. And I'm just wondering where your sensors fit in as far as being able to take real-time measurements of spikes and emissions?

DR. LUNDEN: So the mobile platform is sampling once per second, which it really needs to because it's a moving platform. But that is the same type of sampling frequency we are having with our sensor-based devices, that or something very close. So we really can capture individual plumes quite well, both from the mobile platform but also from the stationary platform. And so you see the sorts of things that other community-based networks see where you can see individual flaring and things that happen.

And if you can tie that to observations, meteorology, you can kind of start to see those individual events as well as averaging the data to get at what, you know, what gets closer to a regulatory value. But I think

the challenge of what -- awareness of what real-time concentrations mean from like a citizen or community member, what that means when I see that reading, is something that the air quality community realizes is a big challenge.

Kristen Benedict at EPA is leading sort of a group trying to understand how to best communicate data that is on the order of, say, even one minute; and when it goes over what that regulatory line is. What does that mean? Because, of course, the regulatory lines are based on, you know, longer-term averages, in part because those were those measurements we had. so that's an open and very important question in terms of how we communicate that and then what it means.

It is certainly my hope that this kind of data can help inform new types of epidemiological and health-based studies where if you see spikes of a certain frequency up to a certain level, even though the area might be below or meeting standards, actually leads to this particular kind of health impact or some sort of acute impact. That we could tease out maybe some of those sorts of things with this kind of data as well and start to get to that connection between pollutants that are moving, you know. What really happened in the atmosphere with the variability of the pollutants as concentrations with time and what might be happening for health effect.

MS. MASCAREÑAS: Thank you, Dr. Lunden. We really appreciate your expertise and your time in connecting all those dots; thank you very much for joining us here today.

DR. LUNDEN: Thank you very much.

MS. MASCAREÑAS: For everyone in the room and on the webcast, we will reconvene at 12:50, that's 10 minutes until 1:00 o'clock, with Charles Lee from the USEPA. Thank you.

(Applause.)

(Off the record at 11:59 a.m.)

(On the record at 12:55 p.m.)

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AFTERNOON SESSION

12:55 p.m.

MS. MASCAREÑAS: Welcome back, everyone, to DTSC's SB 673 Cumulative Impacts and Community Vulnerability Symposium. We are about to get started again after lunch.

USEPA Environmental Justice Program

MS. MASCAREÑAS: Our first speaker after lunch is Mr. Charles Lee.

Mr. Lee is widely recognized as a true pioneer in the area of environmental justice. He was the principal author of the landmark report, *Toxic Wastes and Race in the United States*. If you recall from folks who were here in the morning session, that was the report that Dr. Gina Solomon referenced at the beginning of her presentation. It really helped lay groundwork for science and EJ; we are very lucky to have him here today.

He helped to spearhead the emergence of a national environmental justice movement and federal action including the First National People of Color Environmental Leadership Summit, Executive Order 12898, EPA's Office of Environmental Justice, National Environmental Justice Advisory Council, and the Federal Interagency Working Group on Environmental Justice. Charles Lee is currently the Senior Policy Advisor for Environmental Justice at USEPA. In this capacity he leads the development and implementation of EPA's

agency-wide environmental justice strategic plans.

He has served in multiple capacities ranging from creating the United Church of Christ's environmental justice program to directing EPA's environmental justice office. He was a charter member of the National Environmental Justice Advisory Council, where he chaired its Waste and Facility Siting committee, as well as serving on Institute of Medicine Committee on Environmental Justice and other panels. Please join us in welcoming Mr. Charles Lee.

(Applause.)

MR. LEE: Good afternoon. I want to thank Ana and Director Lee for inviting me here today to speak. I am really excited and honored to be part of this conversation about cumulative impacts.

You know, as Gina was going through her slides and was talking about toxic waste and race, you know, I did that at a point where the words "environmental justice" did not exist. So from that point to now where there is a discussion in a real way about incorporating cumulative impacts in the regulatory process, that's pretty amazing.

And that is, you know, a real credit to the communities here in California, the work that they have done, that Jesse and Robina and others have done, to the legislators who took up this cause and to the scientists and regulators who now have the hard work of translating this

into something really workable in terms of policy and regulations. You know, making an approach that is really systematic is probably one of the more difficult challenges there is.

I think, you know, there is a real sense of urgency we all feel about this because, you know, of the impacts we know exist in communities. It is something that, you know, we all need to be part of as much as possible to contribute to DTSC's work in this because this is really important. It is really important. You have no idea in terms of not just California but all across the country.

So let me just start by kind of having, summarizing two major points and then going quickly through my presentation.

The first is that it builds on what I just said, which is that, you know, at this point I think the idea of cumulative impacts, the idea there are multiple negative stressors that are concentrated in certain communities, and these communities tend to be of a certain socioeconomic status, is a fact that is incontrovertible. That was not the case even a short time ago but now it is and this is a really important thing. I don't think anyone would assert that that is a good thing, you know. That is something we all need to address. As hard as it is I think there is a consensus that this is a really important issue that we all

need to rise to the occasion of.

The second is that there is a lot of work that has been done already that we can all build on. And this work is pretty formative, I think, but there are some really valuable things within that and I want to kind of trace some of that and lay it out here in this presentation. This is something that we should try to understand and build on.

So in my presentation -- so the presentation is going to just quickly go through EPA's Environmental Justice Program, its links to cumulative impacts and community vulnerability - a lot of which has been kind of presented. And then two tools that I will talk about or at least touch upon because some of this is going to be talked about by others, meaning EJSCREEN and C-FERST. Then kind of conclude with a few observations and open it up for discussion.

So EPA's Environmental Justice Program has four basic tent poles:

Support and engage communities;

Build partnerships with other agencies, states, tribes, local governments as well as communities, academia, business and industry;

To achieve measurable environmental outcomes;

And then integrating environmental justice into EPA's programs.

In terms of the first one I just want to note,

what you see on the slide is the focus of the environmental justice grants broken down by areas. I don't know if you can read that very well but one fact has jumped out at us. EJ grants by EPA have existed since 1993 and in the period since then more than $24 million in EJ grants have been given in over 1400 communities.

In terms of some of the work that we have done in partnership with others. I just want to highlight one which is work in Imperial County. This is, of course, work the EPA has done with California EPA agencies including DTSC.

There are a lot of things about this that are pretty important but this focuses on air quality and asthma. You know, we had talked this morning about the importance and the growing importance of monitoring, particularly community monitoring. I think one of the important aspects of this project is that. And along with that is the very last point made, which is that a lot of that is now being translated into Spanish and there is now a bilingual website for this.

The next major area I just want to highlight is this idea of measure of success or measurable environmental outcomes.

In developing the current environmental justice plan for EPA, EJ 2020, we identified five areas from which we wanted to put out in terms of measures, in terms of

environmental outcomes: In terms of blood lead level disparities, small and tribal drinking water systems, fine particle air pollution and reducing human exposure at hazardous waste sites.

This is something of a step forward. In developing this the question came up and I was really pleased that EPA took to the challenge, which is that, you know, after some 30 years of environmental justice being an important national issue that we need to start grappling with the question of what difference have we made? And as hard as this is, I am glad that EPA's program saw fit that they would, you know, go in that direction. And of course, this is just beginning.

And the third, the last area in terms of the broad overview of EPA's programs. These are the tools and guidance for integrating environmental justice. This will probably be the area that has the most direct applicability to some of the issues related to SB 673.

I am not going to go through each and every one of these in detail but, you know, the fact that EPA did issue a legal opinion that, you know, there are opportunities to address EJ issues within existing environmental statutes is a pretty important piece of work and a foundation. You know, having a screening tool that helps identify areas of EJ concern of course is something we are going to be talking

more about.

I want to not lose sight of the fact that EPA along with 17 other federal agencies developed analytic methodologies for considering environmental justice within the NEPA process. And of course, you know, when you start to look at impacts in a NEPA context, the cumulative impacts are really important, direct and indirect impacts and other things.

Now, there is a tool that is analogous to EJSCREEN called NEPA Assist, which kind of brings together essentially a lot of the same data but in a way that is useful in a NEPA context that I think can have real applications for looking at cumulative impacts within the -- you know, within the permitting context.

In then in terms of rulemaking and enforcement. There is guidance developed there as well.

The rulemaking guidance - of which all of these I have put, you know, web links to so you can easily access them - the fact that EPA did develop technical guidance is a really big step forward.

There's a couple of things to note about that. The first is that, you know, that is really looking across the country in terms of national rules so, you know, it's highly geared around quantitative analysis, distributional analysis. But it does not address cumulative risk because,

you know, that is something that EPA has not felt comfortable yet in terms of providing guidance on in terms of underlying guidance and certainly therefore then you can't do that in an EJ context.

Enforcement has made a lot of progress as far as incorporating EJ into the entire enforcement life cycle and the use of EJSCREEN for helping to identify and prioritize areas of concern.

And then in permitting, a foundation has been laid, particularly in terms of two phases of work. The first of which is enhanced public participation, particularly for priority sites, and then the second is developing EJ analysis. And EPA has developed a framework which it is testing internally. When that is ready, certainly the desire to really engage our regulatory partners and communities and stakeholders in this process will be really very important.

So those are some of the touch points from which, you know, it links -- this links to the discussion around cumulative risks and impacts. This slide kind of gives some of the highlights as far as, as far as the issues in front of us here today.

Gina said, you know, that, you know, the cumulative risk analysis has -- does now exist, particularly in terms of things like organophosphates and pesticides and

chemicals of like action. But moving beyond that, you know, there has been, you know, I would say, limited progress.

On the other hand I think that -- and this is going to become increasingly evident as you hear about other tools. What I have observed is as EPA is moving out and dealing with communities around cumulative risk they are -- the distinctions between what is cumulative risks and cumulative impacts are now a lot more fuzzier.

California, you know, took, I think, a really important other tack which is to really tackle that question and the shortcomings of cumulative risk analysis. And of course that's reflected in the CalEPA report on cumulative impacts building a scientific foundation, the 2010 report.

All this is leading -- I don't think I am going to spend a lot of time going into this in terms of specific detail but of course, you know, an important reflection of EPA's progress in this in terms of dealing with cumulative impacts is the EJSCREEN tool.

The other one that I want to point out is the EJ Research Roadmap, which includes many of the things you're going to hear about today, some of which are the C-FERST tool, the decision analysis tools, the health impact assessments and then some other ones not yet as developed but I think has a lot of promise.

I point that out because it is really important

that we start to look at all this and hopefully, you know, there can be a conversation that helps to kind of like work collaboratively to see where this can all be useful in terms of DTSC's efforts.

I am not going to really go into this because this is just a transition slide. I think this is reflecting like where -- I think there is a consensus around -- you know, what are the kinds -- stressors are important when we talk about cumulative impacts and community vulnerabilities, both environmental and the population vulnerabilities. This is -- the framework that is used in EJSCREEN and in CalEnviroScreen are essentially the same and this is, some of that is reflected here.

So I am going to skip a lot of this in terms of the next three slides on EJSCREEN. Kevin Olp who now works in CalEPA, we're really happy he's there but we are not happy because he had to leave EPA to do this and he was one of the key people that helped develop EJSCREEN and really has done a lot of the outreach work in training and engaging states and communities and others around EJSCREEN.

This slide just gives you some of the historical milestones related to the development.

This slide presents what some of the major features are. And what was the point I was going to make around this? No, not a big deal.

And then lastly, these are some of the new developments; I wanted to highlight a couple of things.

One is that we are going to update EJSCREEN. We have made a commitment to do this annually and this is forthcoming in the next couple of months. And there is going to be a new water indicator in there, Kevin is going to be very excited about that, he in fact had worked on that a lot.

And the other is that we are trying to identify ways, case studies in terms of the use of EJSCREEN. That, of course, is one of the things where I think it's a challenge for all of us. With all these tools how do we actually use it in a really practical way? So, you know, we are starting to collect that. And certainly this is an area where we would love to see cooperation with other state partners and in this case certainly with DTSC.

And then just lastly, I think one of the nicest things about EJSCREEN was the development of these training videos, which I have a link to. And I just want to highlight that because it would be just another way, another way that just kind of shows, you know, ways of sharing information about these tools.

And then I'm going to focus a few minutes on this other tool which is really a complement to EJSCREEN which is C-FERST tool, which is the Community Focus Environmental

Risk Screening Tool. If you start thinking about EJSCREEN as a screening tool and looking at broad geographic areas, try to identify areas for, you know, further analysis, outreach or other kinds of attention, this allows you then to look at a particular community in a much more focused way.

A few things that are important to this are that this has also been included as an important part of the Memorandum of Agreement between the Environmental Council of the States, the Association of State and Territorial Health Officials and EPA. I think EPA did a Train the Trainer session for states on this, in fact on Tuesday of this week. And certainly, you know, there is an opportunity here too, you know, to do that if any of the California agencies were not able to participate.

This was developed in partnership with communities and these are three of the sites, one of which is a tribal context so there is a tribal version of this tool now.

I kind of put this slide out there because, you know, this really shows in a pretty graphic way, you know, the kind of concerns that communities have; as well as, you know, in the bottom part of the slide, the kind of data that was collected to help inform, you know, a characterization of those concerns. And certainly, you know, all this is another way of looking at the multiple cumulative impacts in

communities.

And it is a pretty structured process, you know. It starts with community guides and then the use of maps. In this example, you can't see it, diesel PM is the pollutant that was highlighted. And then of course it then gives you access to data and data tables as well as profiles about the issue. It does not stop at the point of then giving you that information but also provides information around kind of strategies to address these concerns that, you know, is also made available.

I would say this as well as many of the other tools being developed, you're going to hear about them from other presenters from EPA. But there's also things like a community cumulative assessment tool, which is in the very early stages of development. And what these are being used for or designed for is use in a non-regulatory context. But certainly, you know, there are a lot of thinking processes and data sets and other features that certainly can be very useful when trying to apply it to the SB 673 kinds of needs.

Oh, there's a couple of other things that I wanted to kind of, to conclude with.

The first is that, you know, on the one hand there is -- I mentioned the EJ research rolling back a broad number of areas that, you know, that EPA is working on that can, I think, be useful.

Now, that is going to require a good deal of thinking in terms of so how do you then apply this in terms of the permitting needs and addressing cumulative impacts? But like I said, you know, it is really important to mine this for, you know, the information that can be identified and certainly we want to do that in a way that is very systematic but also very practical.

And then the last point would be, and this is something that I thought about when Jesse and Robina were talking. I think that it is really important to get this our work to the point of being able to have quantitative or semi-quantitative analysis but we should not overlook the importance of qualitative information. And I find there is a -- that might be blind spot in the way we go about this. A lot of, you know, where we are now in the state of the practice, that is going to be a very important source of information.

Communities that I know, you know, really kind of emphasize that so I would caution against not seeing the importance of that in terms of the thinking process that we kind of pull together. And certainly, you know, if we were going to be true to meaningful community input, to the importance and the central importance of community participation, then that kind of information then should have that kind of level of importance.

So I would just stop there and, you know, open it up for questions or discussion. Thank you.

MS. MASCAREÑAS: Thank you, Charles, very much.

We will go first to the audience in the room for any questions.

MR. MARQUEZ: Charles, are there going to be any C-FERST training classes or seminars coming up this year?

MR. LEE: The answer is "yes." And I don't know specifically, you know, what they are, when, but I will get back to you on that.

MR. MARQUEZ: Okay.

MR. LEE: You know, one of the big commitments that was made in line with that was to do outreach and training and that's at many different levels.

MR. MARQUEZ: Okay, thank you. This is Jesse Marquez.

MS. MASCAREÑAS: Any questions from the webcast?

If folks on the webcast have any questions throughout the rest of the afternoon it is Permits_hwm@dtsc.ca.gov.

Thank you, Charles, very much for your presentation.

(Applause.)

MS. MASCAREÑAS: So moving into what Charles was referencing. Thanks very much for sharing the tools,

walking us through C-FERST. We will have Kevin Olp speak next to give a little more information about EJSCREEN.

Environmental Justice Screening and Mapping Tool (EJSCREEN)

MS. MASCAREÑAS: Kevin Olp currently serves as the Program Director for the CalEPA EJ Taskforce where he oversees the implementation of the task force and other environmental justice initiatives.

Prior to his role in CalEPA he worked for nearly seven years in the USEPA's Office of Environmental Justice where he most recently was the Director of Communications. In this capacity he led the development of USEPA's environmental justice screening and mapping tool "EJSCREEN" and also helped implement rollout strategies for key agency priorities including EJ 2020, the Agency's strategic plan for implementing EJ throughout the federal government between the years 2016 through 2020. Thank you, Kevin.

MR. OLP: Thank you, Ana. This is a little bit surreal for me. I left EPA three months ago and now I'm following after my former boss talking about a tool I used to work on. So if I confuse saying "us" and "they" talking about CalEPA and USEPA, please forgive me.

The other thing I want to do real quick is just say thank you so much for the opportunity to speak today. It is very humbling to be here amongst these incredible speakers and have the opportunity to talk with you all about

EJSCREEN. I am sure you are all a little bit tired after lunch in a food coma so I will do my best to get to the tool as soon as possible with the maps and graphs.

I think this is a really excellent opportunity to talk about EJSCREEN in the context of cumulative impacts because for a long time I think EPA really didn't do a very good job of considering multiple sources of pollution impacts and demographics when looking at things like permits, enforcement and other public outreach and regulatory efforts. I think it is definitely something that the Agency is taking much more seriously and they are very much in the midst of trying to sort out how to do most effectively but EJSCREEN I think represents a huge step forward in that regard.

So the public, stated goal for the USEPA is to protect public health and the environment. In order to protect public health today I think what we have been hearing is that in the overall social determinants of public health, that pie chart, only one slice of the pie is environmental exposures and risks. We also have to consider biology and we also have to consider the community in which individuals are living in to understand truly the impacts for public health.

And what EJSCREEN does is it allows for regulators and other agency officials to be able to look at different

sources of environmental pollution from air, water, toxics. It also allows them to look at other factors that may make people more susceptible to environmental pollution. I think this is something that Gina did an excellent job of presenting on earlier today. Those things that make individuals, given equal level of exposure, more vulnerable to the negative health effects of that exposure. And so if we are truly going about trying to protect public health we have to consider all of this information in order to be truly effective in protecting our communities and safety.

And so EJSCREEN represents a step forward because a lot of -- prior to the development of it there were 17 different screening tools with various levels of effectiveness.

But EPA had all of these data sets on really important things like cancer risk, particulate matter exposure estimates, traffic counts. They were in these huge Excel spreadsheets that were 200,000 values, that were geocoded by eight-digit numbers and who knows what that eight-digit number is and where the boundaries of that area are. And then even after you get to that if you're talking about 12.8 micrograms per cubic meter of exposure to particulate matter, is that a lot or a little? And without any of that context you have to be a GIS genius, you have to be an engineer and know something about science to be able

to put all of that together.

And so what EJSCREEN attempts to do is take all of that data, put it in maps, put it in reports, put it with percentiles so there is this relative ranking so I can say, "Oh, compared to California this is in the 95th percentile for proximity of traffic. That is alarming, that is higher than average." Or I can say, "That's relatively average compared to the rest of the country, although within the state it is particularly high." So it allows you to get access to that data and understand it and interpret it and be able to translate and explain it.

And I think that is very powerful, not only for us as the regulators but to get that data to communities. Because for so long communities have been looking to access this data, but if you don't have somebody that can take that information and put it on maps and put it with percentiles that is a huge barrier of access to the information and resources that EPA has. So that's really what I want to talk to you about is this tool, EJSCREEN. So what I am going to do is show you a few of the features real quick.

Before I jump into the tool I want to back up a little bit. I'm sure everybody here is familiar with CalEnviroScreen but I want to talk a little bit about the distinctions of that before I jump into EJSCREEN screen because you are going to be hearing about that, the tool

C-FERST, and I want to talk about the little niche that EJSCREEN holds within all of that and how it can be useful for your efforts.

So CalEnviroScreen was actually developed a couple of years before EJSCREEN went out to the public and we worked extensively -- we. "We" in my past life worked extensively with the folks in OEHHA and got a lot of really great insights from then and that was very informative for how our tool was developed as well.

You folks in California are very -- us folks now that I've moved here. I'm sorry, I'm trying to break myself. Are very lucky that there's very robust data sets on a lot of these issues so the data in CalEnviroScreen is often more current, more granular and there's additional data sets that at the national level there is not access to.

So if you're looking for the information about different types of environmental or public health data that's really the best place to start. EJSCREEN attempts to use the best available nationally consistent data and we pull that in as soon as it is available, but there are limitations when you're aggregating data from all 50 states versus one state, especially a state that invested resources in the data and technology, so in that regard CalEnviroScreen is much better.

EJSCREEN, I think, can be really useful in being

able to have reports on neighborhoods, individual areas. It's malleable so I'll show you how you can generate user to find shapes for the communities that you are looking at. There's other information and demographics that can be really useful and very much helpful in public outreach and just understanding community context and I'll be showing you those features today.

So I am going to start off by just pulling up the maps. I am not actually going to be -- I don't have enough time to do this as sort of a training session, but as Charles mentioned, with the release of the next version of EJSCREEN which is coming out next Friday they are going to also be releasing training videos that will be really helpful for showing a lot of things that you will see today and how to walk through and do the step-by-step.

So right now what I am pulling up is the environmental indicator for traffic proximity. And we are in the Inland Empire area just right over Diamond Bar.

And so all of these little shapes -- and I know a lot of the folks in here are pretty savvy but just for everybody -- these individual shapes that you see that are different colors are what are called US Census Block Groups. So there's 219,000 of these that cover all of the United States. They are, on average, about 1400 residents although they can be as small as 500 residents, as high as about 3500

residents. And they cover every area where there are people living. So when you see them smaller, that generally indicates that there is a more densely populated area. Versus when you see these larger block groups like over here, that's generally where there is a more rural area and people are spread out in terms of where they're living.

So what we did with EJSCREEN was we took the different data sets, so for example with traffic proximity, we put them all in bins. So you can see right now we are comparing to the rest of the United States. All of these areas in red are in the 95th to 100th percentile. So that means that compared to the rest of the United States only 5 to zero percent of the rest of the country, the neighborhoods are in that close a proximity to high amounts of traffic. So I can actually click on this block group and see that 6600 cars are estimated to pass by the average household per day, which is in the 98th percentile; so only about 2 percent of the rest of the United States are households living in closer proximity to traffic than these. Of course that is near a highway so that is to be expected, especially through here there is lots of traffic.

We have other data on regional air quality so things like particulate matter and ozone. These tend to be more regional in terms of how they are modeled at EPA and so you don't see much of the variation spatially from block

group to block group as you do with things like traffic. We also have ozone as well.

Then with these next three data sets, these are all from the EPA's National Air Toxics Assessment, which is a study that is done every three years where basically they take monitored data from across the United States, they combine it with modeled data of where we know there's local point sources, mobile and stationary, and we use that to estimate diesel particulate matter exposure, cancer risk and then non-cancer-related respiratory hazard index.

We also have other indicators. This is the lead paint indicator. This is actually just a stock of housing pre-1950, which is our best estimate for the areas where there's more likely to have lead paint exposure in the household, which is the single largest source of exposure to lead contamination.

We also have proximity to Superfund sites.

Proximity to facilities with Risk Management Plans. these are larger facilities that are permitted under the Clean Air Act to actually have Hazard and Risk Management Plans in place to protect residents in case of emergencies.

We have proximity to hazardous waste sites, which are generally transfer, storage and disposal facilities or other exchange sites for hazardous or solid waste.

And then the Water Discharge Proximity. Which as Charles mentioned, they are actually going to be updating this indicator with something that instead of just looking at where the points are that the pollution is being legally permitted to be dumped into waterways, we are replacing that with actually modeling downstream impacts and chemicals to actually estimate surface water quality.

So those are the general indicators that are in the tool. Beyond that there's a lot of other maps that are really useful and demographics.

So, for example, if I wanted to know linguistic isolation and where those areas I might want to do additional outreach, you can map that by going to "Percent Speak Spanish - linguistically isolated" and add that to the map. If there is a language translation policy for -- say if 10 percent or 5 percent of the population speaks -- no one over the age of 14 speaks English less than very well and you want to see what those areas are you can use this filter here. So I can look at all the areas where at least 1-in-10 households, no one over the age of 14 speaks English less than very well and they speak Spanish. These are all those households. These are the areas where you want to translate material; these are the areas where you want to bring translators to your public meeting. So it can be really helpful as well in terms of public outreach.

But there's other information on there on educational attainment, on economic income and employment.

There's also these Additional Maps and things like Places, so being able to map parks, being able to map schools. You know, we were talking earlier about how parks are really a good indicator of being able to reduce air pollution through absorbing some of the ultra-fines and so mapping where those are, you can do that. Understanding where the schools are in relation to some of the sites that we are working on is really important, so being able to map that is critical.

There's also information you can map to see if the water quality standards for different lakes, ribbons and streams are being met. So I can click on this stream segment that I can see is not in compliance with the water quality standards for USEPA. See what the name of that watershed is and what the causes of impairment are. So just tons of data that helps to give you that community context, the multiple sources of pollution that exist in a community, all in one place.

Beyond just the maps you can also use your ports as well. If I want -- instead of looking at all of this data one at a time if I want to get it in one place I can go to Generate Reports and I can select a location. I can either put a pin down and put a circular buffer around it.

A lot of times our communities aren't circles so that's not the most useful so you have this irregular polygon generator. So if I want to map this area right here between these freeways I can quickly do that just with a series of clicks. And then when I double-click that finishes the area and then I can generate this report right here that has all of those bar graphs in one place for the environmental indicators, the demographic indicators.

Our demographic indicators that I didn't cover earlier are the percent minority, percent low income, linguistic isolation, percent less than high school education. That's all individuals over the age of 25 with less than a high school education or a GED equivalent. And then Under Age 5 or Over Age 64, which generally tend to be more susceptible populations, especially when it comes to things like air exposure.

We also have these EJ Indexes as well and this is our attempt at sort of the cumulative impacts, which is looking at the relationship between those demographic indicators, specifically percent low income and percent minority, multiplied by each of these environmental indicators to get a sense of is there a high percent of low income and minority residents living in close proximity to each of these individual indicators.

And because a lot of the environmental indicators

score high and because there is a larger low income and minority population in this area, you can see most of the EJ Indexes score very high. So for EPA if we saw this, this would be -- if they saw this they would consider it more carefully in the permitting context. In the enforcement there would be a star next to it or an asterisk that would give it a closer look. As a reminder, this is screening level data so this doesn't drive any decisions but it certainly causes regulators to give extra attention to these areas, understanding that there are likely multiple pollution burdens as well as more susceptible populations in this area, so this data is really critical.

So these are just a few of the features. There's a lot of stuff that I'm missing and I'm sure I'm going to be kicking myself that I didn't get a chance to talk about but I want to leave plenty of time for Q&A. If you don't get a chance to ask a question I'll be around all day and happy to follow-up as well.

MS. MASCAREÑAS: Thank you very much, Kevin.

(Applause.)

MS. MASCAREÑAS: I just want to say that some of this conversation will also thread into later in the afternoon. We have a panel on cumulative impacts data needs and gaps and so the tools that Kevin was also mentioning during his demonstration, California's CalEnviroScreen tool

and then we'll also take a look at SPIGT, which is a tool developed with DTSC and USEPA as well.

So if there are any questions at this point please let me know. Like I said though, this will thread into some of the later panel discussion as well and we can make sure to pass around the microphone during the panel discussion.

Thank you very much.

Health Impacts Assessment (HIA)

MS. MASCAREÑAS: Next up we have a Health Impacts Assessment presentation with Shannon Griffin from USEPA.

Shannon Griffin is a biologist with the USEPA in Cincinnati, Ohio. She is currently involved in studies which focus on the development of quantitative approaches to evaluate community health and well-being. She is also involved in using USEPA web-based tools and Health Impact Assessment to inform community decision-making while promoting community outreach and engagement.

Shannon has worked extensively on the development and application of innovative methods which utilize salivary antibody responses as non-invasive indicators of infection from environmental pathogens. In addition, her work has included developing and validating molecular-based techniques to measure occurrence of microbial contaminants in various environmental matrices.

Shannon holds BS and MS degrees in biological

sciences from the University of Cincinnati.

Thank you for joining us, Shannon.

MS. GRIFFIN: Thank you. And I have an allergy to microphones so sorry if I kind of move in and out.

(Laughter.)

MS. GRIFFIN: All right, great, thank you. And thank you for the nice introduction too.

I am so excited to be here today to talk to you guys a little bit about Health Impact Assessment, or HIA, and how we can use it to link public health to community decisions.

So before we get started I want to share with you a quote from the World Health Organization. It says that:

> "The highest standards of health should be within reach of all, without distinction of race, religion, political belief, economic, or social condition."

So I think we should all keep this very important statement in mind as we think about this concept of Health in All Policies.

So we know that there are all sorts of programs, policies, plans and projects that can have both intended and unintended health consequences, especially if the discussions in the decision-making process are limited to a particular set of issues.

So Health in All Policies we can use a strategy that strengthens that link between health and other policies, across all sectors and at all levels, to improve the health of all communities and people.

Specifically it helps us consider the intentional or unintentional impact of non-health policies, so those things happening outside of the public health arena, on individual or population health.

All right. So what exactly is health. I know I've talked a little bit about it this morning but I want to go over it again. And according to the World Health Organization, health is:

> "A state of complete physical, mental and social well-being; not merely the absence of disease or infirmity."

Health is actually an indicator of quality of life.

But good health is determined by more than money spent on health care, right? But interestingly, we spend 88 percent of our health-related resources on medical services alone and only 4 percent on healthy behaviors and 8 percent on other stuff. I don't know what that is.

But that is not what makes us healthy. So what makes us healthy, if you we look at this pie chart, 40 percent of our health is coming from our social and economic

factors and then we've got 30 percent from our healthy behaviors, 20 percent from clinical care and 10 percent from the physical environment. So you can see a real disconnect between what we spend on health and what actually makes us healthy.

All right, so we are going to look even closer at health and this kind of builds upon what Gina was talking about this morning. This rainbow shows us our determinants of health and these are the factors that are known to directly or indirectly impact human health.

So when you look at the center, that little, yellow semi-circle in the middle, these are the individual factors. This is our age, our gender, our genetics. I suppose I should add "epigenetics" there.

And then as you move out one ring we have our individual behaviors. These are things like diet and exercise or addiction.

And then moving out even further we have public services and infrastructure. So things like education or transportation, health care.

Moving even further we have our living and working conditions. So disease vectors, one of my personal favorites, jobs, the working environment, wages and benefits, even noise.

And then last on the outer ring are social,

economic and political factors. So this is social cohesion, segregation, inequality, poverty. So all of these things in this rainbow make up our determinants of health.

Okay, so getting back to Health in All Policies.

Health Impact Assessment, or HIA, is one of the key strategies for moving toward a health in all policies perspective. It offers a comprehensive approach to health and it is applicable in a broad range of decision-making contexts. So things from education to transportation, housing, a living wage, incarceration, really just about anything you can think of.

But what exactly is HIA? More specifically, Health Impact Assessment is:

> "A systematic process that uses an array of data sources and analytic methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those effects within the population."

But HIA doesn't stop there. It actually:

> "... provides recommendations on monitoring and managing those effects."

So going back to our rainbow graphic. In a nutshell, HIA evaluates how a proposed policy, plan, program

or project may affect all of those determinants of health in our rainbow and lead to health outcomes, but then it also provides recommendations for health impact management.

Okay. So I am gong to go through the systematic process in a moment but I wanted to take a second to just go over the history of HIA in the United States because we are among HIA greatness here in California.

So HIA actually has been going in Europe, Australia and elsewhere for years. It has been promoted by World Health Organization and World Bank but the US didn't get involved until 1999. And actually that started in California, specifically within San Francisco, when an HIA was conducted on a living wage ordinance. So back in 1999 we have N=1.

Now when you fast-forward ten years to 2009 we've got 54 HIAs. And you can still California is out there as the front-runner but you see a few other states have joined in. And I am proud to say that Ohio has one as of 2009.

And then just five years later in 2014 we have over 300 HIAs in the US and lots more states getting involved.

And then not too much longer, this is the last map I actually have, is from mid-2015 where there are over 350 HIAs conducted across the United States. And again we have California with 70 as our front-runner.

All right. So who is conducting all of these HIAs? Well for the most part it's government agencies at 49 percent but we also have folks in educational institutions at 22 percent and nonprofit organizations at 26 percent.

And then when we think about the levels of decision-making that's being informed by HIAs in the United States, most of it, actually 54 percent, is occurring at the local level. And then we have 12 percent at the county level, 18 percent at the state level but only 6 percent of HIAs are actually informing a federal decision-making level.

Okay. So I mentioned earlier that HIA is broadly applicable. It has been promoted throughout the world as a tool for protecting and promoting public health because of its applicability in a broad range of decision-making contexts. So from this graphic we can see that wide range of decisions being informed by HIA.

For the most part, 39 percent, are informing those decisions around the built environment. And then 20 percent in transportation, 12 percent to natural resources and energy, all the way down to 3 percent of HIAs are informing decision around labor and employment; and this is across the United States.

So let's take a closer look at HIA in California. So that map I showed you brought us to mid-2015 but by the end of 2015 California had 82 HIAs completed or in progress.

And this here is just a screen shot of the Help Impact Project, which was brought to us by the Pew Charitable Trusts and Robert Wood Johnson Foundation. This is a wonderful website, I encourage you guys all to go and check it out, but they have lots of information about HIA.

And I wanted to just share these little screen shots with you. On the left you see that there is an interactive map that each dot represents an HIA. You can click on those dots, you can learn more about that specific HIA. And then on the right hand side we have -- it's more a clickable list. So you will have a description of the HIA, where it is being conducted, what sector it might be informing. And again there's lots and lots of links to the full HIA report if it is available and any other helpful information about it.

So when we look at and we do a breakdown of the context of these 82 HIAs in California, 40 percent of them are being conducted by nonprofit organizations, 39 percent by government agencies and 18 percent by educational institutions.

And in looking at the types of decisions or sectors these HIAs are informing, we have got 26 percent regarding transportation, 24 percent the built environment and then we've got education and housing not too far behind.

Okay, so I told you a little bit about what an HIA

is, who is doing them, at what levels are they informing, what types of sectors are they informing; but why should we do them? There are a whole lot of benefits to HIA but I have put just a few here.

The first one is that HIA promotes a greater understanding of health and the health impacts of decisions.

They improve the evidence on which stakeholder and policy decisions are made.

Importantly, they engage and empower our communities.

And they provide recommendations for changes to the design, adoption or implementation of proposed decisions to include health.

And lastly, they promote healthy and sustainable communities. Which is near and dear to our heart. At EPA we actually have a whole research program on sustainable and healthy communities, which is why you see that running at the top of all of my slides.

Okay. I also wanted to take a moment to highlight one of the core values of HIA and this is equity. Equity in health implies that ideally everyone should have a fair opportunity to attain their full health potential; and that none should be disadvantaged from achieving this potential.

And I just love this graphic at the bottom I wanted to share with you guys because it reminds us that

equality doesn't mean equity, these are totally different things.

Okay. So we finally get to the process. HIA is a very prescriptive process. There are six steps to it and I have them listed here on the left hand side. But I wanted to point out that each of these six steps we engage with the stakeholders and the community members so they are involved at every step of the HIA process.

So let's take a closer look at each of these steps.

The first one is screening. This is where we determine whether a proposal is likely to have health effects and whether the HIA will provide useful information. Is the HIA going to add value.

The next step is scoping. This is where we establish the scope of health effects that will be included in the HIA, the populations that may be affected and the sources of data and the methods to be used. And I know we talked earlier, this morning it was brought up that HIA is more qualitative, and indeed it is. But the best part is you can use a combination of quantitative and qualitative data in the assessment.

Now the third step is the actual assessment. This is a two step process that first describes the baseline health conditions in your impacted community and then it

assesses those potential impacts at the second stage.

Okay. The fourth step is the recommendation stage. This is where we suggest design alternatives that could be implemented to improve health or action that could be taken to manage health effects.

The first step is reporting. This is where we present the findings and recommendations to the decision makers and stakeholders. And I just want to point out here that you want to try to be succinct and use plain language for the most part because you are trying to communicate to a broad audience here.

And the very last step is the monitoring and evaluation step. And this includes monitoring the implementation of HIA recommendations and then also evaluating the process, the impacts and the outcomes.

And I just want to point out with HIA that we are never advocating for or against a decision, we are only advocating for health in that decision-making process.

Okay, so I gave you a very quick and dirty description of a prescriptive process so I want to point you to some guidance documents. There are a number of guides and handbooks that have been developed to inform and direct the HIA practice in the US. Two of those are listed here below. There is the *Minimum Elements and Practice Standards for HIA* and then there's *Improving Health in the United*

States. The links are available here. I know you can't write them down. Frankly, you can Google it and it is going to come right up.

Okay. So I want to just over a quick example so you guys can see HIA in action.

And we are going to talk about an HIA of the *Mojave Desert Solar Energy Projects and Tribal Communities*. this was actually conducted by the National Indian Justice Center in the 2013 to 2014 time frame and it was funded through that Health Impact Project. Again, this is in collaboration with the Robert Wood Johnson Foundation and Pew Charitable Trusts. The graphic here is the title page of the full Health Impact Assessment report and the link is just to the left of it.

Okay. So the purpose of this HIA was to evaluate the potential health impacts of the proposed Fort Irwin military base photovoltaic, or, PV array facility which will be located in the Mojave Desert region of California.

And the focus will be on the potential health impacts upon the American Indian tribes with homelands in the region.

I want to mention that an environmental assessment was actually conducted around this proposed project before the HIA. But what happened was that some of the health determinants that were particularly important to the

potentially impacted communities, the Native American tribes, were not included in the environmental assessment, so they wanted to have an opportunity to bring these health determinants up and that's where the HIA came in.

So first step, screening, right?

Well, the HIA team determined that the project does have the potential to impact the health of tribal communities with the region who have cultural affiliation with the region.

They also identified a number of potential health impacts related to limiting access to and protection of tribal cultural sites, destruction of native plants and the displacement of animals near the sites.

The HIA would certainly enhance the capacity for effective tribal consultation.

And then the National Indian Justice Center met with decision makers and tribal government representatives to gauge willingness to support the HIA process.

And at the end of screening it was determined that indeed an HIA would add value.

So they moved on to scoping.

During the scoping phase they continued to identify and engage the key decision makers, which was the Department of Defense, specifically the Fort Irwin Army Base, the Public Utilities Commission and the California

Department of Energy.

They also continued to identify and engage the key stakeholders, which was a number of Indian reservations in the area and other tribal communities with cultural resources in that project area, as well as the Bureau of Indian Affairs and a number of local public health agencies, residents, businesses and community organizations.

Also at the scoping phase we need to identify those determinants of health that the HIA will focus on, right?

So what they did was identified three determinants of health that were actually taken from the 2010 American Indian and Alaskan Native Health Assessment in California where they had already identified three major determinants of health that are important to American Indians and Alaska Natives.

And these are:

- Sovereignty and Self-Determination;
- Cultural Revitalization; and
- Access to Culturally Competent and Affordable Healthcare.

Now for this Mojave Desert HIA they decided, with input from the community and stakeholders, to focus on just those first two health determinants so that, moving forward, was the focus of the HIA, Sovereignty and Self-Determination

and Cultural Revitalization.

Okay. So we are going to skip the assessment phase just for the sake of time. But remember, at assessment you are just going to find out what the baseline health conditions are in your potentially impacted communities and then you're going to try and determine what those health effects might be given the different decision-making alternatives.

So we'll jump to the recommendations that the HIA team came up with.

The first one, and very importantly, was to engage the Mojave Desert tribes in meaningful consultation prior to construction. This is actually required by law.

The second was to employ cultural monitors to evaluate sites for native plants used in tribal cultural practices and to identify landscapes of importance.

And then the third one was to develop a quarterly meeting schedule with tribal representatives in anticipation of future projects.

So I want to point out that during the environmental assessment, that EA, in some ways the tribes felt a little left out of that process and not as engaged so the HIA helps to build that trust and bring back that openness.

A fourth recommendation was that the construction

contractor should develop mitigation strategies for potential infectious diseases, specifically for sexually transmitted infections that are often associated with temporary, transient work forces.

And then lastly, wanted to consider additional observations in an alternative season for the desert tortoise. This is a protected species in that area and when the environmental assessment was conducted it was done so at a time when the desert tortoise was less-active, so they wanted to survey the tortoise when it was more active so they could get more accurate and reliable measurements which would help inform the mitigation strategies.

So the next step would be reporting, right? Which I showed you at the beginning. The report is done. It was completed in 2014, I think, and it's available online. And in that report we have the monitoring and evaluation plan, which is the last step of HIA. And I tried to find some updates to share with you all and I don't have any. You guys probably know better than I do because I'm in Ohio and you're nearby. Unfortunately, the only thing that I could find was that construction was supposed to begin sometime in 2016 and I am not sure if it started or not.

Okay. What you may notice is that I didn't mention EPA at all in that HIA example and that is because EPA was not explicitly involved. We selected that

particular HIA as an example because of the location, in California, but also because it highlights the American Indian tribes as the potentially impacted communities.

So I do want to take just a second to go over what EPA is doing with HIA.

We are evaluating HIA as a decision-support tool for promoting sustainable and healthy communities.

In fact, we have three HIAs that are completed:

The first one I have here is the Gerena School HIA in Springfield, Massachusetts. This was built upon a renovation project of a school and community center there in Springfield.

And the second one was looking at the health impacts associated with the construction of a Green Street, so adding some green infrastructure to the Proctor Creek area of Atlanta, Georgia. And that has since been expanded, this HIA was really quite a success.

And then the last one, which I actually worked a little bit on, was an HIA of the Proposed Code Changes for Onsite Sewage Disposal Systems in Long Island, New York.

So the other thing that we have got going on in EPA regarding HIA is that the resource and tool compilation tool kit is finally out. You can see what the title page looks like on the right hand side there and the link is at the bottom.

And then lastly, getting back to what Charles Lee was talking about with C-FERST - this is my commercial - stay tuned for the HIA roadmap in EPA's C-FERST. This is actually what it's going to look like. You have the six stages, the six steps of HIA and the core values of HIA there in the center. And this is going to be an interactive roadmap that shows you how you can use C-FERST to inform each step of the HIA process.

And that covers it. Thank you guys for listening. I hope you learned a little bit more about Health Impact Assessment and maybe some places where you could go for more resources. Again, my name is Shannon Griffin. I wanted to point you to Flo Fulk as well, she is our HIA lead at EPA; she is a wealth of information and a wonderful person to work with. So I'd be happy to take any questions.

Wait, hold on, one more thing. Government agency, I've got to show you my disclaimer.

(Laughter.)

MS. GRIFFIN: But now I'll be happy to take any questions. Thank you.

MS. MASCAREÑAS: Thank you, Shannon. Let's give her a round of applause.

(Applause.)

MS. MASCAREÑAS: We had a comment come in from the webcast. We have Tim Chauvel who has been a Public

Participation Specialist with DTSC for 17 years. He thanks everyone for the great discussions and presentations.

Over the past years he has been incorporating CalEnviroScreen data into the public outreach and community profile documents and so is making an observation that DTSC should provide guidelines for public outreach documents on incorporating CalEnviroScreen data. I think it's really important to bring up right now, especially since we're going to be talking about additional tools that capture cumulative impacts in discussion later today. So I definitely agree with you, Tim, and thank you for watching and your comment on the webcast.

Are there any comments from the audience?

MS. GRIFFIN: Yes, Jesse.

MR. MARQUEZ: Jesse Marquez, Coalition for a Safe Environment.

As you well know, every environmental justice organization in the entire United States endorses health impact assessments. What we are seeing is that yes, EPA recognizes them; yes, EPA is now funding and supporting them. We need USEPA to issue a simple little statement, "EPA endorses HIAs as an additional public health assessment tool."

Because agencies like the Port of Los Angeles and other agencies, as long as you do not state that it is not a

requirement. And we need it to be an accepted and approved, endorsed somehow with some kind of language so that when we submit our public comments requesting one they will accept it and someday do it.

And so that you do know, USEPA Region 9 did prepare a draft HIA for the Ports of Los Angeles and Long Beach and due to political pressure it has been shelved ever since. However, since I do have a copy and it is available I submit it to all of my Port of LA and Port of Long Beach public comments.

So when are we going to see an endorsement or approval of some type come out?

MS. GRIFFIN: I think that that's a really wonderful comment, unfortunately I am in no position. I can say Shannon Griffin endorses the use of HIA. But I will most certainly pass that along to my managers and maybe that's something that we can talk to Charles about or some of the other management at EPA. But I will absolutely take that comment home with me and pass that up my management chain and hope that we can do something like that. Thank you.

MS. MASCAREÑAS: Any other questions from the audience?

Thank you so much, Shannon, very much.

MS. GRIFFIN: Thank you.

(Applause.)

Decision Analysis for a Sustainable Environment, Economy & Society (DASEES)

MS. MASCAREÑAS: All right. Next we have Brian Dyson.

Brian Dyson is an Operations Research Analyst with the USEPA in Cincinnati, Ohio. He is the Project Lead in the Sustainable and Healthy Communities Research Program for Decision Science and Support Tools. He started with the USEPA working on land management decision support for non-point source runoff and habitat conservation. His current work with the Sustainable and Healthy Communities Research Program is aimed at integrating decision methods and developing decision support tools for community resilience planning, contaminated site remediation, landfill siting, sustainable materials management, and watershed/estuary management.

He holds a PhD in Environmental Engineering with expertise in simulation-optimization and multi-criteria decision analysis methods. Thank you for joining us, Dr. Dyson.

DR. DYSON: Thank you very much for the opportunity to present today. Like Shannon I am also part of the Sustainable and Healthy Communities Research Program out of the Office of Research and Development at the USEPA.

Within ORD there are six programs, SHC being one of them. Within that there are several research projects. I am leading one called Decision Science and Support Tools where we are looking at finding ways to directly integrate decision methodologies into the kind of tools that you are learning about today, things like DASEES, like Health Impact Assessment, C-FERST, et cetera.

So today I am going to talk a little bit about one of the tools that is within my project, DASEES, which is an acronym for Decision Analysis for a Sustainable Environment, Economy and Society.

Decision analysis is a formal, academic term. It's a relatively new discipline. It came into its own in the late '60s, early '70s. In more practical terminology and when it's applied in the field and used there is another term that is generally employed, "structured decision-making." So within our research program we look at DASEES as a structured decision-making tool for the Sustainable and Healthy Communities Research Program.

So I have used this tool or spoken to people about it, you get these very telling questions and there becomes a common theme. So, for example, the first person:

Remedial Project Managers are tasked with cleaning up things like Superfund sites around the country; and he's talked to me about how can I more effectively communicate

with the stakeholders.

And you start to see that. Again, speaking with someone from Cincinnati Metropolitan Sewer District and more recently working with people from Broward County in Florida. One of the things that they are very interested in is they have some plans, they have some ideas, they have the technical expertise to begin addressing problems, but they need stakeholder input. They need to understand what's important from the stakeholders so they can better formulate or better use the tools and assessment capabilities that they have to construct and evaluate the various decision alternatives. And I think more importantly, ensure that the stakeholders are involved in the entire process and that they can effectively communicate to them along the way.

So just a very brief overview about kind of the general decision process that we all go through.

The decision making doesn't really change, whether it is for a large complicated problem, some sort of environmental management problem, or where you are going to go for lunch today. You don't realize it but we all go through the same steps.

Some decisions are easy so we can just go through them very quickly. But generally what happens is time and information are your key drivers.

With the time that you have you need to --

typically what you will start doing is identifying or creating options using the best available information you have to assess what the consequences might be for doing that implementation. So for lunch you're thinking about, you know, do I feel like eating Italian or Mexican today and how do I feel about that? This is what you're doing in your head.

The next step is important for decision making because assessment, while it is critical, is not decision making. The next step is when you evaluate those options. And for large, complicated problems you have to evaluate those options. You have to imbue importance to the assessment results with stakeholder input.

And from there you can then, after doing a trail of analyses, you can decide if you need to document and then communicate and explain to the larger group your decision, especially if you are the one with the authority to make the decision.

So structured decision making in a nutshell: Using a tool like DASEES helps you structure decision-relevant information, enabling the integration of the stakeholder values and concerns for more inclusive evaluation of the consequence assessments, the technical side of your analysis.

So this is a much easier, more simple way to talk

about it. This comes from Ralph Keeney, who was really one of the founders and developers of decision analysis. He wrote a landmark book called *Value-Focused Thinking*, which really lays out the theoretical and philosophical foundations of these ideas. It is really -- decision analysis, structured decision making, is not much more than:

> "A formalization of common sense for decision problems that are too complex for informal use of common sense."

So these are things that you've heard the phrase "wicked problems," "wicked environmental problems." These are things that are not strictly environmental, they're social, they're cultural, they're economic. They get inextricably tied together and how do you sort those out and make sense of them, especially if you have a large group of stakeholders of varying levels of background and expertise and you need a way for everyone to be on the same page and in agreement?

So if there is one thing that you take from the talk today it's the text that is in blue here and that is that: SDM provides an organized approach to integrate Facts, the scientific knowledge, the data, the information, the assessments that we can generate, with the Values, the stakeholder concerns.

We have a term we call "Construction of

Preference" and that's what you do with decision analysis methodologies. You take the facts and the science and the data and you overlay it, you overlay on that this constructive -- this preference structure. Because that is how decision makers are able to then evaluate the information that they are given so that they can make decisions that are consistent and in alignment with the stakeholder concerns.

Two broad steps for doing this kind of structured decision making process.

The first is finding common understanding of the complex problem. That is getting the decision context down. That's much more qualitative, a lot of interactions and workshops, meetings, talking with people.

The second tends to be much more of a technical, that's when you bring in the technical expertise. That's where you create. You create or you identify existing alternatives that are responsive to the stakeholder concerns. You don't just pick the one that the guy down the street did or someone who had a similar -- the next town over they did this, maybe we should just do that. Well maybe, but only if you can evaluate it against what your particular context demands, what the concern are from the stakeholders.

Once you have a list of options then you need to

do some simulation, you need to do your assessments, things like health impact assessments, to evaluate consequences, to get your assessments. And then you look at those -- you evaluate them, you imbue that value, that stakeholder value. And there is a specific methodology for that that we employ, it's a multi-attribute method. From that you can do your tradeoff analysis and then you can hopefully choose an alternative and then communicate that to the stakeholders.

And then from there you work with them to look at implementation plans, monitoring plans for future adaptive management.

So DASEES uses five steps to do the structured decision making approach.

But before we get to that, it is a web-based framework. A web-based tool, it's got a URL. Right now it is finishing being developed, it is password protected, but we have been using it with several regions, several EPA regions around the country. It is a -- while it is a web-based tool it houses a suite of smaller tools within that five step process that you can use through the whole thing or you can use individually or in concert, you can mix and match it depending on your particular needs, it's very flexible that way.

And most importantly, it is a way to really help you include stakeholder perspectives which you then use in

subsequent, more technical analysis.

So for stakeholder participation it kind of spans those first three steps where we start by design with DASEES and decision analysis, we start at the beginning with stakeholders characterizing what the decision context is, what their concerns are.

Eliciting from them, from their values what their objectives are, what their key criteria are.

Another important thing is that the decision makers are also stakeholders and they have important input as far as policy and regulation go. Earlier on today people were talking about how some agencies are siloed or they have to keep in their lanes. As much as we don't like that it is a reality and some -- if you are the person with authority you may not have authority to go beyond that and you have to be able to communicate that to the stakeholders, that there is only so -- this is the bounds of which we are allowed to look at potential options for this particular problem. It can be a pertinent issue. So decision makers are stakeholders and they are there right from the very beginning collaborating with the larger group of stakeholders.

At that point the decision maker may be comfortable. They may say, "Using DASEES to characterize this qualitatively may be all I need for this particular

problem" and that's fine, you can stop there.

But if you don't want to, if you want to go on to more technical analysis, I didn't specifically include it in this particular presentation but we have several tools built into DASEES that allow you to do causal probabilistic assessment and doing -- we have things like consequence tables, which I will show you in a few other slides.

But we have the ability to integrate things like health impact assessments or environmental assessments or whatever sort of data or information that you need for your particular problem. We have a way of integrating them through a causal network that captures the system that you are dealing with and it allows you to effectively capture uncertainty because sometimes we don't have very good data.

Sometimes we have no data and you need to rely on expert knowledge and we have a way of incorporating that. If you have a particular problem and at the time you have you can't get scientific data and you have to make a decision, with these decision methodologies we can quantitatively incorporate expert opinion and knowledge and characterize it and present it very carefully. That can be a real benefit depending on the constraints that you have.

So that second step, the assessment and the evaluation, that's generally a much smaller group, much more technical. And then you do that analysis.

And if you're comfortable making a decision in the last step you can bring the stakeholders back in and report to them, this is the analysis, this is the decision we're thinking about doing, now let's work on a plan for implementation and monitoring. Again, making sure that it is consistent with the values of the stakeholders.

So three quick examples of application of what we have done with DASEES.

So in Broward County there is a small community, Dania Beach, just south of Fort Lauderdale. like a lot of southeastern Florida they are experiencing more and more flooding from sea level rise. So this community is being inundated and it is impacting their infrastructure.

The region wants to implement a Climate Change Resiliency Plan and they started with the smaller community to see if they could build this plan and then repeat it with other communities in the area.

So the first thing that we did according to the steps of DASEES is we wanted to understand the context.

We got together with all the different stakeholders sand asked them, "What is your problem? What do you think solutions are?" Everything. Listened, just listened to them.

And we were able to establish -- some of the major drivers were easy to establish; it was obvious there was

flooding. Sea level rise was causing flooding, infrastructure impacts.

One of the big concerns, especially for the smaller communities, what is the allocation of resources for these problems?

There were some areas of difference that I found to be really interesting. At the county and regional level they were really interested in managing the water, "We have to take care of this flooding." But when you talked to the community they were not as concerned about the flooding. They recognized it was a problem but they had other issues. They have health issues, they have crime issues, they have economic concerns. There's all these issues as a community that they have. And they were willing to say, "We would weigh, we would trade off investing money in flood control if we could put some of that maybe into health or education." So there was a disconnect and it was important to understand that at all of those different levels of governance that everyone is not on the same page and trying to find out how you are all on the same page so that you can start working together.

But what they did agree on is that they wanted to pool all their resources so they could work together because they recognized that they needed to do that.

So the first thing you do is you have a workshop

and we use trained, elicitation experts. This is the stage where everyone speaks and no ideas are scoffed at, everyone is listened to. Everybody in the pool, you know. It's an all-skate, let's go. You gather all of that information.

And then what you need to do for structured decision making is then begin to identify and categorize that.

And then in subsequent steps in DASEES we structure it, we structure it for the decision process.

And it kind of looks like this. We have a thing called the brainstorming tool and it is essentially a digital white board with sticky notes and it is actually kind of fun to use. That was one of the criteria when we built this, that it had to be fun. You can click on things and move them around and change them and it's very engaging because this is not a technical tool for modelers, this is for anyone to use.

So when you ask people about their problem the first thing they do is they tell you what you should do or what needs to be done. Those are Means Objectives. And what we need to do is separate out the fundamental objectives and we do that by asking a really simple question. Whenever they say, "This is what you should do" we ask them "Why is this important? Why is that important?"

And through that series of questions you get to

what are the Ends Objectives. Those are your targets. That's the thing that you really care about that you want to hit.

Once you get your targets then we ask them about criteria, performance measures, because those are the things that you measure, you do the assessments on to determine whether or not you're hitting your target.

So we begin to identify the pieces. And we get all this from the brainstorming session. The pieces and we identify them and we explain to them how they all fit together so they understand the difference between Means and Ends Objectives, what criteria are for.

And the Options are those more specific actions that you might implement in order to achieve your target.

Once we have this organized like this we begin to put it into the different steps in DASEES. So here is where we connect those Ends Objectives with the measures. you have a list of fundamental objectives that these are the key things that are very important to people. Not the things that they want to do but the things, it's where they want to be. It's the quality of life, it's where they want to be. And then you say, "Well how do you know if you're there?" That's what the criteria are for, then we begin to connect those.

So for the next step it's a very similar idea.

These are your Means Objectives, these are the things you want to do. And more specifically, what's that specific option that you think is feasible or that you may have money or you may have in place that you could already do, and you start connecting these.

And this is, you know, this is not brain surgery. But what's important about this is when you have multi-objective problems that are complex there is a cognitive demand, you really can't keep all this in your head, it's really hard to understand, there's a lot of moving parts. This structures it all for you and it makes it very easy to understand. It is very easy to manipulate. If you want to do several what-if scenarios you can change these. This is all about prioritizing and getting down on paper what's important. Not on paper but getting down digitally in the tool what's important to people. What do they want to do, where do they want to go, how do they want to do it.

And then once you get this qualitatively done you move into the more technical part using whatever assessment methodology you think is appropriate for that particular criteria.

This is where you come -- this is where the rubber meets the road. Decisions are choosing this or that. Are we going this way; are we going that way? Typically with this tool what happens is we will help people define the

status quo. This is what you are currently doing. We are here because whatever you are currently doing probably doesn't seem to be working for you. So you can show them, these are the actions you're taking, this is the level of effort. Now we can build alternative futures that will essentially compete against that.

And then once we have this set up of the things that you want to look at to potentially replace the status quo, then we are going to go to the technical people and they're going to do that work for us. They are going to generate the facts that we need in order to evaluate these different alternatives.

And then the decision maker with other pieces of DASEES, other ways of outputting the results, will be able to make that determination.

So for this particular one we finished that step three where we were listing the three levels of governance and their objectives and their measures and what's important to them. We're using that so that they can identify important short-term goals that they can implement now; and more importantly, I think, identify the mid- and long-term goals so that they can start thinking about how to best allocate the resources for the assessments that they need to do. And we're building these causal models for them right now that they will then populate with the information that

the technical experts generate.

One that we are beginning to wrap up now is the Bunker Hill Superfund site in Idaho. It was a silver mine and unregulated for years and years and years and downstream there's all these wetlands that are contaminated with heavy metals. And there's a lot of avian waterfowl mortality and it really doesn't look good when you have dead swans all over the place. And the stakeholders, the community is really up in arms about it, really concerned, and they want the wetlands cleaned up.

So what we did to help them was we did a prioritization exercise. So we sat down and said, you know, "What are your objectives, what are your criteria?" This is a prioritization exercise, this is what we call a consequence table. So they wanted to determine with the money that they had, "Where do we start? We have many, many wetlands. How do we pick the first one? What's the best bang for our buck, so to speak, because there are multiple criteria?"

What you see here is on the Y-axis is your potential options, potential places to start and the X-axis shows you the cumulative impact of al your criteria. Now this is that thing that I talked about where you integrate facts and values. What you are looking at is not just scientific assessment. The length of those segments in the

bar chart represent not only the scientific assessment but the preference and value that the stakeholders assign to it because that's how they make decisions. So this can change depending on how stakeholders change the preference structure. The science does not change but preference can because priorities can change.

So in this case, you know, the wetland on the bottom there might be the one that you would choose to do first. But this is looking at it cumulatively. The tool also allows you to look at each individual criterion because sometimes it is very insightful to understand tradeoffs across the different wetlands. So there are a variety of ways that you can use these results to evaluate and then ultimately prioritize and make a decision.

And then this last one, this is just one slide for this work we did several years ago. We have something called the Social Network Tool which maps communication flow. It maps information of how people, stakeholders are talking to each other.

And it is really kind of a fun exercise to do with a group. We asked everyone to write down not names but just, you know, I'm with the EPA and I regularly communicate with California or I communicate with Department of Environmental Quality, that kind of thing.

I think you can see it here. Over on the right

hand side there was this tiny, little isolated island of communication. These were people that were in the group with us that never spoke to anyone else. They're part of it but for some reason they were not connected.

So this is a real simple exercise. It really shows you where there's breakdowns in communication. We were able to fix that and moving forward, you know, we had much better communication among the stakeholders.

So application insights:

Decisions for complex problems are hard. And you have seen a lot of tools today and there's a lot of other tools out there. They won't make the decision for you, they won't give you the answer, but they will help you understand the information that you're given so that you can make more values-based decisions.

DASEES can effectively help you communicate where you are in the decision process. Some people prefer to use it that way, as a communication tool, although it does also have more analytical and quantitative capabilities.

And then for application of the tool, guidance is important. It's that idea of we start with the values first before we get to the options. It's kind of a backwards thinking compared to how most people think about problems. So within a half a day or a day we can train decision makers on how to use this tool and they get it very quickly, it's

not really -- it is not technically difficult, it's just sort of a shift in your thinking.

And then from there decision makers are usually very comfortable to go to a wider stakeholder group and then use the tool and that seems to work out really well.

It is currently in beta. We are moving it over to an EPA server. We expect the tool to be public by, I think six months or so, by January, but we are currently using it with groups. If you're interested you can contact me. We look forward to working with you on any of your particular problems.

This is just a little blurb about what the tool is.

And of course, like Shannon, the obligatory disclaimer this work does not necessarily reflect any policies of the USEPA. Thanks.

MS. MASCAREÑAS: Thank you, Dr. Dyson.

(Applause.)

MS. MASCAREÑAS: Do we have any questions from the audience? We are going to take a short break after this and then reconvene.

Really a fascinating presentation; thank you so much, Dr. Dyson.

And so for the break we are going to do 10 minutes so if folks could come back here by 2:40.

And in that time Dr. Polidori from the South Coast Air Quality Management District has set out some of his sensors and monitors that he uses out right by the entrance so you can go out there and take a look at those. He will be speaking in-depth about those sensors later today.

So at 2:40 we'll reconvene, thank you.

MS. MASCAREÑAS: Thank you so much. Welcome back, everybody, to DTSC's SB 673: Cumulative Impacts and Community Vulnerability Symposium.

We are going to start this next session, the last session of the afternoon, with a panel with several presentations focused on data gaps and needs for cumulative impacts and community vulnerability and we have three fantastic presenters here today with us. I am going to read through their bios and then they'll share a little bit about their area of expertise and we'll upon it up for discussion and questions.

Sitting to my right is Andrew Slocombe. Andrew is a Research Scientist with the State of California's Office of Environmental Health Hazard Assessment. Among his responsibilities are the analysis and evaluation of public health, chemical exposure, environmental hazard and demographic databases for their suitability in CalEnviroScreen - a geographic screening tool used to identify disadvantaged communities. Andrew conducts

biostatistical analysis and provides scientific expertise for the development of the tool. He also communicates proposed approaches and results of CalEnviroScreen at public meetings and training sessions. He has worked as a health risk assessment consultant and researched water quality in rural Guatemala. He is a graduate of the University of California, Berkeley School of Public Health.

Sitting to the right of Andrew is Álvaro Alvarado. Álvaro has a PhD in Environmental Toxicology from UC Riverside.

He supervises a team of health scientists at the California Air Resources Board. The team is responsible for evaluating the health impacts of air pollution and providing advice on how air quality regulations affect public health. He has provided expert witness testimony, lectured at UC Davis, and has given interviews in English and Spanish on the health effects associated with air pollution exposure. His team oversaw the research contract that developed the Environmental Justice Screening Method, which formed much of the basis of CalEnviroScreen.

And to the right of Álvaro is Rick Fears. Rick is currently managing the Statewide Geographical Information Systems team within the Geological Services Branch at the Department of Toxic Substances Control.

Rick has 29 years of private and governmental

environmental and geotechnical experience. Rick participates in the interagency LA Basin Groundwater Convening Workgroup. Thank you.

Rick, if you want to start us off with presentations.

Spatial Prioritization Geographical Information Tool (SPGIT)

MR. FEARS: Hello, Everybody. My name is Rick Fears and I work for the Department. I heard a lot of people say that they are honored to be here and truthfully I am honored to be here. It's a big thing for us to show our science and be able to present at this forum.

The reason I'm here is because we came up with this idea to invent the SPGIT tool and we did it about three years ago.

What is the point of this tool? We started thinking about our drinking water supply in the state of California so I'm going to talk about that a little bit and walk you into some of the problems that we have.

There are approximately 21,000 drinking water wells in the state of California that are public wells, so each of those has more than 15 service connections, and they are managed by 7,500 public water pumpers and water management systems. So they are at all different levels.

And what we see are some of our concerns. In San

Fernando Valley, and actually they gave a presentation, it says 80 percent of the drinking water wells are lost there. It's only 74 percent of their drinking water wells have been basically not usable because of anthropogenic groundwater contamination. San Gabriel Valley's Superfund area, it's about 40 percent of their wells have either been destroyed or placed on standby because they are too contaminated for us to drink the water from anymore.

So many contaminated wells have been placed on standby or abandoned and we are starting to lose resources in the state of California. So, you know, big water agencies that serve millions of people are losing substantial numbers of wells. The presentation yesterday that I saw showed us that most of that happened between 1981 and now. I'm sorry, 2001 and now, not 1981.

We started monitoring the well systems in 1984. This is statewide. So in 1984 we start off with about 300 wells that exceeded the MCLs. And in 2013, which is the best data we could get at the time we did this, that had moved up to 1200 wells; so there is a slope. And whenever we started looking at this problem we said, "Wait a minute, there shouldn't be a slope." We have been, at the Department of Toxic Substances Control and at the Regional Water Quality Control Boards as well as local and Superfund program work, we have been cleaning up sites in the state of

California since back in the '80s and we have a slope that's going up still and that's of concern. That's the problem.

Not only do we have a slope that is going up but if you look at the lighter, the green colored stuff on this slide, that's wells that have been destroyed in the state. So the slope is going up and we are losing more and more wells through destruction. And these are wells that aren't just destroyed wells, these are wells that exceed MCL, the drinking water standards for the state, what we consider the safe drinking water standard.

So what's really happening here?

So this is like -- and I always show this slide; every presentation I ever do. This is a site conceptual model. You know, this is about groundwater. But if we're thinking about like the rest of the stuff, you know, air, water, soil, this is a good place to start.

So what we show here is that we show that there is a drum spilled and it goes down and it hits water and then it sits there and it bleeds into the aquifer. It can create indoor air issues or it can go over and find a drinking water well and it can contaminate it. And this is pretty typical, you know. So we are not showing the other cumulative environmental impacts but that's kind of what we should be thinking about.

And I think that that's what I'm kind of learning

from the presentations that I've seen today is that this is a pretty good tool for us to do that because we can all look at it and we can all agree upon it and it's simple.

So what did we do about water?

So first of all, when we developed this took we couldn't show groundwater locations within a mile of their actual location per our agreement with the drinking water program folks at the State of California and so we started off with polygons that were roughly two square kilometers.

And then what we did was we said: Well what's important here? What do we know and how can we use that information that we know? And I am not going to say the word "data" in our presentation other than that one time. But what do we know?

So we know that there are drinking water wells and we knew that we had results for those drinking water wells and so we could put that information together. And then we had our Department's generator list. So if somebody in the state of California goes and they dispose of a hazard waste then we put it into our Hazardous Waste Tracking System at the Department of Toxic Substances Control. We also have the USEPA's Toxics Release Inventory data set. So we can kind of look at those things.

Other things that we knew -- and we actually changed this. We added CalEnviroScreen to this because we

wanted that cumulative impact. And that's kind of what we did to put that cumulative impact as well as environmental justice components into this work.

So then the last thing we kind of look at - and a lot of people don't look at it this way - but we look at our sites at DTSC and we say, hey, if we are working on a site we have risk assessors and people that are professionals who are looking at that information for that site and we don't feel like we are going to impact the people that are working on that site once we get on it. We are going to remove the immediate health threat risk from that site.

Also we wanted to use this tool to go find whodunit on those drinking water wells so we kind of say, well, let's put a 1/X whenever we're working on a site. Because we wanted to look for places we weren't working on sites.

So we kind of put all that together and then, you know, the decision process here was like, well, these things are not all equal. And really they talk about from the health risk side. The health risk is the drinking water wells. People can be impacted by contamination from those wells, both -- and you saw from the conceptual site model that we have indoor air issues and soil gas issues that we need to be concerned about. We also have the drinking water itself and the loss of that resource and, you know. You

want to talk about justice. Water, everybody has to drink, you know.

So we really saw that water and that component hadn't been used before by anybody that we knew about to really do environmental work in the state of California and we said, that's the most important thing here.

So we kind of gave it an order of magnitude. We didn't give it an entire order of magnitude but we gave it an 8. And we kind of played around with some numbers and we looked at stuff and we thought about it but, you know, we talked about just being objective. All those data -- I said it, dang it.

(Laughter.)

MR. FEARS: All that information was, you know, in the form of values.

So what we did was we took those values and we tried to bring that from being subjective to make everything here through this process as objective as we could. Because we wanted a level playing field and we wanted to look at the information that was available evenly.

And then we said, let's muck it up with some subjective stuff, but the subjective stuff wasn't just stuff that we, you know, considered, it was stuff that we had understanding of because we work in the health field and we work with our toxicologists and we look at risk and we look

at what the drivers are.

So we had health risk; potential risk from our facilities and the information that we were able to glean from those; and then we used CalEnviroScreen, which was pretty amazing for us to plug into here and the timing was just it kind of worked out for us; and then the last was our sites.

So we are going to talk about calculating the results. Not very much. We're going to zip through those and we're going to see some maps because I love maps and I like a lot of color. I've got this guy named Roger Cleaves who does this work and makes my maps beautiful.

So each of these, each of these polygons that we generated for the state of California combines that information and it ranks it and prioritizes it. So now instead of just having like a bunch of wells out there, now we have an ability to say, hey, where is Number 1 at? It's in San Fernando. Where is Number 2? It's in San Gabriel. Superfund sites, both of them. Where is Number 3? San Gabriel, they're lucky. Number 4, back to San Fernando. But Number 5? There was no place, there was no site. There were no major groundwater contaminant sites from either the Water Board, the DTSC or the USEPA. And then Area Number 5 there were 15 wells in that area and all 15 of them were impacted above the drinking water levels, safe levels. And

so we're looking at that and going, this is of concern. So that's kind of what this tool is and that's what it does.

Then our next step is to try to drill down into the information that we brought with us through our process but we also have to do some additional work here. We have to go figure out which way groundwater is flowing and what's going on with the production well that might be impacted.

Once we zero into an area we're going to be looking at a well so -- I'm going to use my mouse, this is terrible. But this is a drinking water production water well right here. And this is conceptual, this is not a real place but we drew this up.

So typically a well in an aquifer will have a capture zone and that capture zone will be kind of a horseshoe-shaped thing that everything from the bottom right hand corner of that slide flows into that production water well and is captured by that, so we call that a conceptual capture zone. And the arrows on the map show the flow directions conceptually.

But the other information that we are bringing to the table, and we have a lot more information than what we are showing here, but we are showing where industrial facilities are on this map that also were using the same chemicals that we are looking for in the production water well. So if we are looking for TCE then we are looking at

potentially sites that have TCE production, either through the Toxics Release Inventory or our DTSC HWTS information.

And that's how we kind of apply this tool. So right now I work on this tool. And this tool was helped developed by the USEPA in Region 9 through our PSAI grant. So our preliminary Site assessment work is aimed at correcting some of the drinking water issues that we found in our state.

But, you know, if we want to think bigger and broader and how does this apply, what's this got to do with cumulative? And this is a piece, you know. There are lots of pieces out there. The process that we go through our information, bringing that together, making those subjective opinions about what it means, and then implementing it to give us a tool that can help us do this kind of work is the same. It's different, it has different pieces and more components and it has, you know, soil, air and water components, but it also has those human components that we have heard people talk about today. "Hey, this is my neighborhood and this is what I see happens."

Because as regulators we follow our rules, and our rules are really good rules and they are protective, but they don't look at things that are on the other side of the fence. You know, we are in our little place and once in a while it's good to stick your head out of the hole and look

around and see what's out there, if the hawk doesn't get you. But, you know, that's kind of the approach that I see, you know, combining the things that we saw from Gina Solomon today. The process of doing this that was defined in our last presentation. Yes, those things work.

And I think, you know, if we were all physicists up here we would be talking right now about a unified theory. And that's what they did for physics in the last 20 years and that's kind of what I envision us maybe doing for our environmental health work that we do every day and we all care about and this is a path forward.

So that's all I have for my presentation. Thanks.

(Applause.)

MS. MASCAREÑAS: We can field some questions also after the presentations from Álvaro and Andrew. Thanks.

Data Needs for Cumulative Impacts and/or Community Vulnerability

MR. SLOCOMBE: I am also allergic to microphones.

Good afternoon, everyone. Have you had cumulative impact tool overload yet or are you guys still raring to go? I'll give you more.

(Laughter.)

MR. SLOCOMBE: Well unlike Rick I am going to use the word "data" a lot in my presentation so just be forewarned.

So again, my name is Andrew Slocombe, I am a Research Scientist with the Office of Environmental Health Hazard Assessment, OEHHA as we call it.

I am going to talk a little bit about CalEnviroScreen and the data and data sets that we look for for inclusion in CalEnviroScreen.

So specifically I will give a brief overview of kind of the methodology that goes into CalEnviroScreen and how it's put together and how we look at cumulative impacts.

I will go over the criteria that we look for in how we select data sets that go into CalEnviroScreen.

And the importance of, especially geographical accuracy, in those data sets and improvements that have been made along those lines.

The role of geographic information systems, of mapping for CalEnviroScreen.

And then kind of the next steps, what's next for CalEnviroScreen.

So we just released version 3.0, so the kind of second major update of the tool, earlier this year in January of 2017.

What CalEnviroScreen is is a geographically-based screening tool that looks at relative burdens across California of both issues of multiple sources of pollution as well as vulnerable populations that live in these

communities.

And there's 20 data sets or indicators that come together to provide the information to evaluate this.

It's evaluated at the geographic unit of the census tract; which as Kevin mentioned it's small units created by the census. I'm sure most of you are already familiar with census tracts. But based off of what he talked about in EJSCREEN, a number of those block groups form a census tract; so again, it's a small geographic unit. There are approximately 8,000 of them across California. They usually hold around 4,000 people, population.

So getting back to what Gina started with today. This idea of, this kind of concept of cumulative impacts really is what informs the model of CalEnviroScreen.

So again we are taking a departure from the traditional risk assessment approach where we're looking at, you know, one single exposure or one single chemical and the health effect from that; and trying to look at and trying to screen for areas that are both burdened by multiple pollution sources in a community and also that contain populations in that community that are more vulnerable to the effects of that pollution.

And we do this by kind of taking the pollution side and the population side as two separate entities. And we actually have four components that we split up our data

sets into; two components on the pollution side and then two components on the population side.

So the components on the pollution side are represented by Exposures, so indicators that represent direct contact with pollution. So talking about your air pollutants, your water, drinking water quality components, pesticides.

And then your Environmental Effects indicators. So places that have various environmental conditions in the community or close to the community that may cause an exposure but most definitely have, you know, a source of stress for nearby communities, which we know that that stress has an impact. As Gina, you know, talked about at the beginning, that stress can adverse health outcomes in and of itself.

And then we have the population components. We have a Sensitive Populations component. Communities that have people with biological traits that make them susceptible to the effects of that pollution. so things like health problems such as asthma, low birth weight in children and things of that nature.

And then also the socioeconomic issues in the community. We know that communities with high poverty rates or high unemployment rates are more vulnerable to effects from pollution issues.

So breaking it down. These are the 20 indicators that go into the CalEnviroScreen tool. Again, you've got the Exposures and Environmental Effects set of indicators on the left here and then the population indicators on the right. And again, such indicators that go into the Exposures are these air pollution issues such as ozone, fine particulate matter, diesel, which we have heard about today, and then your drinking water contaminants and the pesticide use and others.

Environmental Effects of interest would be hazardous waste storage facilities and generators of hazardous waste, cleanup sites, which we've heard a little bit about today as well, as well as solid waste sites and facilities and impaired water bodies.

And then among the population characteristic indicators again you have your health problems here and then your socioeconomic issues.

And I won't spend any more time going through each individual indicator. But I think this as a group, as a whole really represents this idea of cumulative impacts. All of these different sources of exposure and vulnerability kind of coming together.

So how do we get a sort of cumulative impact score from all of those indicators?

Well, each census tract is given or gets a data

point for each of those indicators. And then depending on how that ranks to the other census tracts of the state it is graded on sort of a percentile scale. So the higher that the score is compared to the rest of the areas of the state, the higher the score for that individual indicator is.

And then each of those pollution indicators gets an average for the pollution, kind of, piece of the equation and then each of those population indicators has the same average.

And the two are then multiplied together to get at this kind of cumulative impact score, CalEnviroScreen score.

The higher the CalEnviroScreen score the more burdened we consider that community to be in terms of this kind of slew of all these different indicators.

That leads us to an overall results map which we can show on a map here, like you can get to it through our website listed here at the address below. The highest scoring areas are shown in red and the lowest scoring areas in green. you can see that much of the Central Valley and much of the LA area score very highly in terms of these cumulative impacts.

So what do we look for when we are selecting indicators or data sets to go into CalEnviroScreen?

Well obviously first we need to have an indicator for the pollution side that is widespread in California so

that it can be compared across the state to other areas of the state and it be linked to, you know, health issues or risk of health problems.

For the population indicators we are looking for, you know, scientific evidence that links these issues to vulnerability to pollution, so that's kind of first and foremost.

Then we are looking for ideally publicly available data and available at a statewide scale so that we can, again, use this comparative approach.

And it has to be attributed to a pretty fine scale of geography.

And obviously we are looking for the most accurate and current data possible.

So with all of those kind of criteria we often are looking at other department or agency, boards and department data within the California EPA or the USEPA data sets. They're the largest data sets that usually have the most coverage and are kind of standardized across big areas like this.

And it is very important. Obviously since this is a geography-based tool that the data be accurate spatially or geographically accurate.

So, for instance, a lot of our environmental effect indicators are scored as in this picture here. They

are individual sites that are then scored based on their proximity to populated areas within a census tract. So having the sites be accurate and where they are stated to be is very important. And also for bigger sites, having the ability to show a polygon of an area that takes up more space rather than just a single dot on a map is important as well.

We have done work to correct accuracy of locations, or at least checked some of them, but there are so many of these sites that we obviously can't do all of them. The Environmental Justice Screening Method Team, which you will hear more about next from Álvaro, have done work to look at and correct locations for a lot of the hazardous waste storage facilities and they have shared that data with us. There has been a lot of collaboration between the Environmental Justice Screening Method Team and us over the years and they have also been able to identify this kind of spatial area or polygons for the bigger hazardous waste sites.

And we have also seen improvements in data for the solid waste sites from CalRecycle in that some of the larger solid waste dumps now have the perimeter area mapped out that we can then use to generate the proximity to populated areas, which has been a great improvement.

Before CalEnviroScreen 3.0 we have received

feedback that the areas of san Diego and Imperial County close to the California-Mexico border were not feeling like the pollution indicators were getting at what they considered to be their pollution issues in that area, so we took steps to again collaborate. We've heard a lot, again, today about how important collaboration is.

But again, be willing to listen to feedback and address some of these data gaps. We worked with local communities and local government agencies in those areas to improve the data as well as with the Air Resources Board and with the USEPA to add to our larger data sets, taking into account toxic releases and diesel emissions along the border area from the pollution originating in Mexico. There is still more work to do in that area and there will be continued collaboration to keep improving that area.

I just want to talk really briefly about the importance of the geographic information system, or GIS, in CalEnviroScreen.

Not only is it, you know, very important in terms of scoring a lot of these indicators in terms of, you know, mapping out proximity to some of these hazardous waste sites or other environmental effect sites.

But also the importance in communicating and displaying results that can then be accessed by anyone that wants to use the tool or learn more about a specific area.

So ArcGIS online has been a really useful tool in displaying this data and Walker Wieland, one of my colleagues, has been really instrumental in making a lot of these individual, not just the overall results but individual indicator maps available.

And also being able to access a lot of the attributes that might be of interest within an individual indicator or data set through the mapping tool. So for instance, in this image here is our pesticides indicator. You can click on an individual census tract and get an idea of where that pesticide score is coming from, how it compares to the rest of the state, and also, you know, what the most-used pesticides in that area are.

So I'll just finish by talking about what we're doing sort of in the next steps of CalEnviroScreen.

So at this point in time we are looking at a future update down the road and what that might entail. That requires us to go back to the public comments. It's a lot of back and forth with workshops in releasing these tools.

And going back to the comments and what people had as criticisms or ideas for the future and then evaluating whether there's potential data to use to get at a particular issue is a big part of the work that we will next do.

Again, we talked a little bit about the

California-Mexico border issue and other collaborations with other government agencies and departments as well as with the community groups that inform the tool to keep improving the data that we do have.

It is always good to work on, you know, peer-reviewed scientific manuscripts to improve the robustness of the scientific aspects of the tool, so we will be working on that.

As well as continued outreach and training and presentations and sharing of information and learning form people like you.

So thanks very much. If anyone has any follow-up questions feel free to contact me. I'm sure that the presentation materials will be available. Feel free to reach out to me, I would be happy to talk to anyone. Thank you.

MS. MASCAREÑAS: Thank you so much, Andrew.

(Applause.)

DR. ALVARADO: Hi, I'm Álvaro Alvarado and I work for ARB. I work for the part of ARB in our research division that funds research.

I will talk about two projects. One is the Environmental Justice Screening Method, which we funded starting in 2004, and then I'll talk also about another contract a little bit on the US-Mexico Border as well.

I am interested in, of course, cumulative impacts and mapping and big data; I am also interested in where the maps fail. Where do we get false positives where a community is labeled disadvantaged when it's not and communities that are not labeled disadvantaged when they should? I think the US-Mexico border is a good example of that.

So the Environmental Justice Screening Method or EJSM was developed by Manuel Pastor, Rachel Morello-Frosch and Jim Sadd under a contract from ARB.

It is used as a research tool. We use it internally taking it apart, using different aspects of it.

It reflects the published research on air pollution and EJ and health and how those affect communities.

The data that went into it is all transparent and publicly available.

And during the development, you know, many of you attended many of those community meetings with Manuel and Rachel and Jim as it was being developed.

And one advantage of it as well is that it is flexible in that we use both a statewide scoring system and a regional scoring system, which I think helps identify some of the more impacted areas within particular areas.

So the EJSM has actually four different parts to

it. It's:

Exposure and Health Risk, which uses modeled emissions inventories and risk assessment.

Hazard Proximity, which actually I'll talk a little more about. I think that's particularly useful for identifying areas of cumulative impacts for DTSC since they look to implement the regulation.

And then Social and Health Vulnerabilities. More of the SES variables including race, ethnicity and poverty and linguistic isolation.

And then a new layer that was added, so Climate Vulnerability, which maps heat islands and future trends in temperature and how that might affect health and different vulnerability aspects of that.

So the Hazard Proximity:

It is made up of two parts; there's a Sensitive Receptors part and the Hazards part.

First the areas where there's residents, schools, day care centers, parks are mapped.

And then separately the Hazards are mapped. So there's land use areas like railroads and ports and airports and refineries. And then large facilities, those that report their greenhouse gas emissions greater than 25 tons per year or toxics and criteria emissions that are greater than 10 tons per year. And so then smaller facilities as

well including chrome platers and auto body shops and even gas stations. And then also as mentioned, the hazardous waste treatment, storage and disposal facilities are mapped and the traffic density.

The way it is scored is there is a polygon in the center there and that is where residents or other sensitive receptors are and the dots represent different hazards. Our distance is measured between the two and depending on how far they are they get a different score and that is added up to each polygon.

So while that sounds easy, working with big data there are a lot of issues with validating big data. You certainly cannot just grab big data and think it's going to be fine.

So this is an image that shows one where the location of these facilities are and then a line to where they really are. So this was done by Manuel and Rachel and Jim's team. They had grad students go in and verify many, many facilities. And you can see most are in close proximity, some are farther apart. You see one that is very far apart.

So these initial databases were used for modeling air quality on a regional basis and in that aspect they are going to be fine when you are looking at the entire valley or the entire South Coast. When you model on that kind of

scale the accuracy of a kilometer or two is not a big deal. but when you're talking about a neighborhood scale it is a big deal.

So here is one example of a facility. So there is kind of a dot of where our database said it was and then over here is where it actually is, it was several miles away.

And so when we zoom in on that we see the facility and we see that there are actually residents living right up, right up next to it and so this certainly would affect the score. In the absence of this facility, not there and now that we know where it really is, it makes a difference on how we might view this particular community and its proximity to different facilities and its vulnerability.

And then one step further is that this facility, while it looks like a point on a map, an address, it is actually more of a footprint. It has a -- if we represent it as just one point here we see it is quite a distance from the nearest residence over here, when in fact it is right at the fence line of these residents.

And so then the last place I will talk about is the US-Mexico border.

I took -- I want to say "I" but it was actually a talented staff person who made some maps for me yesterday, looking at hazard proximity and then added with some of the

pollution layers. And we looked at just the top 5 percent of census tracts. And when you do that really none of the top 5 percent show up at the US-Mexico border.

When you score just within the region you see that it does pick up the areas that you would expect in San Ysidro and Barrio Logan. But even still here absent is the Calexico area, and like I said, this is one of the areas that is a false negative; I think that area should be highlighted.

And so we have worked with OEHHA to add some of those parameters, the air pollution parameters, especially the diesel and the PM and ozone, which my team isn't responsible for, to get a more accurate look at what they really are, in Calexico especially. But in addition to that we are looking to enhance the Hazard Proximity layer.

So one of the issues with any kind of mapping is you have what are called edge effects. At the edge of a map in the absence of any data it appears to be pristine. That may be true on most of California's border but that is not true on the US-Mexico border.

So we have a contract with San Diego State University, with Jenny Quintana, she is the lead investigator for that and she has lots of different collaborators including Manuel and Jim and Rachel. So they will be mapping a lot of the pollutant facilities on the

Mexico side of the border that border especially Calexico, so we might have a better idea of what -- of what the vulnerability really is there.

And then of course there's these low-cost sensor networks that are happening both in Imperial and in San Ysidro and ARB is working with them as well.

I think that's it. Thank you.

MS. MASCAREÑAS: Thank you very much, Álvaro.

(Applause.)

MS. MASCAREÑAS: Thank you so much to the past three presenters.

If you could email questions. We are going to have these presentations online. We are running a bit short on time; but everyone has provided their contact information and we encourage you to reach out with any questions and comments that you might have to the last three presenters.

Thank you guys, very much.

Low-Cost Monitoring Equipment

MS. MASCAREÑAS: The last presenter for today and then we will wrap up with short closing remarks a little after 4:00 is Dr. Andrea Polidori. Dr. Polidori is the Atmospheric Measurements Manager for Science and Technology Advancement at the South Coast Air Quality Management District. His primary responsibilities include the overall management of all SCAQMD ambient air monitoring network

operations, special monitoring programs and related projects.

He is also involved in the analysis of data collected from numerous field activities and air monitoring projects and is currently leading the design, development and implementation of the Air Quality Sensor Performance Evaluation Center or AQ-SPEC, which a program created to conduct comprehensive performance tests of commercially available, low-cost air quality sensors. I saw that many of you were outside talking with Dr. Polidori during the break about the sensors.

He is also managing the South Coast Air Quality Management District's fence-line air monitoring program.

Dr. Polidori received his Bachelor of Science degree in Environmental Sciences from Urbino University in Italy and his Doctor of Philosophy degree in Environmental Sciences from Rutgers University in New Jersey.

Thank you, Dr. Polidori and thank you for hosting us here today as well.

DR. POLIDORI: Thank you very much for inviting me. The commute for me was really, really short because my office is about 500 feet from here.

Today my talk is about basically our experience with working with low-cost sensors for measuring air quality.

So just a few general kind of words about low-cost sensors:

They are rapidly proliferating, meaning that nowadays you can find low-cost sensors for measuring both gases and particle pollutants pretty much every everywhere, on specialized websites, you can go on Amazon and buy, I don't know, PM sensors for, you know, $50 to $200 depending on what you buy. So they are out there.

For the most part they are easy to operate, but of course the big question is, how reliable, how accurate are they?

You know, back in 2014 when we started this program that I am about to discuss, we wanted to know how well this type of technology is working and we wanted to basically lay the ground for systematically evaluating the performance of these devices.

So AQ-SPEC stands for Air Quality Sensor Performance Evaluation Center.

It was established back in July of 2014 so, you know, it's a three year old center.

It was created with about $600,000 worth of investment. These are all internal funds.

Of course, the main goal and objectives are to try to understand the reliability and overall performance of all commercially available sensors and, you know, minimize the

confusion that, you know, some of the citizen-scientists but also people working for governmental organizations and for the private industry, might have about what can be done and what cannot be done with this technology.

So we basically, you know, tried to evaluate the performance of everything we found on the market.

The biggest three categories of this technology are optical sensors for mostly measuring particulate matter, electrochemical sensors and metal oxide sensors for measuring gasses.

Most of them allow you to measure air pollutants/ air pollution in real-time or near-real-time, meaning that you can buy a PM sensor that measures, let's say, like 5 minutes average PM concentration, and the same can be said for gaseous sensors.

So what essentially we do, we deploy these sensors in the field at one of our monitoring stations and we compare them against the performance of an EPA-approved method. So if it is a PM sensor we have the corresponding FEM, federal equivalent method, for measuring PM and we do a very simple one-one correlation.

So after the field testing we bring back those sensors that have demonstrated some promise. We bring them back in the lab and we do some laboratory testing by varying the concentration of the pollutant of interest but also by

varying the environmental condition in the chamber. Then I'll show you a few pictures of our environmental chambers.

So at the end the results basically -- you know, we are not a certification center yet, we are an evaluation center. Meaning that, you know, we only tell you how well these sensors performed against an EPA-approved method. There are many other issues, calibration, durability and many, many other issues related to the use of local sensors. But those, we have like technical reports that address those concerns. But for the most part we want to let the public know and other people know how well they compare against more reliable and more expensive instruments.

So the three major -- so what we want to do is basically to bring together the three major players in the air quality sensor wars. So vendors that sell these types of devices, sensors or manufacturers; air quality officials, there's a lot of organizations like the South Coast AQMD, EPA, ARB is starting to working with sensors too; and also the community. As the previous presentation was mentioning, the community of Imperial Valley, they have a network of about more than 40 PM sensors already that has been up and running for several months already. So we want to bring together and share the same information with all of these major players.

So field testing started, as I said before, the

field testing itself started a little after we created the Center in September of 2014.

Every sensor is tested in triplicate, meaning that when we get one model we buy three units of the same model and we deploy them in the field for about two months.

The low-cost definition is a little vague but, you know, more or less we tend to purchase all of those devices that cost $2,000 or less.

If they cost more we lease them, we borrow them, we steal them, we do everything that we can to be able to test them.

So our main testing locations are Rubidoux, our Rubidoux station which is located inland. It is a fully instrumented station. We have every kind of EPA-approved air monitoring device there and so we are able to do pretty comprehensive field testing.

We have a second station right next to the 710 freeway. The idea was to use that for testing VOC sensors. There's very few VOC sensors on the market so that portion, it has not been fully developed yet but I will tell you more about VOC testing in a second.

So this is a picture of our laboratory testing chamber. It is a state-of-the-art chamber. As far as I know there is no other air quality agency that has something that is specifically designed for testing local sensors in

the lab.

So as you can tell basically we have -- we can test both for particle sensors and gaseous sensors. Like on the top here we have two different particle generation systems to generate particles with different sizes, at different concentrations, different compositions, size distribution and so on and so forth.

And also we do have a gas generation on the back for, you know, gas testing.

This rack basically includes all of the reference instruments for measuring different gasses from all of the criteria pollutants. We even have a methane/no methane VOC monitor there. Again, you know, we can test for pretty much all of the criteria pollutants, we can test for H_2S as well.

We cannot test for VOC yet. We are thinking about hooking up a GCFID system to basically do a more comprehensive evaluation of VOC sensors. The state of technology for VOC sensors is still underdeveloped at the moment so there's possibly, you know, just a few. And those few VOC sensors that are available in the market are not, you know, that great but that doesn't mean that you cannot use it and I'll show you a VOC sensor application later on.

Basically we can recreate every different type of environmental condition by varying the temperature and relative humidity conditions inside the chamber. We can go

from near-freezing to 50 degrees C and the relative humidity goes between 5 and 95 percent.

This is the first commercial break. Of course we had to create a website to communicate to the public and to other governmental agencies and to other interested parties the results of our testing. This is the main address of our AQ-SPEC website.

You will find every kind of information about sensor technology. I guess one of the nicest features about the website is that if you go under Sensors there you will find all of the thirty-plus sensors that we have evaluated. And then you can click on, you know, one of the pictures.

In this case this is an Italian sensor for measuring, I believe, NOX. No, in this case this is for CO. If you click on that page, you know, basically you can find all the information about technical specifications, type of applications, what it can be used for, what it cannot be used for. In some cases we even have like a link to an YouTube video that shows you how to set it up and how to retrieve data from that sensor.

And then we have our summary table for -- we have two different kinds of summary tables. One is for PM sensors specifically, so there you will find basically, you know, sensor name, the type of sensors, most OPM sensors are optical sensors. The type of pollutant it measures and

approximate cost. And there you have a Field R^2; it is basically a correlation between the EPA-approved method and the particular sensors. As you well know, if it is "zero" it is basically a random number generator; if it is "one" there is perfect correlation between the two, the instrument and the sensor.

So generally speaking we have seen that most PM sensors have a minimal down time. Just to give you an idea, over a two month period we have been able to retrieve more than 95 percent of the data at one minute time resolution for most PM sensors, which is quite impressive.

A moderate intra-model variability, meaning that if you buy three units of the same sensors more or less they perform the same, which is also very encouraging.

The have a strong correlation with the FEM, as I said. If you take a look at all these numbers, I know they are very small and you cannot see them here, but you will see that a lot of PM sensors have an R^2 above 0.8, mostly for $PM_{2.5}$. For PM_1 and for PM_{10} maybe it's a little different but, you know, they actually perform quite well.

However, one of the major drawbacks is that they do not come calibrated. The linearity, the correlation could be 1.0 but, you know, maybe they might read twice as much as the reference system. So if you are thinking about using this type of technology it is extremely important to

check the calibration. Maybe if you live -- you can contact your local air quality agency and maybe asked them to do one or two day's worth of co-location to see if these devices are calibrated.

There is also some bias in the algorithm that is used to convert particle number concentration into particle mass concentrations. Most of these devices, I would say all of them, they measure particle number concentrations, they're optical counters. Every manufacturer has developed an algorithm to convert number to mass and so there is some bias in there too.

For gaseous sensors I think the overall picture is not as encouraging. I would say that for sensors that measure CO, NO and also ozone there are very good alternatives out there.

This particular monitor is commercialized by 2B Technologies, a portable monitor. It is battery-powered, has an R^2 of 1.0 and also in terms of calibration it compares extremely well to our FEM ozone monitors. The problem is the cost, more than $4,000. So it uses exactly the same type of technology you would find from -- in a monitor at our network station, UV absorption. It is very, very small but it is still expensive but the technology, you know, is getting better. This is possibly one of the best if not the best performing quote/unquote sensors that we

have tested.

So for electrochemical sensors in particular you might have some interference between ozone and NO_2. There's a lot of NO_2 that is also measured by the ozone monitor.

There is some interference also when you have, you know, high relative humidity so you have to be careful about taking that into account when you evaluate the performance of these sensors.

And then, you know, for SO_2, H_2S and especially VOCs, these are difficult to measure with available sensor technologies. Again, it doesn't mean that you cannot use it. It depends on the specific type of application that you have in mind and I'll show you an example in a few minutes.

So basically one of the questions that we are asked by community members, for example: What is the best sensor, what should I use, right? What they are asking is that what is the sensor that compares the best to the EPA-approved method?

That's a good question but I think that, you know, a better way to approach the problem is that what is the type of application that you have in mind, right? If you ask that question first and then you select the sensor based on the application that you want -- based on your needs. There's a lot of, I would say relatively accurate, relatively precise, relatively good sensors that can be used

for many, many different applications including characterize spatial variations, permitting, fence-line monitoring especially and to resolve certain community concerns.

For example, if you live downwind of a refinery and all you want to know is whether or not there's no VOCs, some VOCs and a whole lot of VOCs, maybe a $200 PID detector can be good enough for you, right?

If there is a spike, if there is a leak, if there is an explosion -- if there is an explosion it's a different story. But if there's a lot of VOCs out there you are going to be able to see it. So that $200 VOC sensor that most people would consider as a so-and-so sensor is actually very useful as an alarm system, right? So it is very important, I think, to establish the type of application you have in mind and then to select the sensors for the specific project.

So these are some of the pilot studies that we started conducting, you know, last year actually.

We basically deployed a sensor network at the fence line of a disposal facility in Southern California.

There we have about 9 sensors, boxes. These were developed in-house. They are solar powered, there is a solar panel here to power them, and they use a $450 device that is manufactured by a British company called Alphasense.

This tells you PM_{1}, $PM_{2.5}$ and PM_{10}, in real-time.

We are using it at five minute time resolution.

There is a central node here that transmits all of that information back to headquarters so we can monitor pretty much, you know, PM concentration at the fence line 24/7 and we have been doing that for about one year.

So one of the interesting things that can be done with these massive amounts of data, definitely, there is some preliminary data validation; eliminate all of the outliers, eliminate all of the time where the sensor boxes were not working properly.

But, you know, what we can do, we can create these heat maps to basically tell us which part of the facility emits the most PM, so where most of the fugitive emissions are coming from.

And this was a concern because it is well-known that in the southern part of this facility - sorry, this is the facility - in the southern portion of the facility, this is where there basically is a lot of industrial equipment that basically gets crushed. There's a lot of industrial waste that gets dumped in there, cement blocks, so it generates a lot of fugitive emissions.

So right now the facility is in the process of, is undergoing an improvement project so they are basically building an enclosure in this part of the facility. One of the reasons why we developed this network, we want to see if

this enclosure is effective, right?

So if you take a look at the heat map, this is just an example, but you will see that like the red dots, which are indicative of high concentration, for the most are only in the southern part of this facility right here.

So, you know, this is part actually of a PhD thesis of one of my staff members. What he is trying to do is, as I said, try to see if this improvement project is going to work. So after they spend -- I think that the project is about $10 million. After spending $10 million worth of improvement are we going to see those red dots? You know, is the impact of these fugitive emissions large or small on the school that is located downwind of the facility.

So one of the other things he is trying to do, he is trying to correlate all of these PM concentrations with time activity logs. So when is the time of the day where most of the trucks are coming in? Is that a correlation between that information and the PM concentration? So there's a whole lot that can be done by just analyzing this data set.

So this is another sensor network that we have created in the San Bernardino and Redlands area. So in this area we mostly -- we have about two monitoring stations. So before deploying in this case 31 low-cost PM sensors we only

had two stations basically where we could monitor $PM_{2.5}$ concentration. Right now we have still the two stations but they are complemented by PM information from 31 more monitors. So that can tell you a lot more about temporal variabilities, spatial variability, it can also tell you whether or not those two stations are well-sited or not, maybe we should move one of them to a location that shows higher $PM_{2.5}$ concentration.

So there is a lot that can be done with this type of information that, again, is not super-accurate, is not -- you know, cannot be used at this point for enforcement purposes, but there is a lot of information that you can draw from, from this.

One of the other cool things we are doing, we have a small NASA grant. Actually it's not that small but it's the first phase of a two-phase grant. In the first phase we are trying to basically use this type of information from ground-based sensors to validate and improve the accuracy of satellite data.

Again, then we'll have the two station, we'll have information from the network and we'll have satellite PM information to get a much better understanding of PM concentration all over the South Coast.

This is another project that is another grant from EPA. It is a Community Scale Grant. And the idea is

basically to use local sensors and more expensive Optical Remote Sensing technology to measure VOC emissions at the fence line of let's say a refinery.

The idea is to deploy -- this is the first design of what we call an SPOD. It is essentially a PID detector for monitoring VOCs plus a 2D anemometer on top. The idea is if you deploy four of these at the corner of a facility, right, and there is a leak, let's say from a tank. You are not interested in accuracy, you are interested in the relative variation of the VOC concentration. So I believe -- I think you made a comment about that before, possibly a few presentations ago.

You know, what you are able to do with this type of VOCs, if there is a leak you're going to see it. So we don't have the sensors telling you, I don't know, there's 200 ppb of benzene. There could be 300 or there could be 150. The point is that there is a lot of benzene coming out, right? And by mean of different trajectory models we are able, or at least that is the idea, we would like to be able to understand where the fugitive emission was coming from; so that's the idea.

You know, at the same time we are working with a company called Flexense (phonetic). They are running $1.2 million worth of equipment there so they will be able to validate our sensor data.

And also -- I apologize for the very bad animation but that will give you an idea of what we'll do. So they will do fence line monitoring but it will also drive inside of the community to see if there is, you know, an impact from VOC emissions from this particular facility.

So this was the concept and this is what we did a couple of months ago actually, yes, even like a month and a half ago.

So we developed the second version of these SPODs. This is all done in-house. The enclosure is 3D-printed. There is a solar panel to basically power this particular device 24/7. And there is, again, a 2D anemometer for basically monitoring the wind direction and wind speed continuously.

The cost of this setup is about $2,000, but again, there's a lot that can be done with those. It's a relatively high cost if you compare it to a $200 PM sensor. But the type of information you could potentially get is really, really important.

So what we did, we did deploy three or four sensors at one small facility in Signal Hill. So while we are still in the process of analyzing some of this SPOD data we were able to see with the more expensive and more accurate optical remote sensing devices is that every time or most times that you drive around this facility the

concentration of benzene is extremely, extremely high. I am not really sure, I should tell you how high they are but they are a lot higher than background.

So one of the things that we did, we tried to figure out where that type of leak was coming from. This is actually a FLIR video from that specific facility. We took this back in 2015 and this was taken, you know, as part of a different project. But we really think that the leak was coming from this big tank that is located right in the middle of the facility. Of course we had to send inspectors there. Over time we have seen that benzene concentration for the facility has been coming down. So this is proof that developing and applying this type of technology actually works and this is just a pilot study.

We received another EPA grant and this is something that we are quite proud of. It's a STAR grant, it's a research project. As far as we know we are one of the first if not the first governmental agency to get this particular research grant from the EPA.

There were 99 applicants nationwide and only 6 grants. The other 5 agencies and universities that got these grants include Carnegie Mellon, MIT, University of Washington, RTI -- I forgot the fifth one. They are all universities; we are the only governmental agency that got this grant.

Basically the main objective here is to provide California communities with the knowledge necessary to select, use and maintain low-cost sensors to correctly interpret and collect the data. So this is an educational project for the most part.

There are four specific aims:

1. Develop educational materials for communities.

Of course number 2. We have the AQ-SPEC center to evaluate and identify suitable candidates for deployment.

Number 3, which is becoming one of the major objectives actually of the proposal, is deploy about 150 sensors throughout California.

And then, of course, communicate the lessons learned to other communities and to the public.

There are two co-PIs on this project, one is UCLA, the other one is Sonoma Technology.

But also this was basically, you know, a proposal that was submitted by CAPCOA, right. Actually back when Barbara was part of CAPCOA she gave us a whole lot of help, you know, kind of finalizing the proposal, making sure that not only the South Coast AQMD but other CAPCOA agencies such as the Bay Area AQMD, Santa Barbara is also involved and Sacramento is also thinking about joining forces. So this is like a multi-agency proposal. It is led by the South Coast AQMD but we will try to pretty much involve as many

CAPCOA agencies as possible.

So we are also very excited about the fact that a few months ago we contacted Weather Underground and they would also like to participate in this proposal by basically installing several other PM monitors in the Los Angeles area. We are also with University of Auckland to deploy 100 extra sensors to measure PM, NOX, ozone and CO.

So what started as a relatively small project, we were supposed to involve only six California communities in EJ areas and deploy about 150 sensors, now we have about 550 sensors to deploy that we have already purchased and nine communities and we are thinking about involving more communities in EJ areas such as the Wilmington area; so this project is expanding. Which is great, up until the point where we have to actually do it.

Anyway, so the first workshop with the community is supposed to happen later in August so we are at the point where all of the contracts with all of the co-PIs, we have all of the contracts in place with most of the community groups. So we will have the first community meetings to start recruiting individuals for sensor deployment late in August, so it's happening.

Okay. So all of this is extremely exciting. I consider myself very lucky for being able to be involved in a project like this. You know, we are well-funded, knock on

wood, hopefully that will continue. We got several grants from EPA but, you know, everything is going well so far.

So, you know, when you think about using local sensors and developing sensor networks it is extremely exciting but everybody gets caught by the word low-cost. That is not always, you know, something -- meaning if you are a single-user, if you are a citizen scientist you could buy say a $300 device. We will help you to deploy it at a good location, in the backyard of your home, you know, far from your diesel truck and far from your barbecue so that you get, you know, realistic information.

Then if you are like a small community group that would like to develop a small sensor network with, let's say, 9 sensors, the situation is a little different. Now you need to start thinking about maintenance, calibration, how you are going to data, data validation, visualization, so you are going to spend a little more. Possibly we will still help you if you are really serious, like for example, for communities interested in participating in the STAR project. This is something that can be done with the help of a local agency, let's say.

But if you are really interested in deploying a large sensor network of, as an example, 100 or more sensors, then your cost will go potentially through the roof. You know, imagine that every sensor, all of these sensors will

stream one-minute data 24/7 and then your data validation, your QA/QC procedures are going to have to be really tight in order -- even to set up the infrastructure for sensor connectivity, managing data management and so on and so forth. What started as a low-cost sensor project is now an extremely high-cost sensor network study. So this is study that everyone that is interested in this type of business should always keep in mind.

So this is my second commercial break. So on September 27, 28, we will have another conference, sensor conference. The first one we had was November 2014; and again, Barbara here was involved in coordinating and organizing that conference. There were like two different phases. The first conference was in the Bay Area and the second conference was here at the South Coast.

Then, you know, three years later, basically, we would like to have another conference that, you know, will mostly be, you know, it will focus on, you know, building a sensor network, how you handle big data, how you communicate that data to the public. But we have different sessions that will involve the public. We will invite EJ communities. Janet actually will participate and will be in a panel session with other representatives of the industry.

So we think that is going to be quite interesting so if you are interested in attending here is our AQ-SPEC

website. I believe that you can also go on the AQMD website, there is a link there too. So if you are interested I look forward to seeing you in September.

Last but not least. Again, I am very lucky also because of the other AQ-SPEC team members. As you see one of the requirements for working in AQ-SPEC is to have a very difficult to pronounce last name but that's a different story. But yes, I would like to acknowledge the contribution of all of these other individuals, they are the heart and soul of the program, so thank you very much.

MS. MASCAREÑAS: Thank you so much, Dr. Polidori.

(Applause.)

MS. MASCAREÑAS: Thank you so much. Again we encourage you to -- we will share Dr. Polidori's information. I encourage you to reach out if you have any questions, for folks on the webcast and in the room today.

Closing Remarks

MS. MASCAREÑAS: We are going to wrap up with some closing remarks and thank you very much, Dr. Polidori. Thank you so much for the audio/visual support from South Coast Air Quality Management District.

Without some people at DTSC this symposium would not have happened. Corey Yep, Evelia Rodriguez and Abraham Zhan in particular for coordinating, thinking through and really putting together this fantastic program today.

We also have a number of other DTSC staff members who have been helping throughout the day so thank you guys very much.

I just wanted to share some thoughts. It has been a long and interesting and fruitful day. Dr. Solomon opening up really with the scope of what we are seeking to address, what we know right now in terms of health research, frameworks we can think about for environmental exposures, cumulative impacts and risks and vulnerability.

And why? Because it's the health of our communities and our environment. So what information do we have to better act on exposures now and that we know can directly impact future generations.

We also talked about community perspectives, highlighting the need for honest and direct collaboration with communities and for government agencies to not only work together but think ahead a couple of steps in a lot of these decisions that we are making and the information that we are using.

The fascinating information around big data, around hyper-local environmental data points. Thinking about how we could use that type of data in every day policy and even personal community decision-making.

And then fantastic speakers on environmental justice technical guidance and tools.

Looking back on what we have learned, what methodologies and community knowledge have come together and what can move us forward from this point. It's important that we stay grounded in making sure we are coming together with a measurable, visible impact in communities.

We also learned about a lot of exciting tools for capturing a broader picture of health and tools for integrating facts and values, construction of preference and some of the rapid analysis of stakeholder information I thought was very interesting. The incredible spectrum of tools that we have right now that have been developed and continue to move forward to capture cumulative impacts and vulnerabilities.

I really appreciated the great emphasis and importance on how fruitful it is to listen with your listening ears for the feedback that we are getting and continue to improve our methodologies and the tools that we are bringing.

And thank you for also wrapping up today with a systematic evaluation of sensors. Of how some of these big data points and data and community come together. We recognize that all this information is increasingly accessible to people, to government, but across the board, and thinking about how we can use those collaborations as government, community and business to really make sure we

are making the best decisions in protecting our health and environment.

I am quoting Rick Fears here but I do think that we are moving closer towards a unifying theory, unifying ways of integrating our data and our values, and I just wanted to thank everyone for joining us here today in that conversation.

For next steps: You are all on the list to receive information about workshops, working groups that we are going to have to really further explore a lot of these concepts. We shared a lot about the big opportunities that we have. We really want to discuss the limitations as well and have heard that throughout these conversations; but I think it is really important that we are starting from the foundation of evaluating and learning about al the information we have out there.

I will open it up if there are any other closing comments. Just really appreciate everyone's time here today.

MS. LEE: There is not a lot I can add to what Ana said, she summed up the day really well, I think. I would just like to leave you with my perspective on DTSC's effort in this arena overall.

As you probably picked up from some of the comments speakers have made throughout the day, including

some of those that Dr. Polidori just made, this is an issue, this is an arena in which I have been working from a number of different angles throughout my career. I started working on air toxics exposure in the early 1990s and have worked on environmental justice issues, on community empowerment issues, on methods of better characterizing and understanding emissions and impacts over the last couple of decades.

I truly believe that we are on the edge now of opportunities to completely change the paradigm or the lens through which we approach these questions. These are central questions to improving lives and protecting lives in communities, not just around the state but across the nation and around the world. I believe California is going to lead the way.

I think the rapidly expanding access to data and tools like the sensors Dr. Polidori talked about, like some of the analysis tools that our panel here spoke of and earlier speakers, pointed to there are efforts being undertaken and questions being asked and answers being discerned at agencies and in academia and in the private sector and in community organizations. We have all been working and nibbling at this question; but now we have an opportunity as this explosion of information becomes available to us, to shape it into something meaningful.

You know, when you're looking for that -- I heard a woman on the plane this morning talking about recently having lost a diamond out of her engagement ring and the challenge of trying to find it somewhere in the house. You know, it's just one diamond and it's a huge house and how do you find it? And that's the kind of problem that we had before.

We have an opposite kind of problem confronting us very soon and that is we are going to be looking for the diamond that has meaning for us in a world where we have diamonds all over the floor, diamonds to a depth that might even bury us. There is going to be so much information out there, so much data. And the challenge that we are going to have is taking from that enormous amount of data, meaningful information that can guide the decisions that we have to make as public officials, as private individuals, as we move through our lives.

The effort that DTSC is undertaking now is to make a contribution to advance that effort and to help us find some of the ways we can make meaningful information and better decisions out of this vast amount of data that is now going to be available to us.

I invite all of you to join us in this effort. This is not something DTSC can do by itself. This is not something DTSC wants to or should do by itself. We will

come up with a stronger, better, more useful answer to these questions if all of us are able to contribute to the asking and the answering.

So I appreciate the time you have all taken, whether it is traveling here to be a part of the presentation of the information today or simply listening, whether you are in the room or listening via the webcast. I appreciate your effort, I hope you continue to work with us on this. I am so excited that we had the opportunity to take these next steps together so thank you.

(Applause.)

(Whereupon, the SB 673 Symposium was adjourned at 4:13 p.m.)

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I, MASON BOOKER, a Certified Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Department of Toxic Substances Control SB 673 Symposium; that the recording was thereafter transcribed.

I further certify that I am not of counsel or attorney for any of the parties to said meeting, or in any way interested in the outcome of said matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 9th day of August, 2017.

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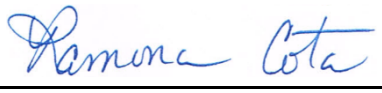

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