

The National Academies

**Assessing the Human Health Effects
of the Gulf of Mexico Oil Spill:
An Institute of Medicine Workshop**

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NOTE: This is an unedited verbatim transcript of the IOM Workshop on Assessing the Human Health Effects of the Gulf of Mexico Oil Spill held on June 22, 2010 prepared by CASET Associates and is not an official report of National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, or the National Research Council (the "National Academies"). Opinions and statements included in the transcript are solely those of the individual persons or participants at the workshop, and are not necessarily adopted or endorsed or verified as accurate by the National Academies.

Table of Contents

Welcome - Harvey V. Fineberg	1
Charge to the IOM - Nicole Lurie	6
Introductory Remarks - Nancy Adler	10
The Compelling Need to Understand the Effects of Oil Spills on Human Health	
Bernard D. Goldstein	19
Blanca Laffon	30
Edward B. Overton	39
The Response of the Federal Government to Health Concerns - John Howard	52
SESSION I: AT-RISK POPULATIONS AND ROUTES OF EXPOSURE	
Panel Discussion: Taking Stock: Who Is At risk and How Are They Exposed? Moderator: Linda Rosenstock	61
Routes of Exposure and At-Risk Populations Paul J. Liroy	63
Residents of Affected Regions: General and Special Populations Maureen Y. Lichtveld	72
Occupational Risks and Health Hazards: Workers and Volunteers Scott Barnhart	79
Questions	85
SESSION II: SHORT- AND LONG-TERM EFFECTS ON HUMAN HEALTH - Moderator: Linda A. McCauley	
Short-term Physical Effects Nalini Sathiakumar	107
Short-term Psychological Stress Howard Osofsky	108
	116

Heat Street and Fatigue Thomas E. Bernard	126
Questions	132
Panel Discussion. The Need to Know: What are the Potential Delayed and Long-term Effects on Human Health? Moderator: Kenneth Olden	143
Neurological Cancer and other Chronic Conditions Peter Spencer	144
Impact on Health and Vulnerabilities of Children Irwin Redlener	151
Human Reproduction Brenda Eskenazi	161
Stress Sheldon Cohen	170
Lessons Learned from Previous Oil Spills Lawrence A. Palinkas	177
SESSION III: STRATEGIES FOR COMMUNICATING RISK	
Engaging the Public, Protecting Health David Abramson	202
Dialogue with Workshop Participants Moderator: Mike Magee	220
Open Dialogue with Audience	225
Day 1 Closing Remarks - Nancy E. Adler	259

P R O C E E D I N G S (8:30 a.m.)**Agenda Item: Welcome**

DR. FINEBERG: Good morning, everyone. I would like to encourage everyone to take your seat, please. I am Harvey Fineberg, the President of the Institute of Medicine. On behalf of the Institute, it is my great pleasure to welcome you to today's workshop and tomorrow's, on Assessing The Human Health Effects of the Gulf of Mexico oil spill.

Many of you here have been directly and intimately involved in working to help mitigate and assess the effects of this oil disaster. It is an urgent and pressing problem. Many of you, as health professionals, have already been involved in trying to reduce the health effects, a most important consideration. We are all here because first, we want to express our sense of unity with the people in the Gulf region who are affected and will be affected by this oil catastrophe and we want to join together to share our best thinking, our experience, our ideas, our expertise, our concerns, our strategies, to try to both assess, to reduce, to learn, to find ways that we can protect the health of the people of the region, monitor the consequences of this spill, both in the short term and in the long term.

I want to say how grateful I am to our local hosts for enabling us to be here and also to each and every one of you, who came on such short notice to partake and to share your ideas, your experience, and your vision. We need your help because this is a catastrophe of a magnitude and of a nature that requires the best that each of us can bring to deal with it.

A number of you are here by virtue of responsibilities that you have as officials in government at local, at state, at national levels. Others of you are health professionals who had been involved in trying to mitigate and deal with the effects, others in public health, in toxicology and environmental health with expertise in the nature and the consequences of the exposures that are represented in this oil spill.

This is not the first disaster of its type. There are, historically, a number of major oil spill catastrophes, but the Gulf oil spill is distinctive in its scope, in the magnitude, in the duration, and in the complexity of assessment because it deals not only with issues of science related to chemicals and exposures in the near and long term, it also deals with people, with the social consequences, with the cultural difficulties and needs that people have to protect their health and to learn

and to know what risks they are facing.

We are here to develop and share ideas. This is a workshop intended to enable all of us to get a clear, more comprehensive, and more focused sense of what needs to be done. So much is already happening that it is almost inconceivable that any one person or group, whether in government or out, can't already have a grasp on what is being undertaken, much less a comprehensive sense of what all needs to be done.

Our hope is that by organizing and pulling together this enterprise, over these two days, that we can, together, come forward with a clearer and crisper sense of what we do need to accomplish, how we can protect and preserve the health of the population, how we can monitor and assess the health consequences of the Gulf oil catastrophe.

I want to express my appreciation to the sponsors of this gathering. We are here at the request of the Department of Health and Human Services, of Secretary Sebelius, who asked us to pull together this workshop to share ideas, to reach a common understanding. I am also very grateful to the members of the planning committee, who worked so assiduously in pulling together the program, Dr. Nancy Adler, who chaired the group, Dr. John Bailar, Dr.

Maureen Lichtveld, Dr. Linda McCauley, Dr. Ken Olden, Dr. Linda Rosenstock, and Dr. David Savitz, who devoted so much time and effort to this activity.

There has been a small army of staff from the Institute of Medicine and the National Academies who have tried to work together to pull this group in this room on these days all at the same time. It has been an effort day and night over the last two weeks. I want to acknowledge, especially Meg McCoy and Andy Pope, Christine Coussens, Bruce Altevogt, Christine Stencil, Katherine Bothner, Trevonne Walford, Pam Lighter, Shelly Cooke, Abbey Meltzer, Christie Bell, Donna Randall, Janet Stoll, and many, many others, who worked so hard to bring us to this moment.

Every one of you is here on short notice. There was not long notice. And, especially, I am grateful to our speakers, many of whom cancelled many other obligations in order to be with us and to share their expertise and their knowledge. I want to especially acknowledge and thank Dr. Nicole Lurie, the Assistant Secretary for Preparedness and Response at Health and Human Services, who was really a key engine behind this meeting. I want to thank Dr. John Howard, the Director of the National Institute for Occupational Safety and Health, the group working to prevent and to mitigate the consequences of this spill in

health terms, based at the Centers for Disease Control and Prevention in the Department of Health and Human Services. I want to express my appreciation to Dr. Alex Garza, the Assistant Secretary for Health Affairs and Chief Medical Officer from the Department of Homeland Security, who is also so centrally involved in these health consequences and working with us in this meeting.

Tomorrow, we are going to have the pleasure of hearing from the United States Surgeon General, who is here with us today, also, Regina Benjamin. We will hear also from Dr. Jimmy Guidry, the Louisiana State Health Officer, Bruce Clements, the Director of Community Preparedness Section of the Texas Department of State Health Services, from Dr. Mary Currier, the Mississippi State Health Officer, Dr. Donald Williamson, who is the Alabama State Health Officer, and Ana M. Viamonte Ross, the Florida State Surgeon General.

Finally, I want to say, from my vantage point, that none of this would have been really possible without the organizational talent, the leadership, the initiative of the Executive Officer of the Institute of Medicine, Dr. Judy Salerno. I want to say, especially to you, Judy, how appreciative I am of the effort that you undertook to make this meeting possible. We all stand to benefit and the

people of the region, especially, stand to benefit from all of your efforts working together.

It is now my special privilege to call upon the Assistant Secretary for Preparedness and Response of the US Department of Health and Human Services to offer her words of encouragement and mandate to us. Dr. Nicole Lurie is the Assistant Secretary. Before that, she served as the Senior Natural Scientist and the Paul O'Neill Alcoa Professor of Health Policy at the RAND Corporation. She directed RAND's public health and preparedness work as well as RAND's Center for Population Health and Health Disparities. Previously, before taking her current position in the federal government, she served in other public roles, as Principal Deputy Assistant Secretary of Health in the Department, earlier. She was also in state government as Medical Advisor to the Commissioner in Minnesota. And, in academia, she served as a professor at the University of Minnesota Schools of Medicine and Public Health. It is difficult to think of anyone who is better prepared and in a better position to help our nation prepare and respond to health emergencies than our next speaker, Dr. Nicole Lurie. Nicole, please come forward.

Agenda Item: Charge to the IOM

DR. LURIE: Thanks, Harvey, for such a gracious

introduction. Let me start, also, by echoing these words of thanks to the IOM, to the IOM staff, to the Planning Committee, to our local hosts, to all of you for being here. I just look out at this room and everybody got themselves here on two week's notice, or less for many of you. It is quite remarkable. I have heard of almost everybody who has upended not only plans and another talk they needed to give, but vacation, to be here. I want to just say how much we all appreciate it and I think it is because we all know just how critically important this is.

Like a pandemic or the earthquake in Haiti, this oil spill is really unprecedented in its magnitude and scope. However, unlike those things, which we have sort of practiced for, dealing with the public health consequences of a major environmental catastrophe of this nature is not something at least that our office and many of us are used to dealing with. It is really unprecedented in many, many ways. So the experience that we have had with dealing with so many other disasters prepares us to some extent, but not maybe as well as we would like for what to expect in either the short or long term health consequences. That is really, I think, a large part of the reason that we are here today. It is really this concern and the commitment to the public's health that prompted Secretary Sebelius to

ask IOM to convene this workshop to talk about the broad impacts of the oil spill on human health. As we all know, there are many other efforts focusing on environmental issues and others.

As we have talked to people and as we have done our own work already within federal government, it is clear that everybody has different ideas about what to do. Scientists, advocates, industry, academia, the affected community, everybody has a different idea and a different set of concerns. What is really critical here is that we develop and use the best available science and monitoring and protecting human health to address all of these needs.

Our charge to the IOM, on the surface, is simple. In reality and execution, I know it is going to be a real challenge and I know that this committee and this group is really up to the task. It includes, although maybe not limited to, clearly reviewing the current knowledge, what is known, and identifying gaps in that knowledge. I think that we all understand that there are many. Identifying and discussing the most vulnerable populations here and what it is that we need to do to protect them and to mitigate harm. To put together a framework for short and long term surveillance, monitoring for potential adverse health effects, I think at large. To help us develop

communication strategies that address the many populations affected by the spill. I think we all understand that communicating with the public about what it is that we know, what it is that we do not know, dealing with the many issues and concerns, is part and parcel of what we need to do here. That is as much a scientific issue as it is other kinds of communication issues.

I want to say this workshop is not intended strictly to guide the HHS response, nor is its goal addressing issues that may arrive in the future in the liability arena, but I am hoping that this workshop will get us all closer to a shared framework for thinking about all of the health issues and the work that needs to be done to prepare us to deal with this event better and to deal with future events. The value of this workshop comes from the recognition that we have both a unique obligation and an opportunity to be sure that the right science is being done, both for this response and to help us in the absolutely unthinkable event that we might have to deal with something like this again. Unfortunately, we still do not have the evidence base we needed to and if I think back to other oil spills or probably the one that was the most famous, the Exxon-Valdez, these kinds of data were not collected afterward. We do not have that kind of

experience base to work off of going forward.

Another value, I think, of this workshop, its focusing on the science and this framework and getting it right, is that it can help us think about how we might need to respond to other events in the future, especially those that have a high level of uncertainty about and concern with regard to public health. So I look forward to the discussion that is going to take place over the next two days. I hope that it is a discussion both with our panelists and with you in the audience and people from affected communities throughout the Gulf because, as I said, everybody has a different perspective and different issues and concerns. But at the end of the day, I hope it is going to help us all understand and have a shared view of how we can apply science to all of these concerns.

We are, and I just want to repeat again, committed to using the best available science, done in the best possible way with the best input possible, which is why we are here with all of you moving forward. So let me thank you, again, all for being here. I am going to sit down and listen to this conversation and, I hope, take away rich new knowledge and new ways to think about this. So thank you.

Agenda Item: Introductory Remarks

DR. ADLER: Thank you, Dr. Lurie, for that very helpful charge to the day. It will really set us up for the next two days of our work. I am Nancy Adler. I have chaired the Planning Committee for this workshop. I am a professor of medical psychology at the University of California, San Francisco. I am in the departments of Pediatrics and Psychiatry and I direct the Center for Health and Community.

This has been a remarkable undertaking. I would like to thank again both the IOM staff and the Planning Committee, who have done an unbelievable job in putting this all together. Let me just set the stage in terms of how this meeting developed. Since the oil spill began in the Gulf of Mexico in April, there have been concerns about the extent to which exposure to oil and other conditions and chemicals related to the cleanup will impact human health. In the news, we hear about oil washing up on the beaches across the Gulf region. We hear about fumes from the oil, itself, the oil dispersants, and controlled burns. We hear about cleanup workers and volunteers being exposed to extreme heat and fatigue. Fishermen, oil rig workers, and countless others, who wait to hear when and if they can go back to their livelihoods and their way of life. And the effects on the food chain.

Unlike prior spills, which have been somewhat more circumscribed in time and area, the Gulf of Mexico oil spill is still growing every day and may have widespread impact so we are dealing with several levels of uncertainty. Given how little is known about the health effects of the oil spill, the Secretary of the Department of Health and Human Services asked the Institute of Medicine to hold this workshop to examine the current state of knowledge about monitoring potential adverse effects of the Gulf oil spill on human health.

The hope is that by identifying not only what is already known, but what still needs to be learned, we can better inform policy makers, public health advocates, scientists, and members of the public so we can work together to create a monitoring and surveillance system. These systems should collect both adverse health effects when they occur, but, importantly, give early warning signals so we can predict when a health effect is likely. This will allow for more efficient deployment of resources and hopefully contribute to finding ways to prevent these adverse health effects from occurring in the first place.

As Dr. Lurie so clearly stated our charge, we have four objectives and I want to repeat them so we are really clear about what we are hoping to do in the next two

days. One is to identify a range of potential adverse effects on human health that may result from the oil spill and the related cleanup efforts. Second, to explore the options for creating effective surveillance and monitoring systems based on available data and also available research methodologies. Three, examine strategies for strengthening existing surveillance systems and filling existing gaps. And, fourth, to figure out how to communicate most effectively with the public about these health risks.

We hope that this working together will allow us to really identify the issues and the options available. We recognize at the outset that in two days we cannot develop a consensus. Really our goal is to lay out the issues and the range of options that are possible. As a psychologist, I am aware that one of the most difficult aspects of any disaster and any, actually, health challenge is uncertainty. It is probably the hardest condition to deal with. And for people of this region, which has had more than its share of disasters, I wish we could bring more definitive data to say these are the known health effects. Unfortunately, we are not able to do that right now. What this workshop represents is an important step in trying to get that kind of data that can be more useful to individuals.

I am supposed to also put in a couple of disclaimers about the workshop. The IOM is hosting it to allow experts to survey our current state of knowledge, including human health in oil spills. We have left a lot of time for discussion among the presenters on each panel and for questions and answers. This is a standalone workshop and it is not a part of an ongoing study at IOM, but we hope that it will be a first step in effective planning and there may be follow-on activities. This will include statements from government agencies, the private sectors, academia, and members of the public and statements made by individuals should not be construed as consensus statements, findings, or recommendations from the National Academies, the Institute of Medicine, or the meeting participants as a whole. Unlike IOM studies, workshops do not meet consensus. They really are meant to put out the range of possibilities.

This workshop is being broadcast live and an archive file of the webcast will be available online and there will be a summary of the workshop available in early August. You should have all gotten briefing books that have within them a welcome letter, an agenda, a one-pager on the workshop and about the IOM, frequently asked questions. In that, you also have speaker bios. We are

going to try and keep things really on time and not do elaborate introductions, but you will have more detail on all of our speakers in your booklets. You also have a list of other related reports from the National Academies. And, importantly, there are question cards for you to use during the panel discussions. We are hoping people will write their questions down and we can use them to frame the discussion among the panel members.

Also, importantly, we are not going to take any formal breaks so, as people need to take breaks, please do so. We are going to just go straight through on the program. We have left about an hour and ten minutes at lunch for you to sample the wonderful restaurants in the area and there is a list of restaurants, also, in your pamphlet.

The format of the meeting - we are going to have a panel this morning, including Bernie Goldstien, Blanca Laffon, and Edward Overton, who will provide the context for why there is such a compelling need to understand the effects of oil spills on health. And then Dr. John Howard, from the National Institute for Occupational Safety and Health, will describe some of the federal government's current activities in this area. At that point, we will launch into a series of panel discussions, where the

experts will discuss who is at risk, potential short term and long term health effects, and how to communicate risk to the public, obviously paralleling our charge.

To facilitate input, we have designed four ways that the public can have input into this process. After each panelist has presented, the moderator will engage the panelist in discussion for about fifteen minutes. We have asked each panelist to be brief. These presentations will be no more than fifteen minutes. That will leave a lot of time for discussion. During that fifteen minutes discussion among the panel members, the IOM staff will gather your question cards and will then use those to frame the last part of the discussion among the panels. Depending on how many questions we get, we may not be able to pose all the questions people write, but they will be reviewed and taken into consideration when the summary is written of the workshop.

Also, at the end of today, there will be an open session, which we have structured by having a few invited speakers, first, give their presentation, and then opening it up to the audience, where we would really love to hear from people here about your concerns or issues you would like to raise. You can individually take up to three minutes for your own statements. Many of you, including

members of the community, have information that can really inform our efforts to monitor the health effects and I urge you to identify yourself during this session, but also to use the other ways of communicating - the websites, in particular - with more detail to follow.

You can submit comments through the IOM website, www.IOM.edu.oilspillhealth. All of this is in your booklet and you can either use your computers or we also have the computers set up here so you can do it immediately while you are here. There is also a comment sheet in your packet and you may hand write your comments and we will also enter them that way. So there are plenty of ways to get information into the process.

Tomorrow, we will start with remarks from the Surgeon General. Then we will have presentations about current and possible state surveillance and monitoring activities from the State Health Officers of Florida, Alabama, Mississippi, Louisiana, and Texas. We will then have two panel discussions, one on research methodologies and data sources and future directions and resource needs.

Before we start, I just want to again observe the great importance that everyone placed on this workshop. People were just remarkable in their willingness to change their plans to be here. Again, I want to commend the IOM

staff for their remarkable achievement in pulling this off. At this point, what I would like to do is ask our next four speakers to come up and let me just give you a brief introduction and we will go from there.

Bernard Goldstein is professor of environmental and occupational health and the former dean at the University of Pittsburgh Graduate School of Public Health. He is a physician, board certified in Internal Medicine, Hematology, and Toxicology and is a member of the Institute of Medicine. Blanca Laffon is an associate professor at the University of A Coruna, Spain. Her area of scientific interest is the study of the effect of pollutants on organisms, especially at the molecular and cytogenetic level. Dr. Edward Overton is Professor Emeritus in the Department of Environmental Studies in the School of the Coast and Environment at LSU in Baton Rouge. He has been the lead chemist for NOAA's Hazardous Materials Response Division for over 25 years, providing chemical hazard assessments for oil and hazardous chemical spills in all marine areas under US jurisdiction. And Dr. John Howard is the Director of the National Institute for Occupational Safety and Health in the US Department of Health and Human Services in Washington. Prior to his appointment, he served as Chief of the Division of Occupational Safety and

Health in the California Department of Industrial Relations. And I will turn it over to all of you. Thank you.

Agenda Item: The Compelling Need to Understand the Effects of Oil Spills on Human Health

DR. GOLDSTEIN: Thank you Dr. Adler. My job is to provide an overview, expand on the context that you have been given, try to lay some ideas out before some people who have true expertise and who have gotten their hands dirty working in this area speak to you. I am going to use three themes. The first is the unity of health and the environment. Second is that we are now better able to respond to the public health consequences of disasters, including the social and cultural issues, but we have a long way to go. And that the majority of expertise needed for disaster response, just as the majority of the impact, is always going to be local.

The Institute of Medicine, as you have been told, has, in addition to its recommendation function, a convening function and this is, in a sense, why we are here today, through that function of the Academy. That has informed the Academy in many ways, one of which is an environmental health roundtable on health sciences and research and medicine that, in the past twelve years, has

been working hard, under the esteem of the unity of health and the environment under the leadership of Andy Pope, Chris Coussens and others, to basically look at ways in which health and human environment are really inextricable from each other. We have previously been here in New Orleans. Maureen Lichtveld has been heavily involved in that, looking at the environmental public health impacts of disasters. I have just put out five of the over twenty products of this twelve-year period.

Environmental health indicators is something that you will hear much talk about. I would emphasize that when we talk about environmental health indicators now, we are talking about actionable indicators, primarily. We need indicators which help us take action now to avert the consequences of this disaster and of future disasters.

It is quite clear that this is a very complex system in the Gulf. I could show many slides showing the complexity. I chose this one because it does show the additional issue of there being a dead zone off the coast of Louisiana. It is a human-caused dead zone. It is very complicated with lots of interactions that lead to human health effects. We can make lists of human health effects. Here is one that has to do with algal blooms. You can get this off of the CDC website. We know about some of these.

This one here, which I will not even try to pronounce, is one in which we are still not sure if there is an adverse health effect.

Well, these are related, to some extent, to the dead zones, and then we have this issue of all this oil going into the dead zones. One issue, which certainly has exercised the public and led to a lot of discussions, is the issue of a dispersant. We are putting a dispersant into the Gulf in a situation where we need to know about fate and transport - Dr. Overton is going to tell us about that. We need to know about hazard to individual species and to the ecosystem, issues such as concentration, persistence, the impact of salinity and temperature and pressure. What about the degradation products, not only of the dispersants, but of the crude oil following interaction with chemicals, with a dispersant? What is going to happen there? What is the impact on the dead zone? And, probably, a good ecologist could add about 20 more to this list.

All of these impact on human health, but what about the dispersant? Dick Jackson, at our roundtable meeting last week, pointed out - he basically took from the MSDS, the Material Safety Data Sheet, looking at this and we have - and I have edited this - something that is not

quite specific, of which we have about a three-fold difference depending upon its formulation. We have propylene glycol, a specific compound which we know has some toxicity. Could be a five-fold range and then we have this proprietary organic sulfonic acid salt.

There is more information on this MSDS. There is more information about this compound. I am not at all criticizing NALCO. They have, it appears, put out as much information as the law requires them to put out and perhaps more. Perhaps a lot more is known about how this interacts on all of the different system issues that I put up on the previous page, but I cannot get this information now. I am not sure what it is. In essence, what we have is Corexit being yet another poster child for the fact that we need better laws. If we are going to really be firm about getting the information in advance, we need to have the information in advance and our Toxic Substance Control Act, for a company following its laws, does not provide us with all the information we need in a situation such as this.

I said I am going to also have as a theme discussing what we have learned. We have heard from previous speakers that we actually have come a long way since Valdez. This obviously is not a situation in which one worries about heat stress as one does locally, but yet

there is a lot that we do know because of this. I will come back to this, but I want to particularly take the opportunity to comment on how little we found out, but yet how much came from the studies of Dr. Palinkas, who I have yet to meet, but I am really eager to hear his presentation later. This is just one of his papers. This is another. We have learned a lot more from other approaches - John Howard's. And, John, when I put this slide up, I did not know you were going to be here. But, the Responder Safety and Health: Preparing for Future Disasters, looking at how the responder health occurs, looking at all the issues here. Another one from Australia. And then all the World Trade Center papers. There are over a hundred of them now.

Most importantly, they are not only documenting what has happened to some extent - not fully, but to some extent, at least - at the World Trade Center to responders because of the local effects, but they are also looking at ways that we can improve our response and do a better job of preventing adverse health effects, such as Post Traumatic Stress.

The second paper here - David Savitz is someone who was one of the organizers and who will speak tomorrow on basically some of the issues of how do you define a cohort? How can you get the maximum information through

studying these kind of approaches to help the people involved now and the people in the future?

Federal programs have broadened. I have not included everyone here, I just pulled out a bunch. There is a theory, an approach that social scientists take toward talking about boundary organizations and their value. Here is the Environmental Protection Agency, which in the past - a little more than a decade ago, headed an environmental justice program, focusing on issues of importance. National Institute of Environmental Health Sciences, an organization which we think of as primarily involved in doing basic research having to do with the environment, has a very effective hazardous waste worker training program, which has trained literally over a million workers, many of whom are involved now.

The White House has a President's Executive Order on Sustainability, came out from President Bush, President Obama has added to it, again, looking at sustainable efforts, which involve both the environment and health. CDC has Centers for Public Health Preparedness and Preparedness and Emergency Response Centers, Research Centers and HRSA has Public Health Training Centers. I will just briefly go through those just to point out how widely dispersed they are. They come from schools of

public health, primarily, but not totally. They are involved in training the people who are very often involved in the response. I asked the Association of Schools of Public Health to tell us what they have done in response to the Gulf oil spill and I got a list of examples from Rita Kelleher at the Association of Schools of Public Health. Again, this is just one type of response that was not there 20 years ago when Valdez occurred. It is there now. It does help us in our responding to the problems.

Again, I apologize to Dr. Palinkas. I am stealing one of his thoughts, but I thought it just was put so well. This is from one of his papers. When the Exxon-Valdez ran aground in Prince William Sound, it spilled oil into a social as well as a natural environment. Just change the words to Deep Water Horizon in the Gulf and you have the same impact. So this is my third theme.

To get back to just some of the cultural issues, there are Aleuts in Alaska, who believe that these pictures show two major threats to their subsistence lifestyle - to the sustainability of these beaches. One is obviously the oil, but the second is all the boots on the ground. Is this really the best way to make a sustainable change? I do not know. Maybe the boots on the ground and all the turning over every rock and every rock there, even though

this seems to be barren land, has an ecosystem under it and washing that ecosystem away. I do not know whether it is better or worse, but I do know that had we thought about it, we could have probably designed a study to find out. Could have probably designed this in such a way so the information would be there. That is really our challenge now. How do we develop the approaches, which will give us the best result for the Gulf and the best result for the next time through.

We know that the social determinants of health are very important. We have learned that these are really guiding health. This is something from a World Health Organization report, but David Satcher quotes it as well, for those of you who are interested in this area, in a recent paper that I cite here. The circumstances which determine health are in turn shaped by a wider set of forces: economic, social policies, and politics. I think we see that very much in play here.

Dr. Satcher is very concerned about environmental justice. When Ken Olden was head of NIEHS, he asked the Institute of Medicine to look at environmental justice issues and to consider how best to do research to evaluate these very complex issues. I would like to turn to the fact that there are three indisputable truisms,

generalities that one can say about environmental justice. There are more environmental hazards in disadvantaged communities. I do not think we can argue about that. There are more individuals with poor health in disadvantaged communities, again, not an arguable proposition. And, individuals with poor health tend to be more susceptible to environmental pollutants. Again, a generalization, which I think is true.

What are the policy implications of that? Obviously, if we are concerned about developing and understanding cause and effect relations, if we are really trying to understand how to respond to people when they say, well, what is this going to do to me, we need to look at where the exposures are highest and the people are most vulnerable, people so much more likely to see the effects if they really do exist. Secondly, we cannot do these studies without the cooperation of these communities.

Unfortunately, in academia and I think in government, we very often only focus on communicating to the community. We tell them after the study has been done. We have gotten, very often, to a second level of allowing the community to participate in our study. We will hire local people. We will ask for an advisory panel after we have decided the study to be done. What we really need

here is a third level, which is working with the community, together decide what research can be done, what research should be done, what are the questions that the community believes ought to be answered?

This, at a cultural level goes well beyond just the usual kind of what does the chemical do to me? There is a growing body of information suggesting that there is a value to nature, if you will, to human health. I think this sign describes it well. It is from New Orleans, from AP Photo. Sand between my toes is different from yellow fin tuna and shrimp. If you notice towards the back it says crabbing - not crabs, but crabbing. The factor of being on the beach and doing these things. We have yet to value these appropriately, but they are health values.

Another cultural issue - I am sorry if this slide does not show well - the culture of the workplace. This is Paul O'Neill. You have heard his name mentioned before. Coming to Alcoa and deciding that the lost workday performance was unacceptable, even though it was below the national industrial average, and working it down from 1.86. Now the company is considered down to 0.07 and not finding that acceptable. The only acceptable level is zero. That is a cultural issue in going forward. We are not looking past, but in going forward we must keep that cultural issue

as a workplace culture that accepts nothing but zero risk.

Let me talk, finally, about the impediments to obtaining the information. There is a lack of background information. There is a failure to ask the right questions early enough. There is the urgency of the other issues, the environmental and economic ones, which are truly urgent. The failure to seek and engage global expertise. We can go through these lists, the multi-sectorial, multi-disciplinary, multi-everything issues that preclude a response. Unwillingness to say I do not know. We heard about risk communication. I teach risk communication.

The number 5000 will feature in my risk communication lecture next year. Rather than saying I do not know, think how much damage that has done. And the barriers caused by litigation. The Exxon-Valdez had barriers caused by litigation that basically we do not know the answers to questions. We certainly know that there are potential barriers here. After an earthquake, we do the right thing and learn how best to make sure that we protect ourselves against the next earthquake. The American Bar, as powerful as it is and as smart as it is, has yet to figure out a way to sue God so we can go and do that. In this situation it is much more difficult - we have to remember that.

Let me close by pointing out that John Snow, who we all revere as the father of epidemiology and is someone who led a change in how we look at public health by being credited with the removal of the pump handle from a water source that was the source of a cholera outbreak. He did not really remove the pump handle, though. He convinced the local authority to do it. If the local authority had not been convinced and removed that pump handle, Dr. Snow's scientific achievements would be little more than a footnote today. We need to remember that. Thank you.

(Applause)

DR. LAFFON: Good morning. First of all, I would like to thank the organizers for inviting me to this interesting workshop.

Oil spills are one of the greatest ecological catastrophes. Since 1960, a total of 410 oil tankers sunk, polluting the oceans all around the world with more than 300,000 tons of oil. As you can see in this map, most of the major oil spills occurred in Western and Mediterranean Europe. The intense maritime traffic of dangerous merchandise makes Galicia, in the Northwest of Spain, a critical point for these kinds of accidents. Up to now, there have been 33 oil spills in front of Galician coasts and it is the tenth place in the world regarding the number

of spills. And the first place is the Gulf of Mexico.

In the last 30 years, there have been five major oil spills before Galician coasts and the last one was the Prestige accident. That took place in November 2002. It sank at 130 miles from Galicia. In this slide, you can see the route followed by the Prestige during seven days after the wreckage of its hull, spilling oil. Prestige tanker contained 77,000 tons of oil. During the accident 44,000 tons were spilled and 22,000 tons more along the next weeks, polluting this potentially protected sea area with three black tides. During the next months, the oil continued flowing from the tanker at a rate of 125 tons per day, polluting 900 kilometers of Spanish and French coasts.

Prestige accident caused a general commotion and a great number of volunteers came from everywhere in Spain and also from Europe to collaborate in the cleanup labors of the sea, the beach, the rocks, and also the oil-contaminated fauna, especially birds.

Prestige oil was classified as heavy oil No. 2, following the AFNOR Normative and as oil No. 6, following the US Environmental Protection Agency. It was a complex mixture of compounds, very viscose and water insoluble and these characteristics favor its transport in the sea environment. There are three groups of substances that

stand out in the composition of Prestige oil due to the important characteristics for human health. These are volatile organic compounds, polycyclic aromatic hydrocarbons, and heavy metals. Many of these substances are genotoxic, carcinogenic, and endocrine disruptors. The European Communitarian Normative established these three groups of substances as the main ingredients in which the risk evaluation must be focused.

The harmful effects of oil spills have been previously studied in marine species, especially in birds and marine invertebrates. Also, in vitro studies and some studies evaluating the effects by transference to the food chain have been performed and they provided evidence for the bioaccumulation and transference of the oil compounds to the food chain in oil contaminated marine food. These studies also demonstrated the induction of DNA damage after metabolic biotransformation of several oil compounds.

However, the human health effects were only studied in a few works performed after seven out of the 38 major oil spills. These studies evaluated the acute symptoms, the psychological symptoms, and also alterations in several important physiological functions. The results showed that exposure to spilled oils induced some acute psychological effects, but these effects or these

consequences diminished with time and they are mainly reversible. There are also two studies that assesses the potential toxicological risk after the Erika oil spill. The conclusion was that the exposure did not entail any significant health risk.

Nevertheless, until Prestige oil spill, there were no studies in the international literature dealing with the chronic toxicity of exposure to spilled oils. This toxicity is very important since the long term effects of the oil compounds are mainly related to genotoxic events. Genotoxicity comprises all processes in which DNA is the main target, either directly or indirectly - that is, after metabolic activation.

In view of the great number of people who participated in the cleanup labors after the Prestige oil spill and the practical absence in the international literature of studies dealing with the genotoxic effects of exposure to oil, we decided to carry out a study with the following objectives: to evaluate the genotoxic effects induced by oil exposure during handling of oil contaminated bird and cleaning beaches and rocks affected by Prestige spill and to determine the influence of physiological factors, consumption habits, and the use of protective devices on the genotoxicity biomarkers evaluated.

Our study comprised two parts. In an initial part, we evaluated individuals who performed autopsies and cleaning of oil contaminated birds and in a second part, individuals who participated in the cleaning of beaches and rocks. 71 individuals were included in the first part, 34 exposed and 35 controls. We analyzed the environmental levels of volatile organic compounds and also genotoxic effects by the comet assay and the micronucleus test.

In this figure, you can see the results obtained after the analysis of the volatile organic compounds. The levels obtained were similar to those reported in other environments of low-contaminated cities. The highest concentrations were observed during the night hours since all the doors and windows were close, but during the day they were opened to maintain an intense ventilation of the room. Our results in the comet assay showed a significantly increased DNA damage in the group of exposed individuals as compared to the controls. When we classified the exposed individuals in three groups, according to their time of exposure, increasing DNA damage was obtained with increasing time of exposure and also a significant relationship was observed for these two parameters. In the micronucleus test, also an increased micronucleus rate was observed in the exposed population,

but in this case the difference was not enough to reach the statistical significance and no relationship was obtained with the time of exposure.

It is usually considered that for chronic exposure, the cytogenetic tests provide information on cumulative damage, but the comet assay gives an idea of recent exposures and a kind of damage that can be easily repaired. So on the basis of our results, it seems that exposure to Prestige oil during handling of oil contaminated birds induced DNA damage, but this damage was at least in part repaired and did not become fixed as structural chromosomal alterations.

All the exposed individuals included in this part of the study wore protective clothes, but only half of them wore protective masks. So we evaluated the possible influence of wearing a mask and our results in the comet assay showed significantly increased DNA damage in those individuals that did not wear a mask. In the micronucleus test, the results were similar, but, again, the difference was not enough to reach the statistical significance.

The results obtained in this part of the study highlighted the need to perform a more extensive study so we decided to perform a second part, including individuals who participated in the cleaning of beaches and rocks. 260

individuals were analyzed: 62 were volunteers that participated in the manual cleaning of the beaches for only five days, 78 manual workers that were hired by the Galician government to clean the beaches manually and that were previously exposed for four months, 60 workers that used high pressure water machines to clean the rocks and that were exposed for three months, and also 60 controls. We evaluated the environmental concentrations of volatile organic compounds, the levels of heavy metals in blood, specifically aluminum, cadmium, nickel, lead, and zinc, and the genotoxic effects by means of the micronucleus test, the comet assay, and the sister chromatid exchanges.

In the analysis of the volatile organic compounds, we observed that the group with the highest concentrations was the group of volunteers and the workers using high pressure water machines were the lowest exposed. The differences between the two groups of hired workers and the group of volunteers were statistically significant.

General increases were observed in the heavy metals in all exposed groups and aluminum and nickel were the best indicators for the exposure. On the contrary, decreases in the levels of zinc were observed in the groups of exposed individuals. This may be related to several interferences with the other metals in the adsorption

processes or due to the protective role of zinc, since this metal takes part in the zinc fingers present in many DNA repair proteins.

The results in the comet assay show significantly increased DNA damage values in all of the exposed groups with regard to the controls. The highest levels were observed in the group of volunteers and this may be a certain adaptive response in the two groups of hired workers that were previously exposed for several months.

In the micronucleus test, increases were observed for the rate in the two groups of hired worker being significant only for the manual workers. Another parameter that can be obtained in the micronucleus test is the cytokinesis block proliferation index. This index gives an idea of the cytotoxicity effects related to the exposure. Significant decreases were observed for this index in the two groups of hired workers, suggesting that a long exposure is needed or is required for the cytotoxicity effects to be displayed.

In the sister chromatid exchanges, we observed a significantly increased rate in the group of workers using high pressure water machines. These may be related to the fact that the use of these machines determines completely different characteristics for the exposure.

So the results obtained in this second part indicate that exposure to Prestige oil during the cleaning labors induced DNA damage and this damage was fixed after several months of the exposure. We also evaluated the possible influence of several factors, such as sex, age and smoking effects, on the genotoxicity parameters. We observed, after adjusting by the exposure, that comet assay and micronucleus test were significantly influenced by sex and age and the sister chromatid exchanges was influenced by sex and smoking habits.

Data collected in the question areas filled in by the exposed individuals showed that the body sections that mainly contacted with the oil were hands, head, neck, and arms. So, in this part of the study, we evaluated the possible effect of wearing protective clothes and a protective mask. Wearing protective clothes only determined slight decreases in the frequency of sister chromatid exchanges and in the DNA damage. In these pictures, you can see two women, one of them wearing a protective cellulose mask and the other one collecting a great quantity of oil with the mask behind her neck. Wearing a protective mask only determined a slight decrease in the sister chromatid exchanges frequency. So this practical total absence of wearing protective devices may

be due to the fact that the characteristics of the protective devices used were not suitable or appropriate for this particular exposure or that the individuals did not use them correctly because they did not receive enough information.

Finally, I would like to emphasize the great importance of evaluating the chronic effects related to exposure to spilled oil, especially those effects related to genotoxicity with two objectives, on one hand to evaluate the risk for human health and, on the other hand, to determine the efficiency of the protective devices used. As a continuation of the study, we are now performing a new research project with the objective of evaluating if the initial genotoxic effects detected are still present seven years after the accident. We have collected the samples between November 2009 and April 2010 and we are now carrying out the genotoxic analysis.

These are the members of our research group, who participated in this study. Thank you very much for your attention.

(Applause)

DR. OVERTON: Good morning. Welcome to New Orleans. I would like to start off by encouraging everyone to go out and eat some good Louisiana seafood. The

Department of Wildlife and Fisheries made me say that there is absolutely no oil in Louisiana seafood, except, of course, for the essential Omega fatty acids. So the oil is there. Good health oil. Please eat seafood before you leave.

Let me start off by just talking about what is oil. I guess that was the challenge that I had. This is an hour lecture in my class so we are going to have to move pretty quickly through it so I will try not to bore you with too many scientific details. But, first, we want to talk about what is the oil. There is a lot of information about dispersed oil. What is dispersed oil? And then, of course, the last, what happens to oil in the environment?

As these two pictures show you, oil acts differently depending on what we are looking at. This is Exxon-Valdez, all the heavy, thick, gunky material. This is an initial picture of the deep water horizon oil. It is already emulsified when it gets to the surface.

Again, you may not be able to see this, but there are some rules of thumb when you talk about what are the chemical compositions of oil. First of all, oil contains thousands, hundreds of thousands of compounds so it is almost impossible to identify everything. I mean, petroleum geologists have been working on this for years

and they are certainly more knowledgeable than myself, but in a very conservative circumstance we are talking about several thousand compounds. We ran a GCGC Time-of-Flight Mass Spect on this stuff and got almost 2,000 identifiable compounds so we are dealing with lots of compounds.

All oils, regardless of their source, contain the same molecular structures. So all of these molecular structures I am showing here and common in oils. What is different about oils from the Exxon-Valdez or the Deep Water Horizon or around the world is the quantity of the various compounds in the oil. So we do not need to re-identify everything that is in oil when we look at specific oils. We know that we have more saturate hydrocarbons and less of some of this stuff or vice versa. That is the rule of thumb.

The quantity of the specific hydrocarbons separates the different oil sources and this quantity also determines the physical and chemical properties of the oil. The lighter, smaller molecules mean the oil is less viscous, a lighter oil. It gets gunky and thick, as you see, as we lose the light compounds. Now, of the hydrocarbons, petroleum chemists separate hydrocarbons. I call them all hydrocarbons, but they separate them into hydrocarbons and non-hydrocarbons. So you are looking at

aliphatic compounds, particularly the straight-chain aliphatics, up to about C-30 in this particular oil. You also have branched hydrocarbons like these isoprenoid alkanes. You have cyclic structures, which are non-aromatic. You have naphthaenaromatics with a saturate ring and an aromatic ring. And then, of course, you have the aromatic compounds from benzene all the way out to the fairly large PAHs. In this oil, we have very little of the parent PAH. In fact, I do not think we have detected benzopyrene in this oil.

Interestingly to note, in oils almost all of the aromatic content is associated with alkyl homologs of the PAH. So we do not have much of the parent PAH, the unsubstituted, but you have a lot of the C-1, C-2, C-3, and 4 alkyl homologs. You also have a variety of non-hydrocarbons, particularly the sulfur containers. This is a low-sulfur oil so there are not many of those, but typically they are in structures like benzopyrene and the alkyl homologs. The mettalo-porphyrins, of course, this is where your metal content is typically associated with complexation in this structure. Last, you have this residue, which we know as road tar or asphaltenes.

Light oils contain relatively more of the low-moleculoid compounds. This is an extremely light oil. So

by the time it gets to the surface, many a third of it is already evaporated. We are losing an awful lot of it. Probably within the first seven days of environmental weathering, we may lose up to 50 percent of the actual content once it gets to the surface. Heavy oils contain more of the higher molecular weights. Again, the good news about this oil is it does not have much of the heavies in it. Aromatic compounds in oils are predominantly the alkyl homologs. That is, these are alkyl homologs. Here is a dimethylnaphthalene, a trimethylphenanthrene. This would be a parent chrysene compound, but you generally do not have much. Now, most of your health studies are associated with you parent PAHs so remember in oils you have very little of the parent and almost all of the alkyl substituted. You also have a series of these saturate compounds that are called biomarkers. These things do not degrade very quickly at all so we can follow oil as it degrades through the environment by monitoring these so called biomarkers.

Again, here are some of the typical compounds that most analytical laboratories will look for. Now, let me just point out that the analytical method is a GC/MS 8270 EPA method. That EPA method only looks for your parent PAHs. You have about eight or twelve of those. Of

course, there are almost none of those in this oil. So if you are going to look for oil, you cannot use a standard 8270 method. That is the first thing. That is one of the big problems in most of the analytical capability as we look for specific compounds on a target compound list at EPA - they are not in this oil. You have to look at the alkyl homolog, for instance, chrysene in C-1 to C-4, naphthalene C-1 - almost all of the way to the aromatics is going to be in your alkyl homologs.

Another little troubling thing, most people consider that most of the toxicity in oil is associated with the aromatics, but there are some anomalies in the saturates. Here are threshold limit values for the light hydrocarbons. Notice the hexane anomaly. It is significantly more toxic so anybody who thinks that the aromatics contain all of the toxicity need to rethink that. Again, we have so many compounds that it is hard to identify all of the structures that could be causing some sort of toxicity.

Quantitative analysis of oil in the environment and in people is very, very difficult because it is so patchy. I just used some pictures here to show. This is a sample of the oil on the beach over on the Gulf shores. How do you quantitate oil on that beach? How do you take a

sample of that and get reasonable data? If I collected a sample right here, I would have a percent level oil in it. If I collected that same sample right here I would have part per million level. So there is a horrible patchiness problem. Quantitative analysis of oil tying with studies is extremely difficult to do. This is why we use something called hopane-normalization. Those hopanes and steranes are so important in determining how long the oil is there. We could talk a long time about this. We just do not have time in the seven minutes I have left. But, quantitatively, even in the water column, notice there is not a lot of oil here, but there is a lot of oil here. There are large areas in the Gulf where you can go and there is absolutely no oil and then you are in the middle of a big patch of oil. Oil is not out there in the black tide. Exxon-Valdez, lot of oil, little bit of water so a big black tide came ashore. That is not the case in this spill at all. We are having continuing oil going in the environment, but there is a lot of area offshore that has absolutely no oil in it, but when you do get in oil, it is very thick and very gunky.

What happens to oil when it goes into the environment? These are the weathering processes. Oil that enters the environment starts changing immediately when it

leaves the wellhead. In this case we have, of course, deep oil and surface oil, but these are generally considered the processes that occur. There is a certain amount of absorption that can occur on sediments. Not a big deal in the blue water of the Gulf. Biodegradation, this is an imminently degradable oil. The bacteria love it. They are degrading it very, very quickly. So with evaporation and biodegradation, certainly 30 to 50 percent of the oil is gone within the first week. A certain amount of the oil can be dispersed, either naturally or with chemicals. We are hearing a lot about chemical dispersants. I will mention a little bit more about those in a minute. Some of the oil, particularly in this case, the small molecules are fairly soluble in water and, of course, we are releasing this oil at depth so it has a long time for these volatile compounds to enter the water column. When they enter the water column, they both have a toxicity, as well as a BOD effect to remove the dissolved oxygen.

The oil, also, by the time it gets to the surface - when it comes up, it is a very light oil. It effervesces, mixes with water, so we see it as an emulsion. So that is what we are talking about here, the so-called chocolate mousse. In this case, it is the Coast Guard red mousse, instead of a chocolate mousse. Then, when the oil

does get to the water, you have a certain amount of photo oxidation that occurs. Photo oxidation basically takes a non-polar molecule and makes it polar. It enhances the mixing of oil and water into the stable emulsions. It also can enhance phototoxicity. So, again, there is very little knowledge about exactly what is going on. But a lot of the nektonic species are at the surface and even in a sheen where you do not have quantitatively much oil, you can have significant photo-enhanced toxicity. Does not have much effect on the human population, but it certainly has a great effect on the ecology of our environment.

Let us talk about what happens when oil does undergo surface weathering. Again, we have two kinds of oil, surface oil and subsurface oil. But, as a general rule, you start off with a sticky, toxic mess. As that oil stays in the environment, the light ends go away. The light ends are generally considered the most ecologically toxic. Right, it's the PAHs - the heavy things stay around. They can only get in animals through some sort of ingestion process, but the light compounds dissolve in the water column, fish swim through that and get exposure. You are talking about toxicity and these are kind of a floating, sticky mess. As oil continues to weather, it gets sticky, but it loses its light ends - the benzene and

the light aliphatics, and becomes a sticky, floating mess. Sometimes it can sink, but we have not really found much evidence of, at this stage anyway, sinking oil.

Then it goes to what I call a gunky mess and gunky is what we are seeing now. I do not know - it is not a very scientific term, but I cannot figure out a nice word to describe it other than gunky. I can think of some not-so-nice words that we would not use in public. But, some of this stuff floats and some of it, now - the most troubling thing is that we are finding some of it on the bottom. It is almost neutrally buoyant. That is, it can very easily be washed down in the water column, pick up a little sediment, and it is on the bottom of water in some cases. Here is a picture that was taken by a great reporter for the Mobile Press Register, Ben Raines, swimming off Dolphin Island. He just happened to see an American flag there, but this is oil, on the bottom, in several feet of water. Clearly, it is not floating. So we have to recognize the fact - this oil, when it came out of the wellhead, was an incredibly light oil, should have floated everywhere. So, as it undergoes weathering, it is changing its composition and physical properties and so what we are dealing with now is both floating and non-floating oil. Of course, crabs and other organisms on the

bottom, oysters, get impacted heavily by this type of oil.

What happens when you weather oil? You lose the light ends, the saturates and aromatics degrade fairly quickly microbially, and you are left with the gunky material, which is probably a high asphaltenic oil. A lot of the more toxic components degrade by the bacteria and you are left with this gunky material. Now, it still has some of the larger PAHs, the alkyl homologs or the PAHs, even in fairly degraded oils. But, they are large molecular weight, not the light things that dissolve in the water.

We have a whole other area of weathering that occurs, which we know absolutely nothing about and that is subsurface weathering. There is obviously no evaporation, but there is dissolution. So as the oil leaves the wellhead, it is being dissolved into the water column, so-called - a lot of controversy about the plumes. They are all plumes of oil under the water, but when we say plumes we think of two things. We think of a smoke plume or a plume of lava floating down the river. There is no plume of lava out there. There might be a smoke plume, very dilute, dispersed oil somewhere under the surface, but that plume is at concentrations in the low part per million, the part per billion, and certainly, some things can have a

toxic effect in the deep water and you can have an oxygen deprivation effect. So deep water weathering is certainly a hot topic.

This is just some chromatographic data. We do not really have time to go into it, but this is what happens when oil - this is fairly fresh oil. After it evaporates, you lose the light ends. These are the more soluble components. This peak right here, this little doublet is C-17, to give you an idea. Here is C-30. The more heavily it weathers, it loses all the light ends and you are only left with the waxy hydrocarbons that look like this.

So as kind of a summary of what we are dealing with, we have source oil, we have at depth, we have at the surface, and we are using an incredible amount of dispersants. Not as much as in the Ixtoc spill, but we have used about half as much and we may surpass that before this thing has ended. So we have dispersed oil at depth, dispersed oil at the surface. And remember, oil always changes. It is changing its composition literally as we speak so we have dissolved and modified oils at depth and on the surface, weathered oil at depth and on the surface.

All of these things are difficult to pinpoint because the oil is continually going in the environment.

So in a tanker, like the Exxon-Valdez, we had a start date and we knew how long all had been in and we could follow the weathering. We cannot do that now because every day we get another 50,000 barrels of oil in there as it moves around. But, it is pretty clear that the oil coming onshore in Louisiana is a pretty gunky mess, does not have much oil, it has lost most of its volatile ends, and it has lost some of its stickiness, too, which is amazing. When we first got some of this sample, it was very, very sticky. It is no longer very sticky. I was really happy to see the impacts, particularly the sociological impacts of the spill - almost everybody focuses on the pelicans, pelicans are not the only things that are damaged. The people are damaged and I am very encouraged to hear Bernie talk about that. I hope that will be part of the conference.

I am finished. I am out of time, but here is the latest information on the dispersants. It is available on the webpage and it shows the compounds that are in there. This is straight from the NALCO webpage. Dispersants have a very storied history, but the current version of the dispersants are more benign than earlier versions of this stuff. So this is what is currently being used, the latest data from NALCO. Thank you very much.

**Agenda Item: The Response of the Federal
Government to Health Concerns**

DR. HOWARD: Thank you very much. I apologize to any of the federal agencies that I have given tasks to that they actually do not have. That is my mistake, but I wanted to give you the overall goals for the federal government, health-responses. We are interested, obviously, in preventing injury, illness, and disability as a result of the spill. We are monitoring short- and long-term health effect. Ensuring care for those who need it, including behavioral health care. And we are trying to anticipate and mitigate problems that could arise.

This is just a model and I encourage the panel to actively criticize any information that I present that looks like modeling data. But, this is just a geography, starting out from the source or as the oil comes up through the water column at the plume. This is the area of the fire and explosion where 11 workers died. There are workers, then, that are doing work on the water. There are workers that are doing cleanup on the shore. There is the community immediately adjacent or near a proximity to the Gulf areas. Then there is all of us, the general public that are experiencing this oil spill.

The overview activities, I think, I want to

emphasize these seven. First of all, dissemination of information on health risks - our partners in the State and Local Health Departments, as well as all federal agencies are doing that. The second is protecting workers, volunteers, and residents. We have a number of federal agencies doing that. I will specify that a little later.

Third, training workers to maximize safety during their response activities. Fourth, monitoring exposure of workers and the public. Fifth, monitoring population health, per se, and providing medical care where needed and preparing for long term follow-up, which we are interested in your views.

Now, this is a model. It may not be correct, but it is the one that we are operating on right now in terms of worker exposures on the water. There are probably three geographies that we are looking at. One is at the source, where individuals closest to the area where the oil plume is coming up through the water column. These vessels have contact with fresher crude, if you will, with VOCs that may not have been totally emitted, as Dr. Overton talked about, through the water column, explosive vapors, methane and others that you have read about, and concentrated dispersant chemicals. Then vessels that may be operating a little further from the source that are involved in burning

oil, combustion products, et cetera hazards. And then vessels that are involved in removing oil from the water. Formally, these vessels were called vessels of opportunity, booming, skimming, containing, and other activities that are going on, primarily contacting more weathered crude.

On the land, there may be three different exposure models. One, folks who are doing shoreline or marsh cleanup. You see them mostly reported on the television. They are taking oil contaminated sand and weathered oil off the beach. Heat stress is a significant hazard for these workers. Decontamination activities, which are occurring, not only in vessels and equipment that have to be decontaminated before they can enter and work again, and also workers and volunteers who are cleaning birds, other wildlife, prior to their relocation. Then there are waste stream management workers, who engaged in the centralized disposal, recycling of hazardous and liquid waste. All of this oil is going somewhere. It is being taken from the environment and moved centralized and there are workers involved in that activity.

For the residents or the folks who are living in near proximity, from an exposure perspective, there is obviously dermal exposure through swimming in water that may have been contaminated by oil, walking on the beaches

that may be contaminated, touching weather crude, inhalational exposure to hydrocarbons and irritant odors that they cause from close proximity or from prevailing winds, ingestion, obviously, which comes from eating contaminated seafood, and psychological stress from, as we have heard before this morning, from social and economic disruptions and, as Dr. Lurie pointed out, the uncertainty about the future.

Now, I wanted to give you just a brief overview of the federal agencies that are involved. Again, if I have given tasks to a federal agency they do not really have and they do not like them, it is my fault. If you like them, then go with it. But, the Department of Homeland Security, obviously under the Homeland Security Presidential Directive 5, is in charge. That operational activity, as you all know, is under the direction of the Coast Guard, with Admiral Thad Allen. Clearly, the Coast Guard is the incident management here and through the Unified Command, it posts health and safety information, including worker/volunteer health and safety information, on its website.

The federal health activity is coordinated through the White House Domestic Policy Council. This group keeps all of the health-related activities of all

Cabinet-level and federal health agencies together. Dr. Lurie, our Assistant Secretary for Preparedness and Response in the Department of Health and Human Services, is our coordinator for all of the assets within the US Department of Health and Human Services - CDC/NIOSH, CDC/National Center for Environmental Health, NIH and the National Institute for Environmental Health Sciences, FDA, the Health Resources and Services Administration, HRSA, SAMHSA, and I will go through the other ones as we go through.

Just in terms of environmental monitoring as a chief activity, done primarily by EPA with some assistance from NOAA, monitoring exposures in the air, water, sediment, and waste stream, collecting samples on the shoreline and beyond for oil and dispersants. NOAA has an aerial monitoring aircraft, which they use regularly and their ship, Thomas Jefferson, just came back from a voyage in the Gulf and that data will be coming forward. Supporting and advising the Coast Guard efforts and monitoring dispersants in the subsurface environment. All of this data, a rich bounty of data, is posted on the EPA website.

The US Coast Guard, itself, ensures all aspects of marine safety and fire control. It has responsibilities

for the port and tanker safety, monitoring vessel decontamination procedures, monitoring the safe operation of all US Flag vessels at offshore facilities, and also sets priorities for human health, welfare, and the environment through the Unified Command, which all the federal agencies participate in. They protect their own personnel by monitoring exposures by means of established occupational safety and health programs. And, they provide senior officials to work with all of us that are working from both the federal, the state, and the local level.

In terms of worker protection, the Department of Labor and the Occupational Safety and Health Administration is very active in distributing worker safety educational materials in multiple languages and is auditing training sessions that are occurring for the thousands of workers that are getting trained. They also work with safety officials to protect workers from hazards such as exposures, heat stress, and injuries resulting from their response activity. They are also actively monitoring exposure and I would encourage you to go to their website where you will also see a rich display of data.

The National Institute for Environmental Health Sciences, which is in the National Institutes of Health, provides recommendations, as you have heard, on worker

education and training, develops materials, and translates those into effective languages that we are using here - English, Spanish, and Vietnamese - in the Gulf effort.

The National Institute for Occupational Safety and Health in the Centers for Disease Control and Prevention is engaged in a number of activities. First is in rostering all of the workers. We have administered 15,000 worker surveys and we are continuing to do that. We are also surveilling, trying to capture all of the health symptoms, injuries, and illnesses that could be related to the oil response work, to ensure that these reports are being evaluated and a preventive action is taken. Using data to monitor the reports of injuries and illnesses with the affected states, with OSHA, BP, and others. We are conducting health hazard evaluations, which is essentially a worker health assessment, as well as an industrial hygiene survey, for exposure characterization both in these areas I told you about on the water and these exposure areas on the land. We are also preparing interim guidance for protecting workers and volunteers, which is in clearance at the present time.

The National Center for Environmental Health of CDC is planning for periodic systematic reviews and evaluation of all health data generated, working with EPA

to review air monitoring data and to identify potential impacts on residents. The National Center for Environmental Health is also working with Gulf States to collect all health surveillance information that we can get our hands on from 60 poison control centers across throughout the Gulf, 86 health care facilities, some of these are community health care facilities funded by HRSA, and from the Alabama, Florida, Louisiana, Mississippi state health departments and local health departments. Data is reported on the CDC website under health surveillance and I encourage you to go to that site.

Under population protection and monitoring, in terms of monitoring behavioral health, the Substance Abuse and Mental Health Services Administration, or SAMHSA, is currently collecting baseline behavioral data from impacted states. Based on post-Katrina information, use that as a baseline to go forward to assess differences in the psychological stress issues of the population as we go through time. They are in close consultation with non-governmental disaster mental health partners, including around cultural issues. Collaborating to ensure behavioral health needs into all aspects of response monitoring and working with states to facilitate needed behavioral health services.

In terms of monitoring food safety, the Food and Drug Administration and NOAA are working very closely together to monitor fish that are caught just outside the closed fishing areas, testing them to ensure the closed areas are sufficiently protective. FDA continues to monitor the potential impact of the safety of the seafood harvest in the area and they have a lot of good information on their website. FDA has deployed a laboratory for testing here in the Gulf and has increased its food inspections.

In terms of medical care, the National Disaster Medical System, or NDMS, provides care on request from states. Currently, there is a mobile unit that is stationed in Venice, Louisiana that is operating now. In terms of research, the National Institutes of Health Director, Francis Collins, announced on June 15th that NIH was planning for a cohort study of exposed workers and residents.

So I would like to thank you for your assistance, again, your participation, to each panel member who has interrupted, I am sure, a lot of activities to help us answer questions about how best to protect response workers, volunteers, and Gulf residents. What long term effects can be expected from this oil spill of a magnitude

and duration that we are dealing with? How should we be responding now and in the future to the human health effects? I thank you very much.

Session I: At Risk Populations and Routes of Exposure

DR. ROSENSTOCK: This is the part where we move seamlessly to the first of our many exciting panel discussions. I do recognize and it was stated earlier that there has been no planned break and we have to worry about biological health effects so, as people come and go, please do so. We recognize that you should be doing that. We are going to move quickly into this next panel discussion. We have three extraordinary speakers, who have a depth of experience that they will share with you, in terms of trying to now help frame a discussion about the populations who are at risk and how might they be exposed and potential exposures, certainly building upon the fine overviews we have just had. I know John Howard just stepped out of the room. I think we may want to revisit over the two days that very interesting diagram he made about levels of exposure from high to low from the inside to the outside levels of anxiety and concern from high to low from the outside to the inside, in that case reflecting the public and community at large to the center.

I think it was interesting about a month into this event, so about a month ago, CNN reported a broad-based US survey that showed that most people in the United States felt that they would be directly or indirectly affected by this disaster. About half said indirectly. About a third said directly. No surprise, as you go away from this region, with increasing distance, the levels of concern about being affected dropped. So from where I come from on the west coast, it was about 25 percent of individuals surveyed felt they would be affected. I think it is quite appropriate that we will frame this discussion here, looking at the populations at highest risk in the region, talking about variabilities in those populations, but I know our panel members will also be interested in discussing the issues of risk beyond the region, including the issues of potential risk outside the borders of the United States.

We are going to start here. As mentioned previously, we have very thorough bios in your packet. I am going to introduce the three speakers in sequence now, very briefly. They will each go and then we will come back for common discussion and questions from the audience. We are going to start with Dr. Paul Liroy. He is a professor and vice chair of the Department of Environmental and

Occupational Medicine at the University of Medicine and Dentistry at New Jersey - this is the hardest medical school in the world to spit out - New Jersey, Robert Wood Johnson Medical School. He is Deputy Director of the Government Relations and Director of Exposure Science at the Environmental and Occupational Health Sciences Institute at Rutgers. He is going to be followed by Dr. Maureen Lichtveld, who is a professor and chair of the Department of Environmental Health Sciences at Tulane School of Public Health and Tropical Medicine with a long standing federal experience dealing with many aspects of environmental health. Then, our last discussant of the three, Dr. Scott Barnhart is a professor of Medicine and Global Health and has previously run the University of Washington's Occupational and Environmental Medicine programs. So thank you.

Agenda Item: Panel Discussion. Taking Stock: Who Is at Risk and How Are They Exposed?

Agenda Item: Routes of Exposure and At-Risk Populations

DR. LIOY: Bernie, I still have to thank you for that ability to have such a long title. Bernie Goldstein and I have known each other for over 30 years and when he started the Institute that I am still at we ended up with

the longest name I thought we could ever imagine for a name of an institute. But, I think we have to thank Tom Kean, who was our governor at the time, for the start of that. Anyway, thanks Bernie.

This morning, I have mixed emotions about being here. I am very pleased to be here to talk about important issues, but I am sad to be here because of the fact that this event has occurred and is effecting many, many populations and individuals in the southeast and probably around the nation. It is a horrible situation. It is in day 64 and hopefully it will be resolved some time relatively soon.

I am going to talk about exposures, but I am going to start going backward in time a little bit because I have been dealing with acute exposure events and significant issues for a long time, the worst of which I got involved with, in terms of emotionally, was the 9/11 event. From that event, I learned a lot about response and about how we have to act strategically in response. That word, strategic, is going to come about a number of times in my talk because there are, I think, five aspects of a response. One is rescue, we have seen that, reentry, we are starting to see that, recovery, we still have a long way to go, restoration and rehabilitation are years away.

But, these are five levels of an event.

The most important part, I think, that we have to remember is time in each part of these events because in each case, in each part of this situation, time is critical. Time is of the essence because in rescue, obviously, you want to save lives so therefore you have to be in there, you have to respond quickly. But, in each of the other situations, response is very, very critical in terms of timing. If you do not time it well, you end up with mistakes.

From the work we did in 9/11, I wrote a book, but the issues that arise in that book I think are translatable to today because you have to have problem identification, strategic planning, and opportunities for minimization and prevention of exposure. I have heard a lot this morning about the issues of looking at populations, look at effects, but let us put it this way, we are in day 64, but to me it is day zero because we still have a leak. The leak is there and we have people being exposed at the source. You saw John's bullet going out from the source. That leak is still occurring. Therefore, every minute of every single day we are dealing with an exposure, exposure to workers at various levels so therefore that is very, very important to remember.

In terms of the past 64 days, there is a certain level of analysis and a certain level of response that has occurred. That is all well and good. But as we go forward, I think the more strategic the government becomes and we, as the community become, and working together, the less opportunity there will be for failure. I think coordination of data collection and rapid response of the data is very, very critical. I was happy to see in John's presentation the idea that the CDC is planning to look at data. Well, I think we should start now. We should start now from the standpoint of looking at the data from the standpoint of who has been exposed, who has been protected because I have a lot of confidence in what has been done so far from the standpoint of number of the workers who are on the site because I have looked at the OSHA response and it looks like they have a good PP, Personal Protection Program, in place.

As we go on, we are in a situation now where we are going to bring in 17,000 National Guardsmen to help. These people are not professionally trained as hazardous waste workers. Some of them may be accountants, your next door neighbor. They may be lawyers. They may be people who own stores. But these are people who are not trained in hazardous waste and a Haz-whopper training program, may

be sufficient to get them started, but then you need constant, constant reinforcement and retraining throughout the process - because this is 64 and beyond, to ensure that they are not exposed and if they are exposed, it is minimal.

I think that is a very, very crucial point that has to be made that as we go forward we have to think strategic. I have to agree with the Secretary of Defense, Mr. Gates, we are bringing these people down but they have to be trained and they have to be properly deployed and they have to have the proper protection.

We saw this morning, people covered with oil from the spill in Spain. I think we have now the mechanisms, the vacuum cleaners and the vacuum tools to vacuum up this waste in such a way that we minimize exposure. Minimization exposure from now on has to be an essential component of what we do and I think it is very, very important. That includes everything from the bullet in the middle, the bull eyes, out to the public, because although we are thinking about cohorts, I like to see 65 and beyond, minimizing the number of people who would be part of that cohort.

I think that is an important point because this has not stopped, it is still going so we are basically on

day zero again.

I think my 5Rs are important because if you look at it from the standpoint of how we do things, we have to minimize prevent exposure, we also have to continue surveillance of those who have been exposed, and I think 64 backwards means surveillance of individuals will be essential and we have to make sure that we don't forget that.

I have two parts to this; 64 backwards, 64 forwards, think strategic for each one because each time you make a decision you are going to affect one or the other and you have to make sure that you are balancing the protection of public health in each case, but also remembering we want to minimize the contact in the future.

I guess my point is this - stop it. Stop it from coming to shore. Here you have a bunch of beach - this is from the New York Times - have a bunch of beach chairs and you have a beach, and you have - what was it called - the red gunk coming to shore in waves. That has to be stopped. We have to get the barges out to minimize the impact on the shore. Once it gets to shore we have to have well trained workers and volunteers. I have to make a very big point from the standpoint of my experience with 9/11, volunteers are extremely important. We don't want to turn them away.

But we want to make sure that they are properly protected for whatever they do. It is essential because you don't want them coming back later as being another injured party. It is extremely important to remember that.

So prevention of exposure at the same time as having the ability to do your job, is to me essential for this situation.

We know that from this morning's lecture about the nature of oil, we will have different types of oil. We will have oil above and below the surface and its structure is going to change over time. That is crucial because as you go forward in time you are going to see that there will be exposures - exposure situations as you go from the bulls eye that John put up, that will be different because the nature of the material is different, as it moves away. It is not only moving away on the surface but it is moving away in time and in composition. Something to remember.

We are still in the situation of acute short-term exposure issues. We will have periodic singular events, we will have chemical mixtures of different types and varieties. Some of them have standards - but the mixtures they don't because most standards are not based upon mixtures.

People who detect smells should be concerned

about the fact that if you are detecting a smell and it is not from a barge going by or from a oil tanker, if you are living near the shore you may be a population at risk. Please remember that and that your local officials remember that because I think as Bernie said, you have to start locally. If you don't start locally you will use a national plan but then you will forget about the local people who may actually be suffering from exposure. If that is the case, go out and monitor them because that is important.

The age versus the fresh oil is very, very crucial because in time you will have totally different exposure situations, both from the standpoint of people and also the environment. I don't have to reiterate that because it was well spoken by Dr. Overton.

Long-term strategies will be different. I think the long-term strategies for people exposed 64 backwards will be different from the 64 forward, and you have to remember that because different exposures situations existed.

This is the gunk coming ashore - again, prevent it from coming ashore. That will minimize the continued risk to the environment, the continued risk to ecosystems in the local area.

Operations and activities that lead to contact in routine daily life; clean-up, restoration and reconstruction, and you will have vectors of exposure, food, water and air. I think food is very important from the standpoint of the food chain. I am happy to hear that I should go out and eat some shrimp tonight, and I will, but it is good to make sure that as the FDA has put these particular laboratories in place, we heed their advice once things move on.

These are the activities that can lead to exposure - try to minimize them. The people who are risk; clean-up workers, volunteers, commercial and recreational fishermen, beach visitors, and visit other facilities, all age groups of the general public, but the closer to the shore the more logical you will have to think about it in terms of being exposed.

We got a little bit of money and we are willing to go to a couple of communities to actually go out and do what we call "passive" monitoring, if people are smelling the material at their homes. If you call the number below, we can get in contact with the community leaders and see if we can actually go in and do some initial exposure monitoring.

I was told to shut up and I am going to, but the

point is I want to listen to you so therefore you please, talk to us today.

Thank you.

(Applause)

Agenda Item: Residents of Affected Regions:

General and Special Populations

DR. LICHTVELD: Good morning. This is the second time in five years that we have the distinction of hosting the Institute of Medicine. First, in 2006, after hurricane Katrina, when you helped us come up with answers to questions that were complex. We thought we never had more complex questions than then. You are here today again, to help us answer a different set of complex questions. We are so pleased you are here.

From a local perspective, we feel a special responsibility to share with you not only the questions we have, but the urgency to find the answers to those questions. It is not only about people, although the workshop has that title, it is very much about pelicans, very much about crabs, very much about oysters, it is about us.

A few things first, the spill is a disaster experienced by us, the community regardless of who declares it, when it is declared, or how it is declared. There is

no substitution, and you heard it and you will hear it from us, there is no substitution for local knowledge and expertise. When workers hurt, regardless of which eye of the circle they are, families suffer. The ecosystem and the health of that and the community well being, are inextricably linked. We can't separate those so those things first.

If you look at the Gulf of Mexico oil spill, and when I was preparing these slides I actually substituted Gulf of Mexico oil spill for Katrina because many of these arrows we are at the same place. Now we have instead of a hurricane we have oil dispersions and a mixture of those that you heard this morning. We know there is ecosystem damage. We know there is a tremendous economic impact. What we are after are the two other question marks; the overall health impact - and often when people say health they mean physical health - but particularly the overall psychsocial impact.

The oil spill brought us more than a wave of oil, it brought us a wave of contaminants and new technology that we have not heard before. When I use the word mousse it was mousse for my hair spray - mousse means something different now. Tar balls mean something different than balls that kids play with. Dispersions is a new word and

booms are new words for us. A number of sea and a wave of stakeholders and contractors and agencies. A number of states that are involved. So all of that is descending on our communities and on our Gulf Coast.

What is unique about the vulnerability of our population? It truly is the intersect of three things. Often I refer to this as the three whammies; health disparities, access to care, which we will talk about in a minute, environmental health threats that have been with us for decades, and disasters - in this case, natural disasters for a hurricane. So that vulnerability is unique in the Gulf Coast, and while there have been other oil spills, this oil spill is in its own class, like Katrina was in its own class.

Why are we uniquely vulnerable? We are uniquely vulnerable because our population still struggles. Before it struggled, after Katrina it struggled with access to health care. We are uniquely vulnerable because of the issues with perceived discrimination. We are uniquely vulnerable because our culture is different. We are uniquely vulnerable because our education system needs help. We are uniquely vulnerable because we live with the burden of poverty and health outcomes that are often at the bottom of the scale when you look at it nationally. How

disparities translated for us are unique and it is in that context that our communities are vulnerable.

We know this exposure pathway and you have heard many components of it. We know we can define what the contaminant source is. We can in some ways define what the environmental media are. It begins to become less clear when we talk about where people become exposed, so what the exposure points are. There is some information of how - by ingesting, by being exposed through the skin, or by inhaling it - but still, there are other questions that are left to define in terms of how people get exposed. Defining who gets exposed is yet a different issue. So do we really need a completed exposure battery? Fair to say yes, but how to implement and how to implement actions based on that yes I think is what the task is in front of us these two days.

How do we define the populations at risk?

Indeed, Dr. Howard showed a very doable and very practical to approach that, but our communities are not segmented in silos. They are the fishermen and the volunteers. They are communities that live on the Gulf Coast. They are the visitors who become volunteers. And they are always the children, the individuals with existing health conditions, the elderly, and the pregnant women. While those are

general vulnerable populations, they have special meaning for us on the Gulf Coast.

What don't we know? It is okay to say we do know things yet. That is why we are having this workshop. We need to know better - we need answer better the question of who is doing what so that we have a better handle on populations of concern. Therefore, we need to know what their exposure is so that we can better define the composition of the contaminant mixture over time. You have heard a good presentation this morning from our LSU colleague.

How can we answer the question of what does it mean - how will their health be affected? So we are not looking at individual risk or additive risk, but really what is the cumulative risk? Lastly, but very importantly for our communities, what is the role that historic health disparities play? What is the emphasis and which socio-ecological factors do we need to pay attention to?

Here is a multi-prong action plan. Not the, necessarily, but one that I would propose. First, to characterize the contaminants of concern in all the media over time and work is being done to do that. But it is through toxicity assays, but through our seafood toxicity monitoring because our seafood is our livelihood.

To fingerprint the exposure, whether it is to develop novel biomarkers of exposure or to do real time exposure monitoring in workers and communities, whether we embark on geospatial modeling or dose reconstruction, we need to protect all, but particularly those most vulnerable.

Whether we do that through long term monitoring and begin now - I cannot agree more with everybody who says the time is now. Even if we do not have the answers now, banking specimens so that we can find the answers later is an action that needs to happen now. How could we come up with the best way to fingerprint their exposure? Should we look at markers of susceptibility for those vulnerable populations who are uniquely susceptible to the exposures? And should we look at the gene-environment as ways to find answers?

Very critically - and you have heard it from every single speaker about psychosocial intervention - you heard it yesterday morning, there was one of our community members in St. Bernard Parish who said the only think I know how to do is to net. Instead of netting now for fishing, he is now making those puffs that cheerleaders use to scrape up the oil. Netting is all he knows. Netting is all he wants to do.

So when we talk about risk, it is critical to communicate that risk clearly, early, and in a way that is health literate. We have a special responsibility to educate our health care providers in the Gulf Coast, particularly in the Gulf Coast, so that they can provide the answers closest to the community. We have an extraordinary responsibility to disseminate the information just-in-time and just-in-case so that communities have it at their fingertips.

How should we do this? We have heard some advice already. It must be synergistic. Whatever we do must be synergistic with local assets. Yes, we have assets, too, not only needs. It must be participatory where communities work hand in hand with us to design, to implement, and to evaluate any action. It must be holistic, that we take into account the kind of extra burden in terms of health disparities that we have. It must be culturally competent. You hear it from my accent; I am not a local New Orleanian. I am learning every day. We must learn together. And it must be transparent because otherwise there will never be trust that we can build.

I will leave you with this very ironic environmental-health picture that we see in many instances and as a good example of why the importance is of

communication. Thank you.

Agenda Item: Occupational Risks and Health

Hazards: Workers and Volunteers

DR. BARNHART: Good morning. I am pleased to be able to take a few minutes to review some of the worker risks. I think we are at a point where at one level you can say if you have seen one oil spill, you have seen one oil spill. On the other hand, we now have unfortunately had multiple oil spills and we do have some data that we can draw upon from those oil spills, as well as really a wealth of other occupational and environmental health data to begin to really develop very effective measures to manage and to mitigate worker, as well as others' risk to a spill such as this.

I would like to really focus some on the basics. If you look in terms of occupational health, as you approach these disease, these diseases that may occur - I am using the word may with an emphasis - are going to present just like any other disease. They do not distinguish themselves as being directly related to oil so we will have to be very careful as we look to see how the links are to any exposure risk. Causation is often multi-factorial. There is often a latent period between the time of exposure so I think some of the points that others have

made about gather data, registries, having samples that are banked are very important because that will be very important to look at this. The effects are often strongly related to dose and that some workers will be much more susceptible than others to those exposures. Importantly for workers, I think we need to recognize that workers will see the highest exposures.

There are many, many risks to oil workers and these are multiple, but they are also manageable. I have listed out here a long range. I will not go through them, but they range from chemical exposures, environment such as heat stress, to multiple safety ones, which need to be focused and, of course, immediately mitigated.

You will hear and you have already heard quite a bit about the risks in the potential exposure to crude oil and toxicity. Crude oil is a highly complex mixture, as has been described. The risks are really dermal and inhalation and, as others have mentioned, this oil - the volatiles will be coming off quite quickly, but depending on where you are working, it is possible. In addition, if there are not good work-hygeine practices - separate places to eat - then you also have multiple other potential routes of exposure, including ingestion. We would hope that we would have work practices that would make that sort of a

risk almost negligible.

Finally, the effects can be dose dependent. Clearly, at very high levels of exposures we know that hydrocarbon solvents can have very significant neurologic, renal, hepatic, dermatological, and hematopoietic effects. There is really no reason why we should be seeing levels at that level of exposure, if adequate protection is provided. There is also the potential for carcinogens to be present. Again, those clearly will have a dose-dependent effect and we would hope that it could be mitigated.

This exposure has quite a number of uncertainties and it is quite important to acknowledge them and to try to anticipate those and make our very best guess about them. The spill is underwater. Most of our data really comes from surface spills so we are seeing a very different exposure. The generation of this exposure is quite different from where we have drawn our data. It is ongoing and so it will result in multiple stages in aging. The effects of cleanup strategies, such as use of dispersants, pressure washing, control burns. Multiple strategies will affect potential exposures. Volume of the spill - this is clearly the largest and the duration is ongoing.

What do we know from selected prior studies? I think, as has been mentioned, psychological stress, both

for workers and communities and particularly for indigenous people from the Exxon-Valdez is of significant concern. But from the MV Braer, the community survey clearly documented a mucus membrane irritation and there was concern over depressive symptoms. A pediatric respiratory survey in the community showed no effects. The Tasman Spirit: Worker Survey, again, increased cough, mucus membrane irritation, general illness. There were decrements in FVC and FEV1, which were dose-dependent and also that improved over a year. So we have seen, there, an additional measurable respiratory effect.

Then Nakhodka spill, residents worked on the cleanup. Again, mucus membrane irritation, a lot of ergonomic musculoskeletal-related symptoms, back pain, leg pain. There were three out of 97 who showed some hippuric acid so evidence of exposure to volatiles, most likely, in the urine. In the Erika: Skin irritation. And, in the Prestige, clearly a mucus membrane irritation, some systemic nausea and vomiting, and a dose-dependent and persistent lower respiratory track symptoms were found.

When we look at prior evidence for chemical and safety risk, clearly there are exposures that occur among cleanup workers. These are generally at low levels. At high levels of exposure, there are significant risks of

toxicity, but appropriate protections should be able to mitigate those. There are short term respiratory effects, particularly with exposure to areas with high levels of volatile organic compounds and there are short term irritant effects. In the short term, probably safety is one of the biggest risks. This includes heat stress. This is an extremely hot climate and the risks are high and can often, also, cause workers to remove personal protective equipment. So this interaction where workers will say, you know, I cannot wear this much gear, I cannot wear a respirator, it is not practical - really requires attention to looking at what are the actual risks present and aligning that with the protective equipment and factors such as heat stress.

There is significant risk in terms of psychological impacts. The evidence for PTSD, anxiety disorders, depression, have been associated. The extent has been noted in multiple studies. Clearly, this can be aided by having careful risk assessment that actually acknowledge the magnitude of the risk and to do this in a very culturally sensitive way that does not overplay or underplay the magnitude of those risks.

When we look at both the area of workers and volunteers, I think there are some important differences.

Workers, by statute, should be trained, monitored, having personal protective equipment, and would be working close to the source and have potentially the highest exposures. I would like to contrast that with the volunteers. The volunteers, I think we should be very careful to have volunteers avoid direct cleanup activity, unless they really have adequate training and monitoring. I think this was very well displayed in some of the earlier pictures.

Volunteers really - I think are at significant risk because they have less if no training, less of any monitoring, less personal protective equipment, and there are potential for unique exposure such as various soaps and degreasers and other things they may use to try and clean up. The risk may be unforeseen. So I think we have to be very careful as we look at both workers and volunteers.

In summary, oil spill work is complex and there are multiple exposures. There have been many exposures that have occurred in the past and effective measures were present to mitigate these risks. Finally, risk mitigation includes exposure and risk assessment, training, use of personal protective equipment, monitoring/surveillance, including the use of registries, and baseline and periodic exams.

Let me just briefly conclude by saying that these

are very complex risks. There are some uncertainties, which really require very much a balanced approach of worker protection and care, not to offer false reassurance, nor to over magnify those risks. And with other oil spills and hazardous waste cleanup activities, risk can be mitigated by careful attention to risk assessment and worker training. Finally, risk mitigation should seek to rely on continuous reassessment based on real time monitoring of exposure data, work conditions, and the results of the surveillance activities. Thank you.

Agenda Item: Questions

DR. ROSENSTOCK: I want to thank each of the three speakers. As mentioned earlier, the IOM staff is now going to be circulating around the room and picking up cards. We very much would like to spend a good part of the remaining thirty minutes or so inviting questions from the audience to start this conversation.

Before we do that, though, I want to take advantage of having our panelists here to start maybe doing a little more in depth follow up from the discussions you have brought forward. A number of you have specifically talked about what we can learn from past experiences, whether it is post-9/11, post-other oil spills, post-natural disasters. Can I ask maybe each of you in turn,

perhaps, to take a little time now to flesh that out a little more and particularly, we want to ask for a little more discussion about our communication. When do we have enough certainty to start communicating and how should we do that? Might you reflect on what you have even seen so far now to give some suggestions or recommendations for movie forward? I am looking down at the end, Scott, but any one of you can start.

DR. BARNHART: I will start. I think there is enough certainty now to provide a lot of information. Oil has been around a long time. There are a lot of people who work around oil. There have been multiple spills. So I think there is more than enough information to provide information to the public. I do think the issues of how do you communicate that and how do you really involve the community early on in actually advising what is the right balance between telling people what we know and also identifying uncertainties. That community early on through focus groups and through advisory boards - however - I think is very important, but I think there is enough information now.

DR. LICHTVELD: We have learned a lot, particularly from Katrina, in our own communities. One thing we have learned is that communities have a lot of

assets to deploy, if we let them deploy them and if we use them. The communication cannot wait until we have all the Ts crossed and the Is dotted. There is enough to communicate.

Specifically, we learned after Katrina that the message is critical. What is the message? Even more critical is the messenger. Who delivers that message? Thirdly, what is the channel that is being used? Communication during Katrina, the web, the internet provided a really good resource. People often thought, well, it should be the radio or the news print. Making sure you inform and inquire from communities what works, will make communication work. After Katrina, one of the critical points was to work with faith based communities. Those are assets right at our fingertips.

DR. LIOY: I can't agree with the other speakers more. It is important to get out there and give the information. I think there is a lot of information available. I think one thing that is really critical is that when you present data on the internet, it may be perfectly obvious to the people who put the data up, but for the general public and others that data is not very meaningful.

In fact, if you just take, for example,

occupational levels versus environmental levels.

Occupational levels are measured in parts per million and environmental levels are parts per billion. That simple analysis there is lost on the public. A number is a number to them and they do not quite understand the difference because, if you look at it from the standpoint of that bull's-eye that John put up - I cannot get it out of my head. I am sorry, but it is very important - the concentrations go down exponentially as one moves away from the source to each individual receptor.

Therefore, that point alone, in terms of risk communication, is very, very crucial in terms of allaying fears or basically categorizing your fears as to whether or not you can or cannot be exposed and at what point? If you are on the ship that is doing some of the cleanup, your exposures are going to be much higher than if you are sitting on the beach or near the beach next to a bunch of tar balls. It is a totally different situation and I think that kind of level of understanding of what exposure and contact is, is extremely crucial in this context as one goes on.

DR. ROSENSTOCK: Your comment Paul, made me think a little bit about parts per billion and parts per million. I am struggling with barrels and gallons - now I think a

lot of us have that conversion immediately in our head, but that even too, that is very confusing. I think the understood that this is massive, but the variation around that and the changing estimates I think as a communication, have been very perhaps on the part of some, intentionally so, but I think that without that intent, very confusing and speaks to how difficult it is.

It strikes me that one of the things as we start - we are going to be over the next day and a half be talking in greater and greater detail about the kinds of information that we would recommend or that individuals would recommend, get collected. Including using our new technologies of biomarkers and the like, and how might we move forward. Before we address that question, I would love to hear from each of you, who wants to address, we know there are a lot of barriers to collecting information and to collecting good information; there are legal barriers, political barriers, cultural barriers, economic, probably go on and on with a list of barriers. Any thoughts in reflecting about what those barriers might be and how to overcome them?

DR. LICHTVELD: You indeed elicited all the barriers that exist so if you put them all together and you bring them to the Gulf Coast, maybe we can't communicate

but that really isn't true. That is one of the issues that we need to overcome. The barriers truly begin with barriers of trust and barriers of the ability to digest the information that is coming out. The barriers come with barriers to sensitivity of not only what to communicate but how to communicate. The barriers come with how confident we are to communicate what it is we know, but particularly what it is we don't know. Communities can handle that.

I think it requires a more - it is a different paradigm between information dissemination, a one-way stream, versus communication and dialogue. That is what we need more of.

DR. LIOY: I think barriers are well beyond just communication. I think there are barriers to collecting data and the collection of data is very, very cumbersome and difficult. Occupationally you have a lot more flexibility because there are rules and regulations for collecting data in an occupational situation.

Environmental data is a really tough, tough nut because you now get into the personal environment of individuals. If you set up a air-monitoring site which in an area, and you expect it to represent the itself, that is okay if you are looking at the general air quality or taking water samples and looking at general water quality.

But if you are talking about individuals and communities, a different kind of sampling program is essential and I don't think we do a very good job at explaining the differences between general air quality or general water quality, and what might be exposed to an individual. That is where a level of frustration occurs just from the standpoint of the data that you collect and the types of measurements that you make.

Just looking at the chart that was put up about the characteristics of oil, there clearly are chemicals that you should or should not measure in more or more circumstances. The farther you get away the less fresh the material is so therefore what you should be measuring is different than what you were measuring originally. People tend to measure what they can measure well and do it quite often.

I think from the standpoint of looking at exposure, one should be cognitive of the fact that especially in something like this, time will change the character of the material and therefore what you measure in one location may not be correct for what you need to measure in another. So I think there are a lot more to deal with in terms of barriers to getting good information out.

DR. BARNHART: I think it is impossible that anyone in this room would think that they could try and manage the situation without good access to the multiple lines of information, whether it is environmental monitoring, health monitoring, work practices. I think we ought to recognize the complex legal and other barriers, but I would be very interested in sort of when you look at a disaster like this in public health law, what actually is the role for more expanded authority in terms of access to data and use of that data to directly manage the situation and mitigate some of the impact.

DR. ROSENSTOCK: Thanks Scott. I think that is an excellent point and we may want to revisit that in our discussions that follow.

One last question I wanted to pose to Scott specifically, has to do with something he identified, which was that injury risks are of concern. Obviously eleven workers made the ultimate sacrifice in terms of fatal occupational injury risk, and we always think of those as essentially preventable, so a lot of reflection will go on there. But post that event, immediately at the time and since in different phases, have been exposures to injuries. One of the things we know from lots of experience, including from the oil industry, but virtually every

industry, is that workers new to a task regardless of their age, are at higher risk. It is actually quite dramatic when you look at that.

One of the questions will be as we retask workers, not from their usual employment but to doing new tasks, they are essentially new workers to those tasks. Yet we have seen from John Howard's presentation an amalgam of different agencies and others, responsible for the worker training and the monitoring. Would you like to reflect on that further in terms of how we might best go about trying to mitigate the injury risks, which still continue?

DR. BARNHART: For injury risks, I think the whole area of injury risk is an area where we have seen that there are effective measures in terms of the right equipment, more than adequate training. But then actually using real-time feedback loops, seeing where are there injuries occurring, what are the nature of those injuries and quickly stepping into is it different equipment? Is it better equipment? Is it more training? On the regulatory standpoint, that is sort of level coordination and I would come back to the issue of like data - there has to be more central coordination.

I do think that injuries is the one area where we

know the most about and ought to be able to mitigate it.

DR. LIOY: I would like to pick up on Scott's presentation, which also is referred to in mine, about the volunteer. The volunteer will be the highest at risk because they have not got the years of training. Those are the folks that when you train them, you can't just release them into the environment where they are going to be working and not have constant monitoring of them.

You are asking 17,000 members of our National Guard to go into a situation which is non-combat. They are not trained for non-combat situations. So you have to look at it from the standpoint of what you are going to have to do to train them properly and then constantly reinforce that training when they are down on the coast doing the various tasks that you want them to do. I think it is essential. Some of these guys have never been in a swamp and they don't realize that there are poisonous snakes there. That is a very simple thing to remember. There are water moccasins, there are other good examples of poisonous snakes. That is just a simple example. You are talking about that in terms of other things like hazards to exposures to chemicals.

So you build upon that and there are lots of things these young men and women will have to understand to

deal with, but constant reinforcement and constant monitoring of their progress will be very essential for two reasons; one, you want to clean up the area, and that is essential, and two, you want them to come home without injury.

DR. ROSENSTOCK: There was a lot of response from the audience. I am going to, with the time remaining, try to pick up three questions of different types and I will direct it to our discussants here.

First starting with Dr. Lichtveld, a question from the audience which is who is going to take responsibility for coordinating studies locally? The concern being that there is a potential for redundancy. There is a potential for confusion, if several entities, whether private, public or other approach to the community with similar perhaps, proposals for short and long term studies? Can you make some recommendations?

DR. LICHTVELD: We have called for this actually over six weeks ago, that it is critical for a local coordinating center, and however we call it, to be put in place so that principle investigators who do research can talk to each other. Communities can inform their research through a community advisory board. And workers can inform the work, whether it is research or public health actions,

through worker advisory boards, linked very clearly with a national advisory board that can assure the quality and the evidence that is coming out of the science.

The IOM plays a critical role in the very meeting that we are having, but without local coordination, what we don't need frankly, is a repeat after Hurricane Katrina, where everybody descended down on New Orleans, did all sorts of studies, and the community was left without the very answers that we need.

I want to come back to the issue of data. Access to data is critical. Collecting meaningful data that will let us take the actions that communities need, it pivotal and that is what we are asking for.

DR. LIOY: I think that local control in terms of a lot of investigations, public health surveillance is very important, but I also think that it is important to make sure that the resources that are available from others around the country both academic and in terms of governmental agencies, which is extensive, are not put up as a barrier to this. I think it has to be done in a collaboration. If there are barriers put up, whether it is from local to national, national to academics, that will hurt too because what you will have is a disparate group of people doing a disparate number of studies, which in fact

will lead to confusion.

I think a coordinated effort being strategic both from local and national and others, is very, very crucial for success.

DR. ROSENSTOCK: Paul, I am going to come back to you. We have a question from actually a discussant I believe, in tomorrow's session, but wants to get you to opine a little bit more about exposure pathways and their relative importance. For example, looking at dermal inhalational and ingestion. Asking about issues about metals and aerosols and the like. There is a small question to tackle.

DR. LIOY: About a three hour lecture. To put it in 15 words or less, you start out with the most obvious, which would be for the workers inhalation and dermal because those are the ones that you would clearly see happen right immediately in zone one, two or three. Ingestion can be minimized with good I think as Scott was saying, standard practice of taking materials off. Don't eat in your PPE materials. I think that it is very important that when we start looking at pathways for different zones of influence, you have to take again, an approach of sitting down and deciding what is important for each group.

Just like it is very important to determine what chemicals and chemical agents are going to be important for each group in terms of exposure. Then each group is going to have a different set of parameters for ingestion dermal or inhalation. It is hard to characterize that in a few seconds, but again, thinking strategically, you can start from there and you can work down. Intersect the populations at risk and then you can come up with a strategic plan for sampling -

DR. ROSENSTOCK: Ask Maureen to first tackle this next question from someone in the community. The question is what efforts have been made or could be made, to mobilize local communities and their citizens, to themselves initiate collection of data and dissemination of information, for example, about healthy and mental health exposures and impacts?

DR. LICHTVELD: Personally, for my work both at CDC and here, I could not envision doing any work, any active investigation, without the community. So it goes without saying, there is a lot more that can be done. There are ready communities, particularly faith-based communities, communities in New Orleans East, the Vietnamese community, communities in the parishes communities, that live along the Gulf Coast that where we

can not only collect the information. So anything that we need we should do, we must do. It is not to the communities, it is with the community, and I am absolutely an advocate for having communities help us collect the data - collect data on themselves such as older locks(?), personal monitoring so that we can not only use the data in the right way, but use the data in a way that is trusted and a way that will lead us to meaningful intervention.

DR. ROSENSTOCK: Let me follow up with that and I may ask each of you to go out on a limb here because I think that part of this question begs a bigger one. The question from someone in the audience was who is going to help communicate and navigate the information we have and how do we hold organizations responsible for presenting clear and concise risk-mitigating information in a health-literate way and who has responsibility? I would like to follow up on that to say we have seen in some other disasters, whether manmade or natural, point persons, for example, post-anthrax episode or perhaps H1N1 and there might have been a single source of go to information. In putting this question in context, I also would love to hear whether you think this kind of ongoing disaster and its complexity is as well served by a point person? Or are there other ways to approach how we get as the questioner

asked coordinated and useful information?

DR. LIOY: That is a loaded question and could probably alienate half the people in this room with an answer. I think one of the things that is important is that a coordinated approach does not necessarily mean one voice. I think a coordinated approach means selecting the people who have the most knowledge for individual components of the issue and trying to use them as a barometer as to whether or not what you are saying is going to be effective. Clearly, people are dealing with the issues of cleanup. Engineers are essential for communicating information as to whether or not certain things are effective and what things need to be done. People who are looking at worker health will have different individuals who know how to respond to questions. I think a coordinated group of people providing information is essential, with expertise in a variety of areas of science, engineering, and communication, will be a more effective tool for providing good information to the public. There may be points of discontinuity so, therefore, having a group of people being able to do this and do this effectively may actually be able to say, I think in Maureen's words, I do not know more effectively because they will say there are uncertainties and they will be able

to express those uncertainties more clearly when it is a group of individuals that are dealing with a complex problem.

DR. BARNHART: I would just, building upon what Paul was saying, I think it is important to stay away from managing information because transparency is very important and having multiple lines of data being made available from agencies and others I think is very important. I do think that have a process where there is clearly a time when it gets synthesized and there is a respected - and whether that is a local health officer, I am not sure - that would be happening. I think the outcome measure I would be looking at is that this room is actually pretty full and if you were to do that on a weekly basis to provide that update, you would be succeeding if this room would gradually empty out.

DR. LICHTVELD: There are times when you need that anointed point person. I do not believe that is the way to go here. I also do not believe that this is the time to throw away an existing health system. We have state health officers. They will all be here tomorrow. They are, by responsibility, the people to communicate. I do believe, though, that the earlier we work with those who have trusted positions in our communities, the better we

will be to translate what is communicated into ways and language that makes sense for communities, but particularly in ways that are actionable.

DR. LIOY: I don't want to lose the fact that in this particular case it is not just health. It is health intersecting with engineering, mitigation, and control. Therefore, you are going to need a variety of different expertise's to help deal with it because of the fact that there is going to be an ongoing problem here. The more we get toward the issue of how many gallons we have prevented from coming on shore, how effective we are in terms of making sure that it does not get into our marshes, is just as important as the questions about health because they are all interrelated.

So health officers are very important, but, again, this is a complex problem and we do not want to live in silos. We want to make sure that each component of this gets a fair amount of information out so that people either feel comfortable or uncomfortable with the process.

DR. ROSENSTOCK: We have a few minutes left. I have a question here that I think Dr. Liroy or Barnhart both might want to answer. It has to do with the exposure, trying to assess the effects of exposure before and after the disaster. For example, the question notes that with

the 9/11 exposures, there were cleanup workers who had occupationally been exposed, prior to the event and after, to some of the same agents. Similarly, here, with the oil rig workers, you have workers who have been exposed prior and after the onset of the disaster to the same exposures and how do we differentiate those exposures to know which were result?

DR. BARNHART: I think in two words "baseline examines".

DR. LIOY: Yes. If there are baseline exams, it will help. I think that is where - I think Maureen can say that the local community, if are baseline information on populations or workers, well, that should be made accessible to all dealing with this. I think one of the biggest problems is in a disaster, it is hard to have baseline information on many people. Professionals, you will have a lot more opportunity for having baseline information. If you are bringing new people in from the outside, well you better have baseline information. One of the most important things that came out of 9/11 was the work done by the New York City Fire Department. The work of David Prezant and his group - David and I are very close friends - was remarkable because what they had is they had baseline information on all the firefighters. So when

people came up and said, my goodness, there is this kind of exposure, they could actually look back and see whether or not this firefighter has had exposure to this or not. I think that was very, very important.

The more baseline information you have on individuals coming in from day 64 on, the better you are going to be. But going backwards, you are going to have to look at the records for each one of the organizations, like the Coast Guard, like the EMS workers that are working as contractors, to see, in fact, what baseline information is available. That will be very helpful for understanding potential longer term risks.

DR. LICHTVELD: We have been ready to collect that baseline information on workers for several weeks now. One good example of the importance of baseline information is what we have at the community level and particularly in our Vietnamese community with both pre-Katrina and post-Katrina psychosocial data. That is the kind of information that will let us take action.

DR. ROSENSTOCK: I have a question that has just been handed to me so I think it is understood that that may be at the risk of going over by one minute that I will ask this. The question has come up several times earlier and in this panel about the need to bank specimens. I wanted

to know if any one of you would like to address whether you feel you have enough information to know whether that it being done adequately now or is that a need that should be addressed and further described?

DR. BARNHART: I do not have enough information to answer that well.

DR. LICHTVELD: I do not know whether that is being done but it is absolutely needed. In order for us to find the answers, we need to look long term. The only way we are going to look long term is to have biospecimen banking done right now.

DR. LIOY: I think that each one of the federal agencies and state agencies which are taking data, collecting information from individuals, should sit down and figure out whether or not any biospecimens are available and make sure that those specimens are used in such a way as a special set of data for use in the future. And that, again, thinking strategically, if you are going to take biospecimens, you have to make sure you have a fair idea of what you want to do with them so that when you come back to these individuals you can say what did it all mean.

I think in the future - I think, again, looking strategically, if you are going to take the samples, make sure you have a fairly good idea of what you want to learn

and how you are going to communicate it back to the individuals at the end.

DR. ROSENSTOCK: Thank you all. The last thing we are going to do in wrapping up - this is going to follow with each of the sessions - is, from some concerns and questions from the audiences, I am going to ask each panelist, including myself, to disclose whether we have received support from BP or other oil companies. Then I am actually going to ask the people who spoke earlier. The answer on my part is no.

DR. LIOY: I guess 15 years ago I had a contract with American Petroleum Institute to study the effects of MTBE.

DR. LICHTVELD: No.

DR. BARNHART: No.

DR. ROSENSTOCK: I think the other people have left. We will catch the others. I just want to thank our discussants for a very interesting first panel session.

SESSION II: Short-and Long-Term Effects on Human Health

Agenda Item: Panel Discussion. The Here and Now: What are the Short-term Effects on Human Health?

DR. MCCAULEY: I am going to try and keep us on our timeframe. We are beginning a session on short-term

health effects associated with the oil spill or the term that was used earlier, the oil blowout, which I think may describe a little more accurately what we are dealing with. I am Linda McCauley and I am the Dean of Nursing at the Nell Hodgson Woodruff School of Nursing at Emory University and I am a professor in environmental health in the Rollins School of Public Health.

In the last session, we began to talk about some of the health effects that we are concerned about in relation to exposures. This session will give us a little more time to delve into some of the health effects, short-term health effects that we might anticipate. I also want to remind you that this session, we will have comment cards again and questions. So as you listen to the panelists, please write your questions and IOM staff members will be circulating again to collect those.

In this session, we are going to focus on what we should be alert for in the days and weeks and months going forward. What have we learned from previous, similar exposures? And what is different about this situation? Who are our vulnerable populations? Are there some health symptoms we would expect in one population over another? We are going to hear from experts who are going to talk about the acute physical symptoms that workers and

volunteers and residents might have. We are going to have a presentation on heat stress, which, I believe, in comparison with some of the previous oil spills, the heat environment in the Gulf region makes this a very special situation. Also some more time talking about the psychological effects associated with this type of devastating events. I am going to also ask each of my speakers to disclose any funding that they have received from BP or other oil companies as they begin their presentation.

I will introduce the three speakers. Dr. Nalini Sathiakumar is the associate director of the Sparkman Center for Global Health and associate professor of Epidemiology at the School of Public Health, University of Alabama at Birmingham. Dr. Howard Osofsky is the Kathleen and John Bricker Chair at the Department of Psychiatry at Louisiana State University Health Sciences Center. And Dr. Tom Bernard is a professor in the College of Public Health and chair of the Department of Environmental and Occupational Health at the University of South Florida. We are very privileged to have these three experts and, doctor, if you will start out first?

Agenda Item: Short-term Physical Effects

DR. SATHIAKUMAR: Good morning. It is my

pleasure to be here. We are going to talk about the short-term physical effects of oil spills, a little about crude oil exposures, the acute toxic effects, the physical injuries, the target population.

I think we have gone over this this morning. Linda wants to me to disclose if I have any conflicts and I have no conflicts. You heard a little bit of this. Again, a little bit on the chemical exposures. You heard three main groups, the volatile organic compounds, then the polycyclic aromatic hydrocarbons and the heavy metals, and then, of course, the oil dispersants. Then you have the physical hazards, which may include ergonomic hazards, noise levels, sun exposure, heat stress, injuries, et cetera.

Now, when you look at the acute toxic effects of crude oil, you have volatile organic compounds, which is almost immediately following the spill and in this instance, which is continuing. The effects are on the skin and through the skin and its effects - the symptoms are skin and mucus membrane. It can cause erythema, which is redness, edema, swelling, irritation, dermatitis, rash, and blisters. VOCs are also caused by inhalation or by contact with the eyes, causing redness, soreness, watering and itching. Again, the VOCs also cause respiratory symptoms:

cough, throat irritation, dryness, shortness of breath, and wheezing. Benzene and Toluene cause neurological symptoms: nausea, vomiting, headache, dizziness, irritability, confusion, weakness of extremities. They can also be ingested in food and water causing gastrointestinal tract disturbances: transient nausea, possibly vomiting, and self-limiting diarrhea.

Oil dispersants also have the same effect on the skin. These are some of the solvents, which are mixed in dispersants. Inhalation and through the skin and through the air and they can affect the skin, mucous membranes, eyes, and respiratory system.

Physical injuries can occur because of working on slippery or uneven surfaces, causing slips, trips and falls. Tools and equipment, and as mentioned earlier, venomous insects causing injuries. Strenuous work schedules and heavy physical workload, which may result in fatigue and lumbar pain and exertion and hot environment causing heat related conditions. Target population are seamen and rescue workers, residents living in close proximity, people eating fish and seafood, tourists, and people using the affected beaches.

A lot of information on the short-term effects comes from previous studies of oil spills. As mentioned

earlier, there are at least 400 tanker spills that have occurred since 1960's and 38 of them were supertank spills. Of these, only seven have been studied to date. I had the privilege of working on the Tasman Spirit, which was in Pakistan, and funded - we did this on a project funded by the National Institutes of Health.

Most of the studies were cross-sectional, looking at the short-term effects, which means studying a subset of a population with regard to exposure and outcome at the same time. You compare the exposed and unexposed people. Exposures - most of the studies did not have, actually, systematic monitoring for exposures, but they used surrogates of exposure like, for the community, distance from the incidence - that is the oil spill - and living along the coast and for cleanup operations, the type of operations and also the duration. Outcome ascertainment - acute toxic symptoms using a standard questionnaire; general health, again there is a standard questionnaires; specific organ functioning because you could have, in the short-term, more serious side effects besides what I mentioned; lung, kidney, and liver function was assayed using a questionnaires; and, of course, you heard about genetic toxicity studies and some endocrine toxicity studies, which was done for the Prestige oil spill.

This is the Braer. The Exxon-Valdez only looked at psychosocial effects so I am excluding that because somebody else will be talking about it. When you look at these studies - this is the Braer in the United Kingdom. Cross-sectional study, they looked at the community and see the numbers are hundreds of people.

With the questionnaire, they looked at both the hematological, liver, and renal function tests. They did find toxic symptoms among the residents, which occurred on day one and day two incidents. No significant differences between exposed and unexposed with regards to the lung, liver, and kidney functions. They did do some exposure screening, but it did not show any exposure known to affect human health, but these are some basic blood and urine toxicology tests.

Cross-sectional study, again, they did a follow-up after six months and they found a mean general health questionnaire score of exposed significantly greater than controls. Again, this was they looked at a sub-group of community children and they looked at the lung function test in the Braer study. This was based on small numbers, about 45-50 children, and the peak expiratory flow was within normal levels. I am not discussing the genotoxicity studies, as they were discussed earlier.

Sea Empress, in the United Kingdom again. This looked at adults, 18-65 years, and they did look at acute symptoms and did find the exposed were more likely to have symptoms when compared to controls. This was the Japanese study, Nakhodka in 1997. They looked at - they had toxic symptoms, but personal protective equipment used - this was among cleanup workers, they found 100 percent used gloves, but masks were used less often. Less than 30 percent used masks. Erika, again, they had cleanup workers' neurological symptoms, lumbar pain, and duration of cleaning work was identified as a risk factor. Prestige, again, they did a group of studies. Again, all of them showed toxic symptoms and bird cleaners had the highest risk of injuries. I am excluding the genotoxicity studies that were discussed earlier.

The Tasman Spirit, we found moderate to strong associations between exposed group and symptoms and this was associated with the distance. Staying closer to the spill, they had more symptoms. There were no hematological or biochemical parameters - were not changed. This was cleanup workers -again, this was mentioned earlier - had a higher prevalence of ocular and respiratory symptoms. They had, also, a decline in respiratory function, which improved when subjects were removed from the polluted

environment.

Conclusions. Now, some of the studies did some exposure measurements. Hydrocarbons were below occupational safety levels. Level of VOCs, within the range observed in urban environments. Level of benzene did - this is interesting - the highest VOCs were recorded in volunteer's environment. Level of benzene did not exceed threshold limit values.

Now, toxic symptoms - community, residents living in the vicinity of the oil spill. Consistent evidence of acute toxic effects: neurological, ocular, and respiratory. Not dermal because dermal was more common among the cleanup workers. This was present in the community after adjustment of pre-existing allergic and medical conditions. Biochemical tests for lung, kidney, and liver function were within normal limits. Six months after the oil spill - similar findings. Children's respiratory function was within the normal range.

Cleanup workers - consistent reporting of acute toxic symptoms: dermal, ocular, respiratory, and neurological. Duration of cleaning work was identified as a risk factor. Seamen had the highest occurrence of toxic symptoms compared to volunteers of paid workers. One study showed that lower respiratory tract symptoms noted after

one year and it was associated with number of days worked and tasks per day. And reduction in lung function was transient. This is, again, in the Pakistani study. It improved when workers were withdrawn from polluted environment.

Personal Protective use; less than optimal, as seen in the Japanese study. Health briefing increased the use of PPE and reduction of symptoms. Uninformed and poorly informed workers were at more risk of exposure and symptoms and in the Prestige study, the seamen were the poorly informed people. With regard to injuries, employment for more than 20 days was associated with risk of injury. Bird cleaners had a higher frequency of injuries compared to other cleanup workers. And cleanup and volunteer workers also reported back pain.

Now, limitations of these studies. Most studies were at a point in time where a cross-sectional - so cannot establish a temporal relationship, however, they compensated by adjusting for these conditions in the analyses. A few studies had no comparison group, limiting interpretations. Some studies were small in size. There is also potential for information or publicity bias and reporting illness occurrence. This, again, was minimized by introducing some questions on anxiety and so on as we

did in the Pakistani study. Some studies, like the Braer, had a low participation rate. It was about 56 percent. The causes for that, they said, were kind of attitudinal. People did not want to participate. They said they felt normal and did not want all the blood drawn, whereas, in the Pakistan study, we had almost 98 percent participation. These studies depended on surrogates of estimates of exposure, either distance from oil spill or living in the vicinity. So inability to develop useful dose-response data, biomonitoring of exposure and outcome limited and, at one point in time, no long-term follow-up of high-risk groups for exposure and/or outcome ascertainment.

So, the end summary, these studies have shown us that consistent evidence of recent ocular and neurological, dermal exposure to - as a result of exposure to VOCs. Personal protective equipment definitely reduces exposure. And, education, particularly of cleanup workers, is extremely important. Thank you.

(Applause)

Agenda Item: Short-term Psychological Stress

DR. OSOFSKY: I do have no conflicts, to start with. My name is Howard Osofsky. I am chair of the Department that is noted. I also have had multiple roles from a research and clinical point of view and I have been

Clinical Director of Louisiana Spirit, the states crisis and response program. We, at the request of the Mayor of New Orleans and then the surrounding parishes, worked with first responders, returning their families after Katrina. We have done the boats with our first responders, rebuilding their families, together with NIH. And our trauma team, we have screened every child, for example, returning to St. Bernard parish, almost all in New Orleans and in Placaman's parish and have continued this type of work.

I decided to give handouts to everyone on background so that I am not distracted by the powerpoints, nor are you, and you can keep them. I am very respectful of the agenda of this very important meeting, the collegial concerns, the ecological concerns, the impacted populations, the economic concerns, the health concerns. I would like to stress and I was asked to do this by colleagues in SAMHSA and the CDC yesterday, and my good friend and collaborator Ron Kessler of Harvard, saying be sure that we sure that we emphasize the importance of mental health concerns because they are so prevalent everyone talks about them, but then usually down the line there is much less research, there is much less application of what we know about the mental health concerns.

I would like to just mention, again, the interface between health, mental health problems, and now we are going to raise the issue of neuropsychiatric concerns and how they can also be played out in a mental health perspective, but all of these are being covered and are extremely important. I would also like to mention, given our work with children and adolescents, the importance of developmental concerns. I know it will be covered later and I want you to go over our data with you, but we are already getting calls from the schools about their concerns about what may well be behavioral problems, learning cognitive difficulties, impulse control, and risk taking behavior.

Let me at least briefly mention, we do have similarities to the other studies on record of natural and technological disasters, the issues on the way of life, the loss of employment, the reduced income. We can even have some similarities to where there have been mass closings such as the marvelous studies from Michigan when plants were closed and workers had to look for jobs that were not available and lower paying jobs.

But there are other differences here and other differences that we should stress, even from Alaska. One, this is an ocean gulf community, a very large community,

and it is an ocean gulf community. There are ethnographic and cultural differences. Within each of the parishes being most affected in Louisiana - we will see this in Mississippi and Alabama - even within the parishes, there will be groups that are different from one another culturally and which we need to account for and which we do in our own work. There are multi-generational issues. For example, here, as opposed to Alaska, we have people where great-grandparents, grandparents, parents, and now younger people are all employed in the same type of industry - the same type of fishing industry. There has been the ambivalent relationship with the oil companies that has been stressed more recently. On one hand, the suspicion, the concern about quality, the concern about safeguards, on the other hand, the dependence on the oil industries for a way of life, not just for our country, but for the communities involved.

There is another issues and that is why I gave the handouts. This major disaster currently is built on what is finally the recovery, what has been a long and painful recovery from Hurricanes Katrina, Rita, and in Terrebonne Parish from Hurricane Gustav. People are just recovering and so the traumas that they are experiencing are being built on traumas that they have experienced over

the last five years and before the hurricanes. Then we also have pre-disaster data, granted it is a different type of data. But since we have been following people for five years, since Hurricanes Katrina and Rita, especially, we have five year data, especially with children and adolescents and some with first responders on what has gone on during this five years and now what will be going on in addition. There is also the importance of traumatization, the cumulative effect of traumas, prior trauma, and multiple traumas. Here we are dealing with all of these issues, here. Where are we now?

One of our local parish leaders the other day in speaking to me, since we are out doing the first step of what will be the needs assessments, in a very careful manner said, Howard, this is the tip of the iceberg. He said we are beginning to see mental health problems emerging, as we expected, but they will get a lot worse. People are still in a state of employment, for some denial, for some hopeful thinking, but we are already seeing the types of problems beginning to emerge. Another of the parish leaders pointed out his own recurrent post-traumatic stress and saying just as he needed to be in treatment after Katrina, he needs to be in treatment again.

We are seeing already an increase in

suspiciousness, arguing, domestic violence. We are having anecdotal reports of the domestic violence shelter being more fully used and some overflowing at present. We are having reports from drug courts. We are already having reports, as we would expect, of increased drinking, anxiety, anger, and avoidance. People are keeping to themselves and not wanting to talk about what is going on. We would also expect that, given the culture in many of the communities. We are beginning to see the symptoms of depression. As I said, we are getting anecdotal reports of domestic violence.

I would like to at least take a quick look at the handouts I gave you that show some of the last five years in our work in over 23,000 evidence-based screenings of children and adolescents. We take a look at the first year where the figures were about half meeting the cutoff. We used these to guide services, not only to gather data and to learn. We have this very special longitudinal data, much of which we have begun to report and much is in the process of being reported. But we take a look and it was coming down. Then if you take a look, when Gustav hit it went up again. It actually leveled off. It did not truly go up because we had an additional population of all the students of East Baton Rouge, including these students who

are still in trailers. We also see the incidence of traumas these people have experienced, such as the displacement, the displacement from schools, the many losses that went on and the losses that have continued that we have been documenting.

I put in some work about our Youth Leadership Programs because what we have done with ordinary students is try to work together with teachers, with members of the community at building strengths and have students taking on greater roles of helping other students. We have found this to be extremely effective. Working together with Ann Masten, who has been remarkable, from the University of Minnesota, Al Bandura, Bob Pimoose(?), others, we have been looking at measure of self-efficacy and leadership and seeing the differences in students who have been able to be in these programs.

Finally, I put in some of our data on first responders because I think it is important to take a look. Using the measures that were developed after 9/11 and that the CDC has been using, what we have been seeing of post-traumatic stress symptoms, symptoms of depression, which consistently are somewhat higher than post traumatic stress symptoms. But, increased use of alcohol, domestic difficulties, and what I do not know is on this slide, that

40 percent - maybe because people have known us and trusted us and we have been out in the field with these stigmatized services as well - 40 percent saying they would like help for themselves and their families. So we go into this particular disaster with these types of data. As I say, we are already beginning to see the early signs that we would expect and I know that we will be working together with many of our colleagues, such as Dr. Kessler, colleagues from the CDC, some colleagues from SAMHSA where we are revising our evidence-based needs assessments this week. We have been doing focus groups as a first step and, as we build, the parish advisory boards, the stakeholders, working together carefully with us.

I would like to mention that I pointed out in the slides that you have all received what we are seeing from the focus groups - some of the things that are being reported, like having symptoms after Katrina. They did not realize there was a lid, like on a container, and they thought things were better and all of sudden it has popped up. It is not as though people are having the flashbacks, but the acute anxiety, the anger, the fear of can they go on, can they rebuild. People saying we really do not want handouts, we want hand-ups. We want to figure out can we remain optimistic. I remember one of the people in the

focus groups and it is stated here, her statement was I will not cry because if I start crying, the tears will be greater in volume than all of the water from Katrina. We had people talking about the people who are getting the work and not all of them really being fisherman. But, in a way, some were feeling a little relieved because they could not say to their husbands, but they were so afraid that if their husbands were out there day after day were they going to be permanently ill? Mothers who were talking about their sons. I quoted one of them, who talked about at times being very angry, at times saying, you know, I feel suicidal. The increase in drinking that we are already seeing. People reporting not only that people are drinking more - and we have noticed if you go by stores, the front of the stores where they are selling alcohol is really quite busy - not only that, but some who have never drunk before beginning to drink. Something, again, that we would expect.

I will just try to pull this together. We know that what we are going to be seeing over time from our work, from that of others, the research that is available, we are going to be hearing more about it, we are going to see depression. We are going to see anxiety. We are already seeing post traumatic stress symptoms. We are

going to see suicidality. Studies tend to indicate the greater incidence of suicide, the greater use of substances, the spouse and child difficulties. In our case, we are saying the importance of our working with the schools around children returning, their concerns, for fortunately we have these very close relationships both with the parishes and with the schools, and the issue of resilience building and helping people with their strengths at this very complex time for all of them.

I will certainly be glad to answer questions. It is something that none of us wanted with Katrina. We did not want it here, obviously. But, in a way, we feel privileged that we have the knowledge, that we have the trust of the communities, and we will be working together to try and solve the problems. Again, I would emphasize that so few of the lessons learned have focused on the needs of children and adolescents and families. So few, in the long run, have done the longitudinal studies on mental health and so much of this is needed, but they also are needed because it helps in guiding the services and helping linking up with resources and also in helping determine where resources are inadequate. But in helping work together, both in gathering the data, gathering the knowledge, which we all need, but also helping people in

their recovery. I thank you very much.

Agenda Item: Heat Stress and Fatigue

DR. BERNARD: Just taking a cue from Dr. Overton, when you are done sampling New Orleans cuisine, consider visiting the beaches of Florida. That is my plug for the state. I wondered why Dr. McCauley asked me to join the panel to talk about heat stress so, again, I want to thank all the previous speakers who mentioned that heat stress was a problem so that that helped validate your decision and made me feel a bit welcome. I do want to announce that I do receive support, recent support from BP to review the heat stress management programs that are under the Unified Area Command. So that should be noted. With that, I want to take you down the road with heat stress a bit.

This is Dr. Howard's, if you will, inner circle. This might have to be a note model for the group as a whole. I want to talk first about what the assumed or the ideal or the populations we are ordinarily talking about. For heat stress exposures, we are usually assuming a healthy and acclimatized workforce. Some of the unstated assumptions are that we do have turnover in these workforces, but they are relatively low so there is also a cadre of well experienced workers to bring the inexperienced workers along and that they do understand

heat stress. The other thing to note is generally there has been, through labor management interactions, a set of controls and management of exposures that are generally pretty effective. That is our assumed exposures in worker population.

I will tell you that we have known acute health effects and, borrowing from one of the introductory speakers, there is no uncertainty about this. Our knowledge bounds are tight. We know that they exist. Exertional heat stroke is our critical health concern mainly because if this is not addressed well, it leads to fatalities. More common are heat exhaustion and then others that we will mention are syncope and heat cramps.

I want to just bring up for a moment that there are some other less appreciated effects to heat stress exposures. Established by a study long ago by Texas Tech, is that the frequency of unsafe behaviors increases with increasing levels of heat stress exposure. In fact, by the time you reach occupational exposure limits, based on a baseline of a thermally comfortable environment, the frequency of unsafe behaviors has already increased somewhere between 50 and 75 percent. At an occupational exposure limit, you already have an increase in unsafe behaviors. A study that we have recently done at USF,

there is also an increase in risk taking behavior in un-acclimatized people versus acclimatized. When we look, as a consequent - what we would assume would be a consequence of unsafe behaviors is acute injury. In fact, over 50 years there has been a well established relationship between acute injury and season of the year. Again, a study that we have done with USF with low heat stress, by low heat stress I mean marginally above the occupational exposure limits, there is a non-significant, but an increase in acute injury with odds ratios about 1.4. When you move to high heat stress and, again, I want to mention to you that high heat stress is not extraordinarily high, that odds ratio is significant at 1.7. Then, again, I want to appreciate the fact that a couple speakers brought up musculoskeletal disorders as a concern. Again, at low heat stress that odds ratio is 1.8 and by the time you get up to high heat stress the odds ratio is up to 2.4. When you look at job risk factors for musculoskeletal disorders, many of them are in that vicinity of two to three, a few that are higher. Heat stress, in fact, is an important contributor to musculoskeletal disorders.

Just sort of laying that groundwork out for what would be kind of within-day effect - there are others. There is not a great deal of information about day to day

or cumulative effects, which I will throw into the broad category of fatigue. But we do know that exertional heat injuries among military recruits, the odds ratio increase when there are preceding consecutive days of heat exposures that are significant. We would know from work physiology models, because the increased cardiovascular demands are reflective, as if there were an equivalent aerobic demand, that we have an increased demand on the cardiovascular system that would point to fatigue. Then, borrowing a bit with a stretch what we know from sustained heat waves in a general population, that we would expect that there will be a cumulative effect and if it is higher in a more healthy group that is still somewhere along the line, we may see something.

Just mentioning occupational exposure guidelines is that the goals are really to substantially limit the risk for occupational heat stroke and that goal is well met. It usually manages the risk for heat exhaustion, but it does not represent thermal comfort. What we have, though, as opposed to what our ideal population is, is nominal twelve hour shifts with extended duty. In other words, it is not unusual for us now to see 7x12s. This is leaving the door open now for these issues of fatigue and cumulative exposure. We also have massive recruiting so we

are not in reducing workers slowly. We, perhaps, have less screening that would ordinarily occur and probably have, maybe, perhaps, a little bit of self-selection. I have to tell you that that is just simply speculative on my part. The other thing that I have been able to observe for the onshore activities is we also have a highly adaptive management/supervision that is changing their work practices daily to adapt to the heat stress.

In terms of knowledge gaps, what we have here, really, is an opportunity to look at extended hours and extended work weeks to look at what affects that might have on heat-related disorders as well as acute injury. My only druthers would be paying attention to a diagnostic protocol to carefully classify the heat disorders. It is usually difficult to go back, retrospectively looking at the record and trying to parse these out clearly.

Then, of course, sufficient linking for individuals because what comes to my mind for rare acute events is a case crossover design. My other wish for the additional exposure characterization, is actually knowing the hours worked. There is a lot of break time happening, whether it is due to storms coming through where the work is stopped, as well as a great deal of variability in the work and rest cycles. Having a good record of what is

happening, as well as some spot or daily physiological monitoring that will help us to understand the strain that the workers see.

Moving to the idea of risk communication, again borrowing from Dr. Howard's bulls-eye, is the risk communication is to the worker population. It is not really to the community at large. This is the group of people that have a low sense of anxiety and a low sense of risk about what they are doing. We have, compounding with that, a face validity problem in that many people feel that they work in hot environments, they understand, and that the occupational exposure limits are too conservative.

We do have face validity issues. The other is if you look at case studies and it is just an accumulation of case studies - what you find popping up fairly consistently is new and probationary workers are at greater risk for an exertional heat stroke than are established and experienced workers. There are issues about language and communications where there are poor understanding of the risk or a lack of communications between the work and supervision that we also have risk. Another area of risk is the timely recognition of a heat stroke and an aggressive first aid that goes with it.

Typically, in industrial hygiene, and it is no

different here, we have very much a top-down communication structure. For the Gulf, it is an incident command focus point with a variety of feedback controls that occur in the field. By and large, these look like they are done well on shore. I do not understand the offshore operations well enough to comment. Just to throw out, whether there is an opportunity for some bottom-up communication such as social marketing or other methods. This looks like we have an opportunity to investigate that.

So, again, thank you for the invitation to the workshop. I appreciate the opportunity to meet with you.

(Applause)

AGENDA: Questions

DR. MCCAULEY: We are going to have IOM staff walking around getting questions from the audience. While we are waiting for those to come in, I would like to thank the presenters for their brief overviews of some of the health concerns that we are all concerned about. I would like to follow up on, Dr. Bernard, something you said about risky behaviors, in terms of protecting oneself from heat. Did I get this right that you are saying that as your heat index increases or your exposure increases that risky behaviors increase?

DR. BERNARD: That is correct.

DR. MCCAULEY: So what I am thinking about is a lot of our heat stress studies have come from hazardous material workers, people who are cleaning up toxic areas. This is a little different of a situation and I imagine if I was a worker on the shore and I knew the oil was coming in and I wanted to work fast and stop it, I would feel that urgency to also work very hard and very fast. Do you think that is a danger?

DR. BERNARD: It is a danger and having well motivated workers is often the case. That is where the having a very well instilled heat stress management program is important, in order to help, if you will, contain that enthusiasm so that they are being self-protective.

DR. MCCAULEY: I think everyone, when you see the contamination coming to shore, I can see that people would not want to take a break. That they would want to continue to work and it could be unsafe so the management is an important aspect.

DR. BERNARD: Yes.

DR. MCCAULEY: There was another point that was made around heat stress, but also mental health aspects. Perhaps some of these toxic symptoms are the need for diagnostic protocols. Howie, I think you used that term - diagnostic protocols or clinical guidelines. Are our

frontline health providers aware of some of these complex symptoms and is this an area that we should focus on?

DR. OSOFSKY: I do think that it is very important. I think it at times tends to get underrated. I know even when you talked about volunteers, on Friday we have a conference call because we were consulting with Chile on an on-going basis related to the earthquake there and assisting them as they are working and we have been helping in Asia.

One of the things that does come up with volunteers, is the recognition that both from the medical and the mental health point of view, the volunteers can develop problems. In other words, many of the volunteers will be well trained and will have had the background so that they can focus on what they are doing and doing it in a safe way, but we also see volunteers that, in a goodhearted way, try to come in and even some who are well trained, who will go through heat exhaustion or who will begin to go through medical problems and psychological problems. I think of the number of times the Public Health Service would refer people to me and say, Doc, they are winged out or they are having problems at home during the two weeks they are here. To try to be aware of this, but it is a complex set of issues because what we will also see

in emergency rooms or in the field, people will come in with respiratory difficulties or cardiac difficulties, hypertension, dermatological difficulties. It can be hard on the people who are treating them to realize that at the same time they have symptoms of acute stress, of depression, of compounding factors that are influencing the expression of symptoms and they really need to be recognized and helped together. In addition to recognizing the secondary traumatic stress of the people who are helping to treat because they, too, are going through the difficulties of want to work very hard, but living through the situation as well as working with these complex problems.

If I can say one more thing, when we talked about children and adolescents, to remember if the families are functioning well, if the parents are functioning well, children and adolescents will do considerably better. It is the families that are going through the stress - one will see this secondarily in the children and adolescents, but it is also a way of being helpful because it is much easier, for example, for spouses to have a spouse come in. If there are concerns, even if they are not totally warranted, about children, to be able to work with the family at a time like this. This we have been finding

consistently in our research and in that of others and other methods of intervening and of being of help to people.

DR. MCCAULEY: Thank you. Dr. Bernard, this is an important question from someone in the audience that many of the cleanup workers have significant pre-existing medical conditions and that may place them at increased risk of bad outcomes related to heat stress. What guidelines or recommendations do you have regarding screening these workers and what should we be particularly attentive to?

DR. BERNARD: I am going to do my best to dodge that question, if I may. There are some guidelines that are worth pursuing. I am not sure that I can name them all off at the moment, but you are going to want to look for things that are going to impair water balance and also cardiovascular capacity, in general. Very often, either disease or many of the drugs that are used to treat chronic diseases will affect thermal regulation. The problem we have in pre-screening is that there is no real, good test for who is capable of working in the heat, other than a previous successful history of working in the heat. What we have done - or, what other companies have done is review with people those risk factors as they find them. Also,

provide letters that introduce these heat stress exposures to their personal care physician so that they can be properly guided. That is a more standard response, rather than what can the Unified Area Command do with all of these people? I am not sure I have the answer for that.

DR. MCCAULEY: Do you think the rest periods need to vary according to the age of the workers that are out in the heat?

DR. BERNARD: Again, it is less age-related than it is fitness-related. Fitness - aerobic capacity, seems to be the best single indicator of ability to tolerate heat. Then, as I mentioned, previous heat exposure is also a good indicator. The rest breaks are extensive. There is a two hour break at lunch for the onshore workers in an air conditioned space. Those are all important. Again, the beauty of the heat exhaustions is that they are quickly observed, they are readily reversible, but they provide a good index for are these work practices working. The sense that I get from the few sites I visited is that they adjust their work cycles accordingly.

DR. MCCAULEY: Okay, in our earlier sessions, there were several references to baseline screening and biomarkers. I would like each of our panelists to reflect on the areas that they presented and what recommendations

for biomarkers - this is a question from the audience, also - what recommendation for baseline screening of biomarkers would you make at this time?

DR. SATHIAKUMAR: Well, biomarkers can be varied, both of exposure and of outcome. Exposure, I think was previously discussed - definitely, the hydrocarbons, the volatile organic compounds, and genotoxicity studies and so on, and endocrine disruption because some of these chemicals are also endocrine disruptors. As for the outcome, most of these were toxic symptoms, but, of course, in this instance because of continuing exposure, there could be more serious side effects of acute toxic physical effects, such as affecting the kidneys or lung function and respiratory function. We saw that particularly among the works, since in most of these studies prolonged exposure can cause respiratory depression in function. In fact, one of the studies showed as much as the effects lasting for a year so some of these short-term effects can extend into the long-term. Monitoring for respiratory, lung, and renal function would be quite appropriate.

DR. OSOFSKY: I would just agree with this and also instating these will be very important in monitoring mental health symptoms. The other types of monitoring that could be helpful would be neurocognitive assessments. I

think, here we are here seeing the question both in the adults and in the children and adolescents who live in these communities. Are there going to be any shifts? With what we know about brain development in childhood and adolescents, and even if we take a look at some of the NIDA studies on brain development and the risk for increased substance abuse over time, some of this could be very helpful as we monitor the outcome. I think, for us, as much it will be the integration of the co-occurring components - the medical components, the neurological components, the substance abuse components, as well as everything that we know from the literature about risk and risk at different age groups from a mental health perspective, the baseline understanding and then the longitudinal follow-up.

DR. BERNARD: Again, I don't have much to add to the discussion that I had about what would be medical screening. There are no good biomarkers that I am aware of for these. There is about four percent of the population that is heat intolerant, but it is difficult in advance to know who they are unless they are forthright in presenting a health history of having problems with tolerating the heat. That is where some of the self-selection usually occurs. People know that they do not tolerate heat so they

will not seek that out.

DR. MCCAULEY: Do we need to worry about a synergistic effect of heat exposure and the chemical exposure? Should we be worried about that? That you might begin to see the effects from the chemical exposures faster?

DR. BERNARD: Sure and I do not speak as the toxicologist so I will pass that one down the line in a moment, but remember that anything that affects the central nervous system is probably going to have an effect on the thermal regulatory center, also to the extent that you have effects on the renal system or other things that will effect fluid and electrolyte balances.

DR. SATHIAKUMAR: Heat also has indirect effects on the PPE use - personal protective equipment.

DR. MCCAULEY: So you are really talking about a triangle of heat, chemical exposure, and then the behavioral changes that you see as a result. That is very important, I think.

DR. OSOFSKY: Of course, a number of people who are taking medications for mental health issues are much more vulnerable for heat exposure, as well.

DR. BERNARD: I was not that specific, but it was actually the psychotropics that I was thinking of as a

class of drugs that would be a high concern.

DR. MCCAULEY: I also want for us to think about - we are going to be talking a lot the rest of the day and tomorrow about setting up ways to monitor populations going forward and research that needs to be done, but we also have to consider the provision of clinical care because everyone is going to need care. Not everyone will be in a research study. Have you seen, Howard, any changes in terms of trying to ramp up the mental health services available?

DR. OSOFSKY: By the way some of the data that we obviously know is people who have had prior mental illness and mental health difficulties are more likely to have increasing severity of their difficulties, as well as new classes of people who have not had symptoms, who will develop symptoms following a disaster. This will be different, for example, from Katrina and Rita in that we do not have a gross disruption of the mental health services. However, they are very limited. If we take a look, for example, in lower Placaman's, there are very limited services, who are working together with them at this time. In Terrebonne Parrish, the human services district, the mental health district, is just going to be established as of July first. There are very limited resources. Again,

in looking at the differences in the subpopulations, in St. Bernard Parrish, we are seeing increased symptoms. We also work with resource mapping, with trying to look at coordination and not only better utilization but the services working better together. Hopefully that will be occurring, right? I hope I answered your question.

DR. SATHIAKUMAR: The same with toxic symptoms. Pre-existing asthma, allergy conditions exaggerate the symptoms due to these chemicals.

DR. MCCAULEY: Thank you. Watching the time. It is time to close this session. We will have time in the public discussion section later on to delve into this area in more depth. I wanted to remind everyone that you are on your own for lunch. In your packet is a list of nearby restaurants. We are going to reconvene at 1:30. 1:30, sharp, to continue our discussion of health effects, particularly those that we might see as more persistent and long-term. I think the speakers and the committee planning know their lunch details. Thank you and see you at 1:30.

(Whereupon, a luncheon recess was taken at 12:10 p.m.)

A F T E R N O O N S E S S I O N (1:30 p.m.)

Agenda Item: Panel Discussion. The Need to Know: What are the Potential Delayed and Long-term Effects on Human Health?

DR. OLDEN: Good afternoon. If you'll take your seats, we need to get this session started.

I have enjoyed the morning sessions very much. I'm impressed that all the speakers stuck to the time. But I have learned that some of my speakers have 30 or so slides, so my job is cut out for me this afternoon.

I'm Ken Olden. I'm the founding dean of the School of Public Health at City University of New York. I'm very pleased to chair this session this evening.

Before we get started, I want to put environmental health risk assessment into perspective. When I was involved in environmental health decision making in the U.S. government for 14 years, the most common phrase that I heard was "inadequate or not enough information." We have heard that a lot this morning already. As we deal with the long-term effects of a complex mixture like oil, we are going to hear that a lot this afternoon.

I have five speakers in this session. Let me start by introducing all five of them at once.

First is Peter Spencer. Peter is professor of

neurology at Oregon Health and Science University. He is also former head of the Environmental Toxicology Program at the University.

The second speaker is Irwin Redlener. He is professor of population and family health at Columbia University.

The third speaker is Brenda Eskenazi. Brenda is professor of maternal and child health and epidemiology at the University of California Berkeley.

The fourth speaker is Sheldon Cohen. He is professor of psychology at Carnegie Mellon University.

The final speaker in this session is Dr. Lawrence Palinkas. He is professor of social policy and health at the School of Social Work at the University of Southern California.

This session is on the long-term health effects of exposure to oil. Peter.

Agenda Item: Neurological, Cancer, and Other Chronic Conditions

DR. SPENCER: Thank you, Ken. Good afternoon.

To declare that my research has been funded by various federal agencies, and in the 1970s, by the Petrochemical Industry.

I have been asked to talk about the chronic toxic

potential of selected hydrocarbons in crude oil. As I go through this, I hope you'll keep in mind all that we learned this morning. Some of it may be a little repetitive. In particular, I want to emphasize that the types of responses that I'm going to describe result from very heavy exposure, often in the experimental setting and often using laboratory species, to identify what the potential adverse effects are.

We have already learned that crude oil is composed of thousands of chemical structures, and these structures change over time. What I want to convey is that very few of these have been tested individually for toxic potential. Clearly the toxic potential varies with the chemical structure. The dose and duration of exposure are key variables in determining outcome. Some of the low-molecular-weight compounds are able to be absorbed through skin very readily, but there is no absolute predictability of their absorption dermally. Of course, others can be inhaled and absorbed by that route.

Our ability to study biological effects of chemical mixtures -- theoretically they are available, but data interpretation is a huge challenge. We have some limited understanding of molecular mechanisms of chronic neurotoxicity that I will focus on and carcinogenesis.

An important point especially relevant to neurotoxicity is that acute health effects, chronic health effects, and possible long-latency health effects may operate through entirely separate mechanisms. So the presence of acute health effects -- for example, headache or dizziness -- may or may not predict any long-term effects. In terms of whether an individual has a special susceptibility through a gene-based mechanism, we are right at the beginning of understanding this.

Most of our information is on the hydrocarbons. A lot of information has been focused on the straight-chain compounds. These are the low-molecular ones that blow off very quickly. The cycloalkanes have attracted much less attention, and the aromatics, of course, have been of interest in relationship to carcinogenicity, but also neurotoxicity more recently.

We did hear this morning that polyaromatic hydrocarbons, PAHs, so far have not been detected. They are of importance in relationship to potential carcinogenic properties.

Way back in the 1970s, it was apparent that workers exposed to certain alkanes, these straight-chain compounds, the ones that blow off very quickly, the ones that may have acute effects in terms of irritating eyes and

in terms of irritating mucous membranes, producing dizziness and headache -- it was clear that these straight-chain compounds only in some instances had the potential to go on to produce neurotoxic effects. When I say neurotoxic effects, I'm speaking of more chronic effects, in this case, on the nervous system. It was quite clear that the ability to do that was dependent on the chemical structure. The compound N-hexane that we heard about this morning was uniquely able to undergo metabolism through this route to this compound 2,5-hexanedione. We came to learn that the spacing of these groups was absolutely critical in determining whether or not this was able to produce something called peripheral neuropathy.

A peripheral neuropathy in the industrial setting occurs when an individual is exposed for prolonged periods of time to very significant concentrations. We heard the threshold limit value for N-hexane this morning is 50 parts per million. So a peripheral neuropathy is associated, then, with a very insidious gradual onset of changes in sensation in the feet and the hands. The deficits may then slowly ascend the affected limbs symmetrically, bilaterally. Once the exposure ceases, the disease classically continues to advance for a short period of time and then gradually regresses, until recovery is almost

complete, although there may be persistent effects.

Fortunately, the rodent studies that have been conducted clearly show what's going on. It's the very-large-diameter nerve fibers that are particularly affected. Those that run down my long legs, for example, would be particularly vulnerable. Those running up and down my spinal cord would also be vulnerable, although the effects clinically are seen in terms of a peripheral neuropathy.

On recovery, the peripheral nerves are able to regenerate, reconnect with their end organs, sensation is usually restored, and muscle function is usually restored. But any damage occurring within the spinal cord is very poorly repaired, and new types of neurologic deficits may appear after the recovery of strength has occurred.

There are a couple of reports from Italy claiming that there may be late-onset parkinsonism following exposure to N-hexane, but this has come from, I think, a single laboratory and, I think, as yet has not been submitted to rigorous experimental testing and clear demonstration of this effect.

Whereas many of these straight-chain compounds will produce acute reversible effects of the type that we are hearing about among workers -- that is, people who will be complaining of some dizziness or giddiness or

headache -- these will disappear, rather like taking too much alcohol. If you take too much, you will have some effects, but they will disappear. But if there is chronic exposure, then the neuropathy may appear. But it's dependent on chemical structure, for the reasons that I just showed you, because of the ability of one particular alkane to produce a protein-reactive 2,5-hexanedione or another alkane that is simply unable, because of chemical structure, to produce that.

We used to think that this problem of neuropathy was restricted to straight-chain compounds. But starting around 2000, in my laboratory we were able to show that, in fact, benzene derivatives, but only certain benzene derivatives -- in particular 1,2-diethylbenzene -- were able to produce a structure with a similar type of spacing as we had in the aliphatic hydrocarbon. This was also able to produce in the experimental rodents a type of neuropathy. It turned out that this was much more potent than the straight-chain compound in the experimental animal. So when we look at the nerves of either humans or animals with N-hexane neuropathy, we see that these long nerve fibers undergo degeneration, with disconnection of muscle. You can understand why that would lead to weakness. When we exposed animals to this compound, the

metabolite of 1,2-diethylbenzene, we found that pathology occurred right up in the spinal cord and even in the nerve cells that control motor function. These are the cells that are lost in poliomyelitis or motor neuron disease. This disorder has not been recognized in humans because, fortunately, nobody is heavily exposed to this particular alkane, which is in very small concentrations in petroleum. But the potential exists.

It turns out that this type of compound is not only neurotoxic, but it has a very interesting reaction with proteins. It causes a blue change with amino acids, whereas this structural isomer is completely without any reactivity. So this one is neurotoxic apparently because of its reactivity with key proteins, but this one is completely inactive because it is not able to react. If you look carefully, you can see that this blue staining can be even seen in the ear region of this animal treated with this compound in comparison with a normal animal. This animal will go on to develop the hind-limb weakness and the forelimb weakness associated with this disease.

Now, the entire animal turns blue, which simply means that while the nervous system is particularly vulnerable to degeneration, the point I wanted to make is that this material goes throughout the body; it reacts with

proteins throughout the body. But it's because of the peculiar architecture of the nervous system, in which you have these very long processes which are extremely vulnerable to intoxication -- as a result of that, there is degeneration of long and large nerve fibers.

Terminating, I just wanted to say that back in 1960, the Exxon toxicologist Gerarde noted a large number of both monocyclic and dicyclic compounds that had potential chromatogenicity, not only in animals, but also in humans. Therefore, there is the potential -- the potential, not the reality -- that these compounds would have neurotoxic properties.

I need to stop there. I did just want to mention that the polycyclic forms, the polyaromatic forms, which I don't have time to discuss, the ones that apparently are not present in this particular oil spill, are, in particular, associated with DNA damage and tumorigenesis and carcinogenicity.

Thank you.

(Applause)

**Agenda Item: Impact on Health and
Vulnerabilities of Children**

DR. REDLENER: Good afternoon.

I am, unfortunately, going to now take you down

from the intellectually interesting and stimulating to the other level that we discussed as well. I'm going to talk briefly -- and I'm going to try to keep within the timeframe -- about the issues with respect to children and this disaster.

Before I do that, I just want to note that I am a member of the National Commission on Children and Disasters, a federally appointed commission that works with a lot of federal agency partners and is making recommendations that will go to Congress and the President.

This particular disaster that we are confronting now in this region has an extreme relationship to general preparedness with respect to children. I can't dwell on this at all, but, basically, children, who are about 25 percent of the United States population, in fact, have really been under-resourced when it comes to research, resources, and support for their needs during, as well as before and after, major disasters.

I'm saying that really by way of background. The other point I want to make by way of background is -- and I'm sure this is obvious to many of you, and maybe it's part of your everyday work if you, in fact, work with children -- understand that the anatomical and physiological and behavioral considerations with respect to

children, which are very applicable to this current disaster, are things that we are getting more and more information about, starting with the fact that children live and breathe close to the ground. They are shorter, so toxic elements in the environment that are sinking to the ground, that are heavier than air, will, in fact, be breathed in at a greater concentration than they would be for adults, and the MIZ (phonetic) volume respiratory-wise for children is much more efficient because children's respiratory rates are much more rapid. So this speaks to inhalation-related problems that we might want to be following in children.

They also have very large permeable skin surface-to-body mass relationships. The amount of skin, and permeable skin, that kids have to compared to adults is much greater than one might anticipate, if you are not used to working with children, which, of course, has implications for absorption through the skin of toxic materials.

Those of you who have or remember or would like to have toddlers know that they put everything in their mouths. This means that they are a danger to themselves in places where there are toxic materials on the ground. The likelihood of their ingesting toxic materials is also

great.

They also take risks. Let's talk about our 7-, 8-, 9-, 10-, 12-, 15-year-olds. To say that they may or may not follow appropriate public health guidelines and do what is necessary safe is probably an understatement that every parent and every grandparent in the room is familiar with.

They are dependent. They can't necessarily move out of the way or understand when they have to move out the way of anything that is threatening the environment. So they are dependent on adults, generally speaking.

This is really a constellation of issues, and if you couple that with the fact that they are highly vulnerable to short- and long-term stressors in the environment, I'm just making the point here that this is a very, very different and special population that we need to consider. I want to summarize all this by saying that children are, in fact, low-living, thin-skinned, risk-taking humans, and they are not just little adults.

No one is going to take this personally, right? I have grandchildren myself.

From a practical environmental point of view, there are a lot of things to consider. First of all, the exacerbation of any kind of respiratory illnesses in an

environment like children are experiencing right now is a particular concern, especially for children already at risk for asthma, for any number of reasons. If they are in a high-risk group -- low-income, disadvantaged, previous episodes of asthma, and so forth -- the potential for exacerbating respiratory symptoms is ever-present in the pediatric population.

Inhalation-related issues, from narcosis and tachypnea, or rapid breathing, to pneumonias, headaches, and other kinds of mild neurological symptoms are, in fact, already being seen.

Dermatological conditions, as I mentioned before, because of the skin characteristics in children, deserve our special attention.

Many of the petroleum products can result in actually fatal aspiration for children. It's something that we have to keep in mind as we are thinking about cleanup and what kinds of environments children are exposed to.

Then there is a whole series of issues, which I'm not going to dwell on -- because others have and will -- the possibility of possible long-term central nervous consequences or even malignancies or other kinds of systemic issues that children may have to face after long

periods of study that many of you are involved in.

But the really big issue, in our view -- and we had an unbelievable day yesterday, 16 hours down in lower Plaquemines Parish and then over in Mississippi on the coast, doing what amounted to three mini-town hall meetings, one of which was just children ages 9 to 18 and then one general community one in Boothville-Venice, Louisiana and then another one that we did in the evening in Mississippi.

The reality is -- I know we are talking about toxins, but the concept of toxic stress that I want to stress. It's a concept developed by a number of researchers, including Jack Shonkoff at Harvard, which has to do with the fact that children exposed to longtime, persistent, difficult stress without a strong mitigating parental figure can suffer all kinds of potentially irreversible effects that even involve medical chronic illness development and so forth in adult life. This toxic stress is a very, very significant issue that we need to worry about. But the kids in this region are now experiencing round two. These are children who are just now recovering or trying to recover from Katrina who are now facing this new reality in the environment.

This is a long quote. I don't usually do this in

talks. This was yesterday. I said to each of the kids in the group individually, "What's worse, this oil spill or Katrina?" Plaquemines was badly hit by Katrina. This is one of the kids: "This is way worse than Katrina. That was just a hurricane. It destroyed a lot, but we could rebuild and eventually come back to our homes. With the oil spill, we live with uncertainty, and most of us are afraid that this place we love will not come back. It will mean the end of our way of life" -- 9-year-olds using this term "our way of life" was pretty striking -- "I don't know what we'll do or how we'll survive." That was Austin, a 15-year-old. It is here because it is absolutely reflective of what everybody was saying, adults and children. It's just something that we have to put into the equation as we are trying to understand what to do.

I'm going to also do a quick "what we know" and "what we do not know."

Here's what we know: There were tremendous issues around anxiety and posttraumatic stress documented after 9/11. But here's what you may not be fully aware of yet. David Abramson is going to publish this in a few months. There have been severe consequences for the children who were vulnerable after Katrina that were related to the persistent uncertainty of when the recovery

was going to be completed and parental dysfunction, severe economic stress, and so forth. Three out of four children in the studies that we are just completing now are reported to have psychological issues at some point post-Katrina.

Secondly, they are four times more likely than the general population to have serious emotional disorders. This is the last round of the face-to-face interviews with the cohort group of 1,000 individuals that happened just a couple of months ago. They are twice as likely -- this is really important now -- twice as likely to be too old for their grade level as the general population. So there are significant academic, as well as psychological, consequences -- things, ladies and gentlemen, which will not be easily reversed. That lost schooling, that lost academic momentum, et cetera, can have lifelong effects for them, for their communities, and for the rest of us, really.

The other point worth stating is that the well-being of children is directly related to resiliency and stability of parents. I can't emphasize that enough. When we are looking to stabilize children across an environment of significant stress, we really want to make sure we are paying attention to how the parents are doing.

The list of "I don't know" is, unfortunately,

large. I know we would like it not to be large, but this is it.

We don't really know about the long-term systemic pathology related to persistent high-level toxin exposures. This is something that hopefully our researchers that deal with this will be able to understand sooner rather than later.

We don't actually know the long-term psychological consequences of persistent toxic stress, environmental psychological stress, from uncertainty, economic loss, and so forth. What will be the consequences of that?

What will happen with exposure to multiple large-scale disaster traumas? It's Katrina, it's the recession, it's the oil spill, and it's the possibility of another big hurricane in the next couple of months. We are just at the beginning of hurricane season. I wouldn't even begin to predict how that would turn out if, in fact, we did face that.

We don't really know the best-practice interventions for prevention and mitigation of trauma across populations. It's something we really do need to figure out. And we don't really know enough about the best practices for assuring stability and bolstering family

resiliency, assuring access to health care, and other essential services, including academic continuity, in the face of these kinds of displacing types of large-scale disasters.

For monitoring children -- and I think we are going to have to look at this very carefully -- at the minimum, I think we should be looking at baseline chemical lab assessments, biospecimen banking, new onset of emotional or behavioral symptoms, well-being indices, and so forth. This is probably obvious to you.

I'm just going to conclude with this slide. Here are seven guidelines that we would think about in terms of protecting children in the face of large-scale disasters:

The first is in red. It's the only one in red. Reliable information from trusted sources is critical. Dr. Abramson is going to speak in a little while and is going to get into that in much more depth. Every single person we spoke to did not trust the federal government, didn't trust outside agencies, didn't like the state government. They wanted to hear from the parish that they lived in, from their officials, to give them information. This is not just general information. It's, should my child be allowed out in the yard if I smell fumes? Should the child be allowed to go swimming? What are they going to do this

summer?

They have no place to go to get answers to these questions, which severely exacerbates their levels of anxiety.

Monitoring, appropriate family support, the rapid availability of assistance when they need it -- hopefully we will not repeat the horror story of the so-called recovery post-Katrina, where families were in limbo for months and years. We need to do all that much, much more effectively.

Let me leave it at that and just say, for the seventh point, the faster children can be in a non-stressed return to a stable, positive community setting, preferably their original neighborhood, but alternatively another neighborhood that offers that same level of stability, the better off they will be.

Thank you.

(Applause)

Agenda Item: Human Reproduction

DR. ESKENAZI: In 10 minutes I'm going to talk about:

- What should we consider in examining exposures to pregnant women and children?
- What do we know about oil spills, and what

don't we know?

- What information can we get quickly and cheaply to understand risks?

- How do we prevent exposure in the face of uncertainty?

We have already talked about the fact that there are critical windows of fetal development, and fetuses are particularly vulnerable, and so are children, because developing organs are more sensitive. Irwin just talked about the fact that children are different, and not little adults. They actively explore their environment. But one thing I would like to go into a little bit more is the fact that they are also less efficient at detoxifying and metabolizing chemicals.

This is a study on pesticides, something unrelated to this, that we completed, where we looked at hundreds of children followed from 6 months to 7 years. We were looking at the enzyme that's needed for detoxification of organophosphate pesticides. What we found was that children do not reach adult level of enzyme to detoxify chemicals until age 7 or later, which means that the period of vulnerability is much longer than we originally had thought, at least for this chemical, and we don't know about some of the others that we are talking about for the

oil spill.

How do children get exposed? We know that they get exposed across the placenta from chemicals that get through the placenta, but also through breast milk. We have already talked about the food that they eat and their hand-to-mouth activity, but also inhalation of contaminated air and dermal absorption.

But we're also concerned about epigenetic transgenerational effects. This is a study done by Mike Skinner and group on, again, a very different chemical. But it is illustrative of the point that exposures that occur in one generation may, through epigenetic mechanisms, affect future generations. In this case, it was a rat dam that was exposed to a fungicide and mated with a normal male, producing an offspring that had low sperm, and then four generations after that also had low sperm. No other generations were exposed, except for that mother.

There's one take-home point here: Paternal exposures can affect offspring. We now have a growing body of evidence that shows that paternal exposures can increase risk of the mother having spontaneous abortions, the child having birth defects, children with aneuploidy syndrome, such as Down syndrome. We have a study that came out this week in *Environmental Health Perspectives* where we looked

at benzene exposure, which is important for what we're talking about today, in Chinese workers. We measured urinary benzene. We showed that in the sperm of the workers there was a dose-related increase in hyperhaploidy, which means that the sperm was not carrying the proper number of chromosomes, but one more than it was supposed to carry. From other research that we have done, we know that if that sperm were to fertilize a normal egg, we will see aneuploidy -- something like Down syndrome or Klinefelter syndrome -- in the offspring. So we are very concerned about fathers' exposures, too. Many of the cleanup workers are fathers or future fathers.

So what do we know about oil spills, and what don't we know?

We have talked about the hundreds of different chemicals. We have talked about the dispersants. We have very little information on these chemicals. I'm going to go over quickly what I was able to glean in the two days that I had to prepare this talk.

In terms of PAHs, there are at least four studies -- these are good studies -- that have shown a relationship with PAHs, measured by some biomarker, on decreased birth length, birth weight, head circumference, decreased body weight of toddlers.

There are also studies that have shown that airborne PAHs are related to DNA adducts and that DNA adducts, especially in maternal blood, are related to spontaneous abortion. So we have some studies that show a relationship, at least, of PAHs -- although we hear that it might not be the most important exposure here -- to be related with outcomes.

There is also a case-control study on brain tumors, which used a job exposure matrix and found that particularly paternal exposure to PAHs was related to brain tumors, a 30 percent increase.

There are at least five good studies that have shown a relationship between childhood leukemia -- most case-control studies -- and, usually, proximity to petrol stations, so gas stations, or repair garages where there was noted benzene.

In terms of benzene itself, there is a study of nonsmokers that has shown a relationship with spontaneous abortion. There is a study that has shown a relationship with neural crest birth defects, such as cleft lip and palate, craniofacial anomalies. There are a couple of studies that have used GIS measures and also personal samples for benzene that have shown effects on birth weight.

Another one of those studies I think is particularly interesting, because when they compared women that were exposed to benzene only compared to non-exposed, they do not see much of a decrease in the offspring's birth weight, nor when they looked at a population that had high stress did they see a difference in the birth weight of their offspring. But in the women that were exposed to both stress and benzene, they saw about a 200-gram difference in birth weight of the offspring, suggesting that there is interaction across these different factors.

What do we know specifically about oil spills? Since I took a crash course in this, I could only find two papers. One paper, which was mentioned earlier, looked at spirometry in the U.K. after an oil spill and found normal spirometry in the children. Another study, which looked at pregnant women, showed that there was eye irritation, headache, abdominal pain, dose-related to distance. Those are the only two studies that I could find that were specifically on children or pregnant women.

What don't we know? All of these things down there we don't know. I would like to put in a particular plug. We are not just looking at hard endpoints in children, like low birth weight. We are also interested in long-term effects in future generations, as you saw in that

rat study that I showed earlier, but also neurobehavioral development of those children.

What information can we get quickly and cheaply to understand risks? After 9/11, we requested the birth certificate data from New York City and New York State. Using forecasting techniques -- the same ones that we use to forecast whether stocks will go up or down -- we were able to predict what birth weights we expected versus what we observed. What we observed was a much higher rate of children of low birth weight. We also showed that there was a sex ratio change, meaning that there were more females born than males, in the city after the 9/11 event.

One thing I would like to advocate for -- at least in California, when we were interested in environmental tobacco smoke exposure or interested in fertility issues, we were able to add some questions to the birth certificate. It was just a very small number of questions, but in a very short period of time we were able to get information on thousands of pregnant women. In a way, pregnant women are our inroad into an entire community, because they are a captive audience. They receive medical care. So we can get an idea of the general population health by looking at pregnant women.

We have also done something similar in terms of

adding questions to the birth certificate, by working with the state health department, on caffeine and smoking, and have used those questions to monitor health in the population.

I would also like to emphasize how critical it is to collect biomonitoring data now. In 1976, right after an exposure to dioxin in Italy, Professor Macarelli collected blood from the population there. He had no idea what the chemical was that the people were exposed to at the time that he did it. He had no idea how to measure that chemical. It wasn't until more than a decade later that they had a way of measuring that chemical. But it's because he collected the blood that we are now able to look at breast cancer in that population and thyroid problems in their children and many other things.

So I really want to emphasize the importance of collecting biomonitoring data. And there are some easy ways to do that.

We know that there are neonatal screens that are routinely occurring -- for example, women that have alpha-fetoprotein screening. The blood is usually taken, the test is usually done, and the blood is tossed. If you could keep that blood, we could use it to look at the health of the population, to monitor exposure. We have

done that in other studies.

There is also a heel stick sample that is done, where they take blood from all neonates, to be able to look at phenylketonuria and also to measure thyroid hormone later on. Sometimes those cards are just tossed. If we could keep those cards and make sure that they are used in a way that we possibly can do research -- we actually were able to measure cotinine in AFP sera that were stored. In one month we got 3,000 AFP sera.

Other easy-to-collect biomonitoring data: urine, breast milk, amniotic fluid, meconium.

So how do we prevent exposure in the face of uncertainty? What do we tell pregnant women and concerned parents?

This came from CDC. It was modified by my looking at the NRDC blog. My real question is, if you were pregnant, would you eat local fish if you had a choice? That's something we need to talk about. I don't really know that.

My take-home messages:

- We know fetuses and children are vulnerable, some more than others.
- Future fathers count.
- What we don't know is much greater than what we

do know.

- We know little about mixtures and those chemicals interact or interact with stress.

- There are cheap and easy ways to begin surveillance.

- We believe in the precautionary principle when we are dealing with pregnant women and children. You act before you know completely information.

- Everything that we do needs to have community participation, using a community-based participatory research framework.

I would like to thank my postdoc, who is pregnant and from here and worked on the oil rigs.

Thank you.

(Applause)

Agenda Item: Stress

DR. COHEN: I was asked to mention that I have no conflicts.

Up to now, both this morning and this afternoon, we have heard quite a bit about the potential role of psychological stress and how the oil spill might influence psychological stress. My assignment was to talk a little about what psychological stress is and about what the implications of stress are for disease, what we know about

other stressors and disease, and what that might say for the oil spill.

I'm going to address a number of issues. One is, how does stress get under the skin? What do we know about stress and health that will inform us about the Gulf oil spill? That includes, what types of stressful events are associated with disease risk? Which diseases are likely affected by psychological stress? Who is most likely to be affected by psychological stress?

Then I'll make a couple of recommendations about which endpoints should be monitored and what kinds of studies are needed.

So how does stress get under the skin? Usually when we talk about stressors, from an epidemiological point of view, we would look at people who are exposed to a particular stressor, similar people who are not exposed, and follow them over time for disease. If we take job loss, for example, you could look at people whose company laid everybody off and compare them to similar people over time.

Psychological stress takes a more individual or personal point of view about this. First of all, we say that we appraise the threat that the event might have for us. You can imagine that job loss for someone who is going

to retire in a month wouldn't be a very serious issue; job loss for someone who is responsible for caring for their family and supporting their family could be a much bigger issue. So the event itself, although it's the exact event, could be very different for these two people.

The other level of appraisal is our ability to cope with the event. If we take the person who has to support a family, do they have a broader family who will help them out? Do they have access to other income or resources that will help them? Versus a comparison person who has no close family, no friends who will help, whatever. Again, you have the same event, in this case threatening for both people, but in one case they are able to cope, in another case they are not.

So psychological stress occurs when both you appraise an event as stressful, as threatening, and you are unable to cope with it.

What are the consequences of psychological stress? There is negative emotional response. People who appraise events as stressful have high levels of anxiety, depression, fear, anger. Those emotional responses can lead to intermittent effects that are going to influence health. Some of those effects have to do with physiological activation that is associated with these

emotions, the activation of the sympathetic nervous system and the hypothalamic-pituitary-adrenocortical axis that has effects on later physiology.

The other issue is that people who have these negative emotional responses tend to have poor health practices and adherence. Under these conditions, stressed people have poorer sleep quality, they have poorer diet, they don't engage in physical activity, they drink alcohol and increase drug use, and also people who are ill don't adhere to their medical regimens as closely. They don't take care of themselves as well. This can influence physiological changes -- immune, cardiovascular system -- and could have potential influence on both psychological disease outcomes and physical disease outcomes.

What do we know about stress and health that can inform us about risks associated with the Gulf spill? I should say that this literature that I'm going to draw from now is literature on natural disasters, manmade disasters, job loss, work stress, and personal stressors, like divorce and caregiving for a chronically ill person.

The kinds of stressful events associated with disease risk turn out to be the same kinds that we associate with the events surrounding the Gulf oil spill,

for example :

- Threats to self-esteem, something you would see in job loss.

- Threats or loss of purpose or meaning in life -- loss of clear career aspirations, losses of family businesses. I have tried to pick examples that touch the Gulf oil spill.

- Loss of feelings of control over important outcomes, things like being able to support your family and protecting the environment.

- Perceptions of unfair treatment. We hear daily on the news about issues of unfair reimbursement for loss.

- Damage to social networks -- the loss of close others, conflict within family and networks.

All of these things are known to be characteristics of stressors that influence health and all seem to be quite close to the kinds of things that are going on in the Gulf oil spill.

Which diseases do we think should be influenced? This literature shows that stress has influence on a number of mental health outcomes. Many of these have been talked about today. For adults, there is increased risk for depression, for posttraumatic stress disorder, for anxiety disorders, and also for seeking care for mental health

problems.

For children, emotional and social conflicts -- and I actually just learned two talks ago some implications for other health outcomes for children -- and also seeking care for mental health problems. We assume that it's children's parents who are driving the care seeking.

What about physical health outcomes?

Psychological stress has been associated with seeking medical care for physical health problems; with total mortality; in terms of disease incidence, the onset of disease in healthy people, with coronary heart disease, including heart attacks, cardiac arrhythmias, sudden death, with increases in hypertension, and also with increased risk for upper respiratory infections. This includes children, as well as adults.

There is also the exacerbation of chronic diseases: HIV/AIDS progression among HIV-positive men, oral and genital herpes exacerbations, rheumatoid arthritis flare-ups, asthma exacerbations, and this includes children as well.

I want to give you a couple examples from heart disease. Risk for coronary heart disease, for myocardial infarctions, for arrhythmias, for sudden death has been found to increase following 9/11. Interestingly, this

study was done in Florida, separating people from any of the direct effects and looking only at psychological effects. Thirty days after, there is an increased rate of cardiac arrhythmias. SCUD missile attacks in Israel -- heart attacks and sudden death within 60 days after the attack all increased.

Risk for CHD and work stressors: Work stressors are associated with risk for coronary heart disease and hypertension six months to several years later, when they involved perceived lack of control over work or perceived lack of institutional fairness, when they feel they are being treated unfairly.

What populations are most vulnerable to stress-associated risk? People with chronic illnesses, people with lower levels of income and education, which means they have fewer resources to address the stressful events, people with lack of close social ties and histories of poor coping, and also children, including stress transmission. What we mean by stress transmission is that an event that happens to a parent -- their stress responses can transmit that event to the children so that they experience the psychological stress as well.

Finally, recommendations.

What endpoints should we monitor in the Gulf oil

spill? In terms of pathways to disease, perceptions of stress and threat; feelings of depression, anxiety, and anger; health practices, including sleep quality, diet, physical activity, smoking, alcohol and drug use, and, of course, adherence to medical regimens.

Disease outcomes: utilization of health care; incident cases of depression, anxiety, and PTSD, as we have heard several people speak to so far; cardiovascular risk and incidence of disease, particularly hypertension and myocardial infarctions; markers of disease progression among the chronically ill -- for example, among HIV-positive and among asthmatics.

How should these data be collected? Longitudinal long-term individual follow-up, at least for people under high risk, with special emphasis on mental health, cardiovascular disease, and progression and exacerbation of existing chronic diseases.

Thanks.

(Applause)

Agenda Item: Lessons Learned from Previous Oil Spills

DR. PALINKAS: I will start off by confessing that I have no conflicts or never have received any money from the oil industry.

What I'm going to talk to you about today is some of the evidence that we do have of the social and psychological consequences you have been hearing about from a number of the presentations, both this morning and early this afternoon.

Twenty years ago, we were treated to scenes of ecological devastation coming from the Gulf of Alaska that in many ways were very similar to the scenes that we have been witnessing coming out of the Gulf of Mexico today. Until the Deepwater Horizon disaster, the *Exxon Valdez* disaster was the largest oil spill in the history of the United States. Unlike the Deepwater Horizon, however, we saw the *Exxon Valdez* oil pretty much reach its maximum distance within a matter of 56 days. However, the *Exxon Valdez* story didn't end after 56 days. In fact, it continued for about 20 years, up until late last year, when the U.S. Supreme Court finally ruled on the issue of compensation for damages and the amount of money that Exxon was required to pay to the aggrieved party. For many of the residents of the affected communities, however, that story continues even now.

In the months and years that followed the *Exxon Valdez* oil spill, there were a number of studies that were conducted to look at the social and psychological

consequences of the spill. I happened to be involved in what was considered at the time to be one of the largest of those studies, known as the Oiled Mayors Study. It got that name because the request for proposal was issued by a subcommittee of the Alaska Conference of Mayors known as the "oiled mayors" because they happened to be from the affected communities. They were funded through a grant from the Alaska Department of Community and Regional Affairs.

The study involved what was called a mixed-method approach, where we combined qualitative ethnographic techniques along with a quantitative household survey, both so that one set of methods could help to address the limitations of the other and also to provide a more comprehensive picture of the magnitude of the oil spill and its consequences than either method alone would be able to provide.

It was a cross-sectional study conducted one year after the spill, and it involved field work in 22 different communities in the Gulf of Alaska region, as well as a quantitative survey of about 600 households in 13 communities, 11 in the area directly affected by the spill and 2 control communities in a region not affected.

What was unique about this, even though it was a

cross-sectional design, was that we had a measure of exposure that was based on responses to a series of questions about whether individuals had been affected by an area where the oil had occurred that the households had used or whether they had participated in cleanup activities, whether they had had any other form of contact with the oil, whether they had any property damaged or lost, whether there had been any damage to areas that they had fished in commercially, and, finally, whether it had had any effects on their regular pattern of hunting, fishing, and gathering activities.

Using that measure of exposure, we created three categories: those who were not exposed, those who fell into a low-exposure category, and those who fell into a high-exposure category. We found a number of psychological outcomes that were significantly associated with the degree of exposure to the oil spill and to its aftermath, primarily the cleanup activities.

As you can see from this chart, there was a significant dose-response association between exposure to the spill and psychiatric disorders, like generalized anxiety disorder, posttraumatic stress disorder, and depressive disorders. What was particularly noteworthy about the PTSD prevalence at the time, which, as you can

see, was almost three times greater in the high-exposed group compared to the non-exposed group, it was one of the first studies to document PTSD in an event where there was no loss of human life. Back then, according to DSM-III, you had to have either had loss of life or the immediate threat to loss of life. Rather, what happened in this event, as Dr. Redlener commented about the Gulf of Mexico, was that there was a loss of a way of life or death of a way of life that profoundly affected these individuals.

In addition, what we found was that not everyone was equally affected. One of the groups that was most highly vulnerable to these traumatic consequences was Alaskan Native populations that rely heavily on these areas, particularly for subsistence activities, but who also tended to participate heavily in the cleanup activities as well. As you can see, whereas in the non-exposed group the prevalence of PTSD was about 5, 6 percent, in the high-exposed group, in this segment of the population, it was 25 percent.

Similar impacts were documented among other groups, but not nearly to the same degree.

Other vulnerable populations that were specifically impacted by the spill were cleanup workers who spent long hours involved in cleanup activities, long

periods of time away from family and friends. Women were uniquely impacted by this. Families and children were impacted by this as well.

In addition to increased rates of psychiatric disorder, we also found increased rates or reports of drinking, drug use, fighting in communities and among family and friends in the high-exposed groups compared to the not-exposed groups.

We also found significant declines in traditional social relations. People were reporting not getting along as well with spouses or partners or children living at home, other relatives, family and friends in the community, and increased conflicts, with friends as well as outsiders.

When we created an index of social disruption to look at this association, we found significantly higher levels of social disruption in the high-exposed community compared to the not-exposed community, again in a dose-response relationship.

We also looked specifically at the impacts of the oil spill on family and children. We found that parents who were in the high-exposed group tended to report significantly more often a decline in their children having relationships with other children in the community or their children having more difficulty sleeping or poor

performance in school or getting upset when someone talked about the spill, being left alone, fighting more with other children or having more difficulty getting along with parents or siblings.

Interestingly enough, these same outcomes were associated with level of psychiatric symptomatology of their parents, which has been found in other studies of other natural disasters and manmade disasters. But one of the things that we found particularly interesting was that difficulty finding childcare was significantly associated with increased rates of PTSD, anxiety, and depression in their parents.

Dr. Cohen mentioned the impact of chronic stress on physical health. We also asked study participants about reported chronic conditions, both before and after the spill. Here, too, we found a dose-response relationship. With increasing exposure to the spill, people reported more chronic conditions, like heart disease, high blood pressure, diabetes, thyroid problems, cancer, bronchitis, chronic cough, and skin rashes. When we asked if these conditions had been verified by a physician, we also found a significant dose-response relationship as well.

Finally, we noticed that there had been a significant increase of the oil spill on mental health

utilization. In the community of Seward, for example, you see significantly increased numbers of client contacts by month in July through December 1989, after the oil spill had occurred, compared to the same period beforehand.

What did we learn from all of this that might have relevance to what's going on today?

First of all, we have heard numerous times about the importance of monitoring previously traumatized populations, such as Hurricane Katrina victims. I also might point out that many of the Vietnamese shrimp fishermen are themselves previously traumatized by virtue of their experience of having come to the United States in the aftermath of the Vietnam War. Children and families we have heard a lot about. Ethnic minorities, like the Alaska Native populations and the many underserved populations here in the Gulf of Mexico, are also particularly vulnerable.

But in addition, participants in spill cleanup activities are vulnerable, because of the separation from families for prolonged periods of time and the conflicts between those who get cleanup jobs versus those who do not, and those who witness the physical evidence of the destruction of the ecosystem, who are involved in handling the remains of dead mammals, for example.

Mental health indicators are things that we need to pay attention to -- measures of social disruption, drug and alcohol abuse, measures of child behavior. But speaking as an anthropologist, I might also put in a plug for the importance of qualitative or ethnographic data collection in conjunction with the long-term surveillance and monitoring. Many times a lot of the information that comes out of those efforts is hard to translate unless you have individuals with intimate knowledge of the communities being affected who can provide some context and give voice to the people who are being affected to help in that process.

The last thing I want to mention is the influence of litigation on all of this. We found in Alaska that it constituted a form of lifelong exposure to the oil spill. Differences between who went with the plaintiffs and who didn't created conflicts within communities that persist even until this day, and it also created uncertainty over the outcomes. Whether they were going to be fairly compensated really wasn't resolved, as I said, for over 20 years.

But it also had an impact on data collection. Soon after these studies were conducted, all of the data, including the raw data, with names and addresses of study

participants became subject to disclosure and subpoenaed by the court, which meant that attorneys for plaintiffs, attorneys for Exxon could directly contact each individual study participant, trying to encourage them to engage in a lawsuit or refrain from such a lawsuit.

These are things to keep in mind when conducting a long-term monitoring effort and acknowledging or at least taking into account the potential legal ramifications.

Thank you very much.

(Applause)

Agenda Item: Questions

DR. OLDEN: I want to thank the speakers for their excellent and informative presentations. They had, as I indicated, a very short time to prepare for these talks, but they used the last 72 hours well. These were very good presentations.

We welcome questions from the audience. While those are being collected, let me just get started and ask the panelists, what can we do today with the information we already have to mitigate the possible adverse health outcomes that you think are likely to be important?

While you think about that, Brenda, I think you were the only speaker that did not declare your possible support by the oil industry.

DR. ESKENAZI: I have no support by the oil industry. My university does, though.

DR. OLDEN: Thank you very much.

Go ahead.

DR. PALINKAS: I will start off, based on the Alaska experience. As I mentioned, one of the biggest sources of both conflicts within community and the stress that manifested itself in many of these behavioral outcomes was the way that the cleanup activities were conducted. Many people and many communities, in fact, felt a loss of control, in much the same way that Dr. Cohen referred to earlier, by the fact that in Alaska Exxon's contractor, known as VECO, basically came into the community, started hiring people, started bringing people in from the outside, and offering wages that far exceeded what was available to workers in these communities at the time. So one of the greatest sources of stress, for example, was the lack of available daycare. The daycare worker who could make \$5 an hour watching kids in the community could make \$16 an hour cleaning oil off the rocks.

One of the ways to mitigate the adverse effects really does involve a degree of local control, not only in the way that compensation is provided to local residents, but also the extent to which local communities can and

should participate in cleanup efforts, in a way that doesn't overwhelm both local resources and the physical and mental capabilities of the residents of the community.

DR. OLDEN: Thank you. Anyone else?

DR. REDLENER: I think it is essential that the services available and the information available to people who are now victims of this oil -- people are calling it a spill. Is it a spill if it's gushing from the -- whatever it is, the oil gusher. They need to have immediately -- and it's already too late for a lot of families -- a sense of who is in control of information, news they can use on an everyday basis to make decisions about whether it's safe for their kids to go outside or not and so forth and so on.

A lot of the most affected families have been medically underserved and are disadvantaged to begin with, pre-disaster, and their access to the usual forms of medical and health care information is extremely limited. I think what we need to do for them is to make sure we have a coordinated, intense effort to provide a sense of structure, cohesion, and the availability of trusted messengers to help people get through what is a very, very stressful time. If we don't do that, as we saw and are seeing post-Katrina in many places, in many situations, we will undoubtedly exacerbate the problems that are going to

be there anyway.

So we have to get our act together. I'm talking about government at all levels, private organizations, and so forth. There has to be some sense of cohesiveness, honesty, and direct addressing of the concerns that families have.

DR. ESKENAZI: I would also like to say that whatever we do, we need to really also focus on pregnant women. There are studies that are now showing that some of the mental health consequences, first of all, seem to be greater in women than in men, and I think pregnant women are particularly vulnerable. They are not just protecting themselves; they are protecting their unborn child and maybe other small children at home. They don't know what to do. When I asked my postdoc, "Your family lives in New Orleans and you are seven months pregnant. Would you eat the fish? And you're a chemical engineer," her response was no.

How do we get pregnant women to get the information that allows them to trust the authorities that their fish really isn't contaminated? Or can we?

DR. SPENCER: I would like to second Brenda's concern with regard to the unborn child. In terms of chemical exposure, there is the potential of producing a

permanent change in the development, for example, of the brain as a consequence of exposure.

Having said that, I would also like to point out that at the other end of the life spectrum, aged people also have peculiar susceptibilities to chemical exposure. One, because of weight loss, their liver metabolism and their renal excretion function is down relative to a younger person.

In addition, I would also like to remind people that with regard to the adult, the threshold limit values that are set up by federal agencies to protect people against the adverse effects of chemicals that have a threshold effect -- that is, below which there are no known adverse effects and above which there is expected to be an adverse effect -- I would like to remind us all that those threshold limit values are based on protection of the majority, but not the totality of the population. We increasingly recognize that there are individuals with peculiar or specific genetic susceptibilities to X, Y, or Z.

One example in regard to heat stress and heat stroke, which is an exceptionally important problem, I believe, in terms of immediacy, is that we recognize that a phenomenon called malignant hyperthermia, which we

recognize in the operating room -- the usual reaction of individuals to certain anesthetics -- results from an inherited deficit of muscle function. It also appears that individuals with this particular genetically regulated muscle function -- it's called a ryanodine receptor abnormality -- also seem to be especially vulnerable to heat stress and heat stroke. So it may be possible, in terms of screening individuals, to make absolutely certain, to the extent possible, that we are not sending in individuals to clean up who have established vulnerabilities, whether it be genetic, whether it be nutritional, or whether it be some other factor.

DR. OLDEN: There is also another question about the application of biomarkers. The question is, wouldn't they be limited to heavily exposed populations and not have much relevance of other populations?

DR. SPENCER: Very probably. In the experimental setting, of course, we are limited by grant funding and we are limited by the duration of exposure of the species that we are interested in trying to develop a model of the human condition that we are concerned about. So we very frequently tend to raise the dose and condense the duration of exposure in order to find an adverse effect. Those biomarkers of exposure may often be developed as a

consequence of those experimental studies. In the situation where there are much lower levels of exposure, perhaps in a human population, the biomarkers that we come up with may have limited usefulness in that setting.

DR. ESKENAZI: I think some of the exposures that we are talking about are transient, but there are certainly sensitive biomarkers, for example, of benzene that have been used, where you can get fairly low exposure levels detected.

The one thing I did want to raise is that in the study that I showed where we are seeing aneuploidy in the sperm, what we observed was aneuploidy in the sperm even at the levels within the U.S. permissible exposure limit. So we are seeing changes. Where we didn't see it in lymphocytes, we are seeing it in sperm.

Again, it depends on what we have looked at in terms of what the most sensitive biomarker is.

DR. OLDEN: There is another question about your concern about exposure to heavy metal. This is with respect to neurotoxicity -- lead, mercury, cadmium.

DR. SPENCER: Well, of course, there is a whole slew of metals that we refer to as heavy metals that have potential adverse effects on neurologic function. I think I would need to be advised as to the likely levels of

exposure that might occur in the setting that we have locally. If we think of situations like Minamata Bay in Japan, where industrial effluent containing mercury was poured into a bay and there was a conversion of that mercury species to an organic mercury, which was then taken up by fish and cats, and humans both consumed this material and developed profound neurologic damage. But more importantly, speaking to Brenda's point, unborn children developed abnormal brain structures and permanent dysfunction as a consequence.

But again, there is a threshold for these effects. I don't know whether those thresholds are likely to be reached in this particular setting.

I would also just like to mention that we need not to forget one of the first slides that was shown this morning. It mentioned the word "brevetoxin." These are naturally occurring toxins that are present in bivalve and molluscan shellfish, which are responsible for red tides and other situations around our coasts, including in this region. These organisms containing brevetoxins can be carried in the wind and they can be inhaled. In particular, they can, of course, enter the food supply in significant consequences, and acute neurologic dysfunction may result. Because some of these are lipid-soluble, they

are also able to cause some persistent dysfunction.

My point is that I don't think we know what the consequences are in terms of the natural generation of brevetoxins by algae when they are confronted with large-scale contamination of water from hydrocarbon breakdown products.

DR. ESKENAZI: I am particularly concerned about lead and other of the heavy metals. We are now learning that even low levels of manganese may have effects on neurobehavioral development in children.

I guess I would ask the authorities in the state, in California, we have routine screening of children that are on Medi-Cal, where at 12 months and 24 months, they get a lead screen, so that you can see in general populations whether there is an elevated lead level. Again, it gives you a window into whether there is a problem in the Gulf States. So I would suggest that anyone here who is from a state authority begin to look at the lead levels and see if there are pockets of elevation.

DR. OLDEN: A member of the audience has pointed out that we haven't said much about cancer, and they are right. Let me just start by saying that it is clear that many of the chemicals in oil are known human carcinogens, so it is a disease endpoint where there is a potential for

some concern.

Would anyone else like to say anything about cancers?

(No response)

If not, there is another question that I would like all of you to respond to. If you or your family were living in the Gulf Coast area, what concerns would you have and what precautions would you take?

DR. SPENCER: I think I would be primarily concerned about the quality of food.

DR. REDLENER: Living on the Gulf Coast has become a trial that many of us could not have imagined some number of years ago. The threat of storms and this contamination and so forth, and the possibility of other industrial accidents and other natural events make living in these communities very difficult, although it is most definitely counteracted by very, very strong identification with place -- maybe unusually strong.

If I was here as fourth generation in the region, I would have a different answer than if I had moved here 12 years ago to take a job at a local institution. In the latter case, I wouldn't be here. In the former case, I would try very hard to figure out how I was going to get information that would help me understand what the

consequences would be for my family. This would be my principal concern.

I have heard this over and over again from residents here. Is this dangerous or is it not dangerous? The food supply, the water supply -- one of the women at the event we had yesterday brought in, in a plastic baggie, the filter from her swimming pool, which was completely chockfull of oil. She said to me, "Can my children swim in the swimming pool?" I said no.

She was very concerned. There are many, many details of normal day-to-day living for which people want answers. How we deal with that when we don't have them -- that was a fairly obvious one to me. But there are many, many others.

So my concerns would be, how do I deal with my children and what do I need to know?

DR. ESKENAZI: I think if I were a parent of a young child, I would very carefully watch the EPA air-monitoring website, looking at levels in the air. I would have to say that I would be concerned about feeding my children local fish, but that would be mostly a gut response rather than a response based on knowledge. I would really want to be sure that I could trust the authorities and the information that they gave me.

I'm not an expert in this. I turn to my expert friends over here. There are a lot of studies looking at populations after different disasters -- for example, at Three-Mile Island -- where one of the biggest outcomes was distrust of authority. I think we really need to be careful that the messages that we give are earnest and what we would advise our own daughters if they were pregnant or our own grandchildren.

DR. PALINKAS: One of my concerns if I were living in the area probably would be the adequacy of services that would be available to me and to my family. Many of you know, after Katrina, perhaps one of the sectors of the economy that was most heavily damaged was the medical sector, the health-care sector, social services and so forth. Even now that sector is just slowly recovering. To have increased demands for social workers, psychologists, psychiatrists, and having access to them, is going to be a concern for the affected communities that, were I a parent with a child who is suffering behavioral difficulties, I would definitely be concerned about.

The trust in authority that comes with government not only pertains to whether they are holding whoever is responsible accountable for restitution, but it also relates to maintaining a sense of stability within

communities. In the likelihood, for example, that cleanup positions are offered to local residents who run for them because it offers an opportunity to make more money or it offers an opportunity to make any money if they were made unemployed by the oil spill, it's something that should and can be managed at the local level. Having faith in one's local government, I think, would be key, as Brenda was suggesting, to alleviating those concerns.

DR. COHEN: First of all, I agree with everything everybody has said so far, and certainly the physical exposures are a major issue. Something unique about this particular spill and this particular community is the really strong culture and community that there is. I would be concerned with the loss of community, the breakup of churches, of families, separation from culture, as well as loss of jobs and purpose in life. There are a lot of cultural and community issues that have major implications for the psychological distress and being able to cope with these kinds of events.

DR. OLDEN: Probably the final question: Could either of you who spoke about the stress factors talk about your recommendation for long-term monitoring for mental health stress? I think they are looking for biomarkers.

DR. COHEN: I made some recommendations in the

talk about long-term monitoring for symptoms of anxiety and depression, before we get to the kind of clinical areas. Biomarkers are stress are a harder issue. There are biomarkers of stress that are used quite readily in research. They tend to be extremely variable. They don't tend to have standard cutoff levels, and sometimes are not comparable across labs. Although it would be nice to say let's look at levels of epinephrine and norepinephrine or cortisol, the current quality of those measures really doesn't make them amenable for this kind of thing.

DR. PALINKAS: One study I am intimately familiar with that also emerged out of an IOM workshop pretty much like this one had to do with -- it's known as the Millennium Cohort study. It's funded by the Department of Defense. It's perhaps the largest population-based study in the history of the United States. It really emerged out of concerns about the so-called Gulf War syndrome that occurred after the First Gulf War.

That study was basically to answer the question, what are the long-term health effects of deployment of military personnel, in which people, either through questionnaires that they get mailed or, more frequently, through computer-based websites respond annually to a questionnaire that uses standardized instruments for

assessing stress, mental health, many of these adverse physical, as well as mental health outcomes. That cohort study is beginning to generate some substantive knowledge about the health effects related to deployment in, particularly, vulnerable populations within the military. This year they are adding a cohort of 10,000 families of active-duty service members to look at the effects of deployment on families and children.

These kinds of ongoing strategies for data collection under the guidance of the Institute of Medicine I think provide a fairly standardized way, as well as a way to capitalize on advancements in biomarkers or the use of questionnaires and standardized item assessment protocols - - to incorporate that in the surveillance process, not only to generate new knowledge, but to transfer or translate that knowledge in relatively short order so that it can have policy implications, it can be used to allocate resources to identify promising techniques for both prevention and mitigation of stress and the stress related with events like oil spills.

DR. REDLENER: Just a quick comment. I think we should not forget the clinical realities of following stress, and particularly toxic stress, in children. There are, not biomarkers, but psycho-markers that have to do

with certain kinds of symptom presentations in children that are important for parents, as well as providers to be aware of. Sleep difficulty, changes in behavior patterns, difficulties interaction with siblings or social peers, and so forth should be monitored very closely. Parents know when they need to call the primary care provider, and primary care providers need to know when they need even more advanced troops to come in and assist with this.

Some of the connections between the actual biomarkers, which are not practical in terms of following children -- for instance, linkages are already being made between toxic stress in children and brain architectural changes and cortisol levels and so forth. I think what's important to know for an actual provision of care is that the clinical indicators of stress in children need to be clarified and identified as the things that we want to really be looking out for.

DR. OLDEN: I want to thank the speakers. We are right on time, I think. That's the end of the discussion.

(Applause)

DR. OLDEN: Let me introduce the third session, which is "Strategies for Communicating Risk." We have David Abramson. He is director of research at Columbia University's National Center for Disaster Preparedness.

Dr. Abramson

SESSION III: STRATEGIES FOR COMMUNICATING RISK

Agenda Item: Engaging the Public, Protecting Health

DR. ABRAMSON: Thank you very much for the invitation and for the challenge of getting 72 hours to think about a fairly complex subject and try to decipher what would be most useful to think about.

I should probably add that I have no conflicts to report.

What I would like to talk about today, at least initially -- and then move our way through some of these issues -- is:

- To consider some of the factors that influence how health and risk communication are perceived, disseminated, understood by a variety of populations.

- To think about what vulnerability means and what the salience of the threat is and how that salience is really perceived right now and how it may evolve in terms of its saliency.

- Then to consider some of the communication strategies that could account for variations in culture, literacy, and how to address high-risk populations.

Actually, before I get into this, I would like to

muse a little bit on some of what we have already heard, with two particular things.

The first is, when we think about risk communication, I think we should think about decision making and think about decision making in one of two ways. When we think about risk or health communication, we are talking about how we get people to make a decision. A lot of this is sort of the push on the decision making, where programmatic or policymakers are thinking, how can we push a decision, whether it's to avoid an exposure, whether it's to engage in a specific behavior? We are trying to take a piece of information or a body of information -- and it could be very complex information, as we have just heard -- and essentially serve it up to a population that has to make a decision.

But there is another type of decision making that is occurring at the same time and that I think we should be thinking about. This is more of a pull instead of the push. This is the decision making that the population is making all the time: What should I do? This is short-term decision making and long-term decision making. It's short-term decision making, like should I let my child get into that pool? It's long-term decision making, like should I leave the area? You heard before from Dr. Redlener that we

have been conducting focus groups and town hall meetings in the last couple of days. Just this morning we conducted one in Mississippi, and somebody raised an issue that was completely new to me. It was the question, should I get my soil tested now, before there may be the full effect? They are already beginning to think, maybe I should be developing a baseline soil assessment on my property so that I have a legitimate claim to make when I have to deal with the insurance industry.

So now we have a whole host of pull decision making that is happening at the same time. I would like us to think about the pull and the push of decision making when we think about these communication issues.

The second one is a bit of a counterfactual question or a little thought experiment. What would this all be like if Katrina had not occurred? How would we be thinking about communication in the absence of Hurricane Katrina and its aftermath? In fact, we have heard a lot about this when we have been engaging with the communities here. I think there is a lot of bridging that is occurring between the disaster of Hurricane Katrina, and all of its long-tailed consequences, and the evolving disaster that is happening with the oil spill. It's almost as if we have a curve that has sort of peaked and is now all the way on its

tail end out, and now there is a new tail that is a very long tail up, of this evolving oil spill.

Some of the issues of the bridging: There is a re-traumatization. You have a population that is already susceptible and may have less resilience because of what they have just experienced.

There is definitely a lack of trust in authority that we have heard about as a result of what people saw having occurred post-Katrina.

There were things where people mentioned the relationship and analogies between the insurance industry and how they dealt with one large industry, and now they have to deal with another large industry, the oil industry. Some people may feel as though, we have dealt with one large industry; we can deal with another one. But again, it's a bridging issue that is going on, I think, in people's minds, and I think it's something we should think about when we think about health communication and risk communication.

The last one is that as much as we talk about all this bridging, people are really tired in the Gulf of talking about Katrina. Here we are talking about it all over again. We are bringing it right back into their faces. We are saying things to them -- and you can hear it

on the media every day -- is this worse or better than happened in Katrina? Are you feeling this way or that way compared to Katrina? So we are forcing the population that was hoping to put it behind them to face it all again on the table.

Those are just precursors to what I was going to talk about, but after hearing the previous panels, I think those things preface a lot of what we should be thinking about.

In terms of risk and health communication, there is a very long line of science and scholarship. I'm not going to go into the theories. I think there are far too many. I'm happy to talk about them, but I would rather actually focus on some of the work that we have done in the last couple of years that I think is fairly relevant.

One is, we have done something called the American Preparedness Project, where we have done a random-digit dial sample of the U.S. population looking at attitudes, behaviors, and practices around preparedness. One thing we found out when we asked this between 2003 and 2008 is that there is one trusted health authority. At least this is according to the U.S. population, generally speaking. It doesn't vary in terms of the population's trust, whereas when we ask about many different players,

trust goes up and down and varies. But there was one consistent authority, and that was the CDC. Again and again, the CDC was ranked -- between 80 and 85 percent of the population felt that it was a highly trusted source of information.

You heard a little bit from Dr. Redlener about our Gulf Coast child and family health study, a longitudinal cohort study of 1,000-plus families in Louisiana and Mississippi. We will draw a little bit on that.

We did a project on elusive communities post-pandemic flu, post-H1N1, where we went in and we looked at how undocumented Mexican immigrants responded to health communication strategies and what kind of health-seeking behavior they engaged in. One thing we learned about there that I think is probably relevant here is the role of community-based organizations and the filtering effect that they play. They played it both in terms of how they restricted information going to these highly vulnerable communities and also -- I say "filtering" -- they actually censored it in some ways. If they felt that the information would not be particularly useful, they were acting as gatekeepers of information for those communities that were most marginalized. They were very protective of

them. At the same time, they were highly relied upon by those communities for accurate and reliable information.

Again, I think that's going to be an important consideration when we think about this. Obviously -- I hate to use the bridging post-Katrina -- post-Katrina, there are a lot of workers that have entered the Gulf region to help with reconstruction and renovation. Not all of them are documented. Many of the same issues that we saw in this elusive-communities project across the country we will be seeing again here. The notion of those community-based organizations operating as filters is something we are thinking about.

We have been engaged in community studies in New York, looking at how different communities vary in terms of their attentiveness to risk and health communication. We have seen an incredible amount of variation amongst homogeneous populations. We could see Pakistani groups operating differently than Chinese, different than Orthodox Jewish populations, different than Jamaican, Caribbean, et cetera, each one acting, responding, and dealing with these information messages very differently and each requiring, in some way, some tailoring of the message, which I'll come back to in terms of strategies.

We are presently funded by CDC to look at what

kinds of information mechanisms can be developed that would allow a rapid two-way communication with high-risk or at-risk populations. We are working with HIV/AIDS populations, teenagers in Harlem, homebound populations, and undocumented immigrants, to understand what the best ways are of reaching out to them. This may also prove to have some value. We have learned about some of the novel technologies and emerging technologies that can be very effective, and we have also learned about some of the things which are really tried-and-true and worth thinking about in terms of how people hear messages and whether they are scared by the messages that we think would be relatively innocuous.

The last one is the American Hotspots Project in which we are using geospatial intelligence and social data to measure and look at public health preparedness.

There are five points that I really want to hit upon here today.

Number one, health communication is not risk communication, and economic information is health information. I think if there is anything that we have heard in the last couple of days, it is that economics, and understanding economic decision making, is really critical to how people perceive their long-term health effects. So

how they regard economic information that they are going to be making about, "Should I move or should I stay," I think -- and we heard from many of the panelists in this prior panel -- will clearly be related and associated with the long-term stressors, depression, anxiety, and health effects.

Number two, one-way communication has limitations. It's very important for us to think about how we develop mechanisms for two-way communication so it's not just the push from us to them.

Three, vulnerability comes in many forms. It's not just the static vulnerability. When we say a vulnerable population, we may be referring to mobility impairments or disabilities or handicaps or chronic disease. That's one type of vulnerability that we are very comfortable thinking about, but, as you will see, vulnerability comes in many forms, and I think we have to think about economic vulnerability for this type of an event.

Number four, action is not reaction, and citizen action often requires both interpretation and deliberation. That really means that we have to think about how we allow those things to occur.

The last point I want to make is that

policymakers and providers are consumers of complex data as well.

I'm going to go over each one of these in a little bit more detail.

In terms of the health communication/risk communication, we already know the differences. They are often very clear. In terms of the differences between the two, health communication is really more of a social marketing event, and the risk communication really draws from the alerting and warning literature and the emergency broadcast, where you want to get an immediate response. You need to get an immediate reaction. You want to elicit an immediate decision on behalf of a population. The longer-range social marketing obviously means you want to get into something like the stages of change. Then you want to begin seeding behavior change by providing sufficient information, making sure that people have sufficient self-efficacy and ability and capacity to make those kinds of changes. They are clearly different. In some ways, this kind of oil spill will necessitate doing both at the same time or in stages.

Number two, the goals are radically different between the health communication and risk communication -- that is, between the long-term behavior and the alerts and

warning.

Also the response differs. With the health communication, there is often an inattention to the message itself, whereas with the risk communication, in fact, there could be just an unawareness of what the critical messages are. That's why social marketing spends so much effort trying to disseminate its message and really get it in front of the consumers that it wants to reach. With risk messaging, in the absence of clear threat or salience, you can have risk fatigue. People are looking at it and saying, "It doesn't apply to me. I don't see the threat."

I think this is something that is coming up and will be really critical right now in these early days, while people are looking out there and you have two governors across two states offering two very different messages. In one state you have a governor that's trying to raise the alert to a very high level and to really engage and arouse the population. They are aware and aroused, but also a little wary. Then you have another state where the governor is taking a different approach and saying, "There is not a problem there. In fact, we don't have that kind of an issue. In fact, look at our pristine beaches."

So the population is both wary of that and

saying, "Is that really true?" but also they are on different footing, and the situational awareness across those two states will differ because of the context and environment of how those messages are being transmitted.

In terms of the one-way communication, we certainly have heard that the community wants its voice heard. They are far more receptive and engaged if they feel as though somebody is listening to them. It's really critical for them to know that health officials are paying attention to what their issues and vulnerabilities are. When we think about vulnerability, as I said before, it's not a fixed characteristic, but it's a predisposition to a higher risk. I'm offering to you think about economic vulnerability because I think what we are about to see is a crisis that has short- and long-term health effects, which is what we are here to talk about, and I think those are critical to us, but keeping in mind that critical to the population are what the economic risks are that they are going to face, which will, in turn, lead to those health effects.

In terms of communication vulnerabilities, there is the issue that people don't hear the message. When we do our work with teens, this is a very big issue. It's hard to get teenagers to hear messages, period. It

certainly is hard to get messages across to them when it's a public health message. If you want to say to teens, "This summer when school is out, don't do the things you ordinarily do. Don't go into the water and do the things in the water that you ordinarily do. Don't go boating. Don't go fishing," that's going to be an important message, perhaps, and a very hard one for us to transmit.

Often there is the question of not understanding the message, whether it's language or literacy. I have a colleague in New York, at Mount Sinai School of Medicine, who looked at mapping literacy and found out that it's associated with reading literacy. In other words, people who are not reading literate are also map-illiterate, oftentimes. You could show somebody a map and say, "If you look at your map, you could see where your risk is." People may not be able to read or interpret the maps.

There is always the question of not trusting the message or the messenger and the inability to act upon the message. One of the things that we did with our Gulf Coast study was, we looked post-Gustav at evacuation patterns and we asked people how much it cost for them to evacuate from Louisiana and Mississippi. On average, it cost people between \$450 and \$600, for the four- to six-day period, to evacuate their families. For me to say to you, "Do you

have \$450 to \$600 of disposable cash right now to put on the table," most of us would probably say, yes, we could probably do that. For a population that is living on the margin, that is an incredibly high level for them to hit. So it's a huge barrier for them to do something like evacuate, even in the face of the fact that they knew what happened to them the last time they did not evacuate.

In terms of vulnerability, there is always this question of whether to scare or inform populations. In fact, when we do our analyses and our focus groups, et cetera, we find them fairly evenly split between people who want to be informed but not scared and the other half who say, "You had better scare us in order to arouse us." But in terms of the scaring issue, we also have seen that people who are particularly vulnerable may find things scary to them. If they are unable to compete for resources and there is some sense that there is an allocation of scarce resources or a prioritization, then they are going to feel like they are in an unfair advantage.

Disclosure issues clearly are a big problem for people who are HIV-positive or undocumented, if they feel like they have to provide documentation to receive something -- to receive whatever, a vaccination, an immunization, a treatment -- or maybe, in this case, to

make a legitimate for something. If we were to say, "Make a claim, but show your documentation," that may be a difficult issue.

The other thing to keep in mind is that families often made decisions based on the least advantaged person in that household, or most vulnerable. So even though many people in the household would be quite competent and capable of doing things, the least advantaged -- the most mobility-impaired perhaps or whatever the case may be -- will constrain the actions of that household.

The action is not reaction. I think the oil spill is being regarded by some as an accelerated version of climate change, which is, "First, show me the risk. Show me the salience, and then I'll believe it."

We talked about the short- and long-term decisions before.

Then there is the question of handling complex data. Most graphics and data that are used by either the media or by policymakers refer to one or two variables, at most. So they may show just geography or maybe, when they get a little bit more complex, they will show something by geography -- let's say race/ethnicity by geography. What we probably need to see and display are things like geography by race, by occupation, by exposure, by

socioeconomic status, and by language. That gets very complex.

One of the things that we did recently was take New York data and tried to show you could display complex data. This is two pieces of data, geography and pediatric non-vaccination in the lower New York area. Then you could take six different variables representing those six different maps and begin to layer them one on top of the other and compress them all and put them into a single map -- I'm going to go through this quickly, obviously -- and weight the different variables, so that you can begin playing with many different variables at once and say, okay, I'm going to weight one thing over another, and I'm going to set a certain threshold so that I can see what the problem is and how it differs, and be able to get something really targeted. Now you are using geospatial data, social data to come up with these kinds of complex data solutions, when you have to help figure out what's vulnerable, how you target a public health intervention.

Another mechanism that we have been playing with is something called radar charts. These are six variables. They were able to show, by taking a mouse and moving it over the map, that you would be able to see how each one of those variables will differ.

Again, I'm only offering this as a very quick illustration that there are ways of taking complex data and being able to train practitioners and policymakers in being able to use complex data to target interventions. I think that, likewise, it could probably be used for the public as well, equally.

In terms of immediate actions needed, I'm going to finish with just a few of them:

- Number one, we clearly have to identify the populations at risk and determine what makes them vulnerable. I don't think we could use pre-established definitions of vulnerability.
- Number two, we have to understand their concerns and issues in order to address them.
- Number three, we have to know who the trusted messengers and media are for those different communities. We are talking across four states and multiple communities.
- Number four, we need to create platforms for both disseminating and interpreting these complex data points. I'll briefly mention that there are a lot of mechanisms for this that are community-based. In the CBPR world of community-based participatory research, there are things in Europe that are known as science shops, which have been used here as well, where you get community groups

together and then you can essentially attach a scientist to those groups -- bring in a marine biologist, bring in an economist, bring in a social scientist -- to help those groups be able to interpret and understand the data and feel like they have control over it.

· Then the last thing that was really important that we have heard again and again from a lot of the groups that we have been talking to is to develop responsibility and capability and capacity amongst local leaders. The people here really do want to hear from the parish presidents, the mayors, the local health officials. They recognize that they don't have sufficient expertise, although they think they have access to information resources that they themselves do not. They trust them to represent their interests better than other people representing their interests. Needless to say, they are a little wary and skeptical about BP representing their interests. But on the other hand, they do feel as though those local leaders would be the ones best able to represent their interests.

That's what I have. Thank you very much.

(Applause)

DR. ADLER: At this point I would like to invite the planning committee up. Our final session will be led

by Dr. Mike Magee. Dr. Magee is a physician and president of Positive Medicine, Incorporated, which is a strategic health communications firm. He launched the Healthy-Waters movement to educate the public regarding the topic of water and to mobilize health professionals on behalf of our environment. He is the perfect person to lead this last session, where, having heard about what the potential risks are and about some of the issues in communicating them, we really want to hear from all of you about your views and concerns.

Agenda Item: Dialogue with Workshop Participants

DR. MAGEE: Thank you very much. I am Mike Magee. I don't have any conflicts to report. I run a strategic health communications firm.

I will moderate, with each and every one of you, I hope, the last panel of today's meeting.

First, I want to add my thanks to Dr. Fineberg and to Surgeon General Benjamin and Dr. Lurie, the HHS and the IOM, for convening this meeting, and to Dr. Adler and her committee and Dr. Salerno and her staff for creating this important workshop, on short notice.

In the next hour we will hear brief, three-minute testimonies from four community leaders and activists. But the majority of our time is going to be dedicated to your

comments. The IOM is most interested in tapping into the vast experience and knowledge of all of you in this room. Through this open-mic session, we invite you shortly to approach the microphone with your comments -- not your questions, but your comments. If you would like to build a question into the comment, that would be great. But at the end, we will ask the panel to comment on your comments. So we are not going to have back-and-forth, but we are interested in your comments. They need to be three minutes or less during this open-mic session.

This is going to allow us, by keeping it to three minutes, to include as many of you as possible. We are looking for a diversity of point of view.

Also, for some of you who say to yourself, "I just can't say it in three minutes," we do have the website that allows you to say it in much more than three minutes if you feel compelled to do that, or the comment cards as well. But I believe most of you should be able to do it in three minutes. We do want very active participation.

Before I ask our four invited guests to begin and to demonstrate for you, in a very tangible way, what a three-minute comment actually looks like, let me make three quick points regarding general communications.

First of all, as my print and broadcast and new

media journalistic colleagues know so well, when you are communicating complex topics which involve numeracy to the general public, graphic displays, and especially the instructional design behind these graphic displays, are absolutely critical. What does good instructional design look like? Let me give you two examples from the Healthy-Waters project that was developed with the creative team that developed Al Gore's *An Inconvenient Truth*.

Challenge number one: How do you communicate that water is essential to human life? Here are the words and images that we ended up going with.

We are blessed with water. But the amount of fresh water we have available to us is only a small percentage of the total. Ninety-seven percent of it is contained in our oceans. Only 3 percent is fresh, and less than 1 percent is accessible as surface or ground water.

As for us, we're 65 percent water. A loss of 1 percent results in thirst, a loss of 5 percent in a mild fever. Losing 10 percent leaves us immobilized. Lose 12 percent, and you're dead. Ours is a delicate balance.

Challenge number two: How to communicate that the American diet consumes enormous amounts of water? Here are the words and the images.

Water is food and food is water. What we choose

to eat affects how much water we consume. For instance, 1 unit of water produces 1.5 units of cereal. But it takes 6 units of water to produce 1 unit of chicken and 15 units to produce 1 unit of beef.

Consider this fact: Americans require 3 liters of water a day to survive. But 3,000 liters a day are required to produce the average daily American diet. It makes you wonder about our choices.

So those are just two concrete examples of how the use of innovative graphics and good instructional design can support complex messages when you are dealing with complex communication strategies that are required for a situation like we have been talking about today.

My first point is, then, that sound instructional design is critical. What are the last two quick points?

First of all, in health-care stories, there are always two sides to the story. For me, two sides to the health-care story involve the stories, on the one hand, of the people and the stories, on the other hand, of the people who are caring for the people. By representing both sides of that story, you provide context to the story. Oftentimes the people's stories are the ones, in my experience, that provide you with the context.

The last point I want to make is that in good

health communications quantity often does not equate with quality. Sometimes brevity, supported by good instructional design, is what you need to penetrate and to generate behavioral change.

On that last note -- that quantity is not necessarily quality -- we're going to move now to our three-minute commentators. I'm going to ask them to use this front microphone here and ask them to come in order. The four commentators are, in this order, Myra Lewis, who is an environmental justice leader from Dillard University; Diem Nguyen, who is a Vietnamese-American health leader; Wilma Subra, who is an environmental activist and head of the Subra Company; and John Hosey, who is the head of the Mississippi Interfaith Disaster Task Force. Let's begin with Myra Lewis.

Agenda Item: Brief Invited Remarks - Community Perspectives

DR. LEWIS: (Sound system malfunction) I'm thrilled to be one of the first to be challenged with the three minutes.

I am the assistant director at Dillard University's Deep South Center for Environmental Justice. We have been for almost 20 years in outreach and communication along the Mississippi River chemical corridor

and along the Gulf Coast as well. I'm gratified to realize that a lot of the factors that affect the population along the corridor and along the coast are already in discussion here. Yes, this is a low income group very often, economically and environmentally challenged. A lot of ethnic minorities are groups represented here. These groups of people have been previously traumatized by disaster. These groups have been previously traumatized, a lot of them, already by various kinds of toxic exposures. As such, they are often not trusting of authority. They are not trusting of governmental agencies at any level. Very often these groups of people have language barriers that need to be taken into consideration.

I think recently we realized that they are less resilient now that they have already experienced Katrina and Rita. I recently talked with a community activist who has been very energized for the last five or six years, who is suddenly feeling powerless in this case of another disaster.

All of these factors need to be taken into consideration. As we are gathering information from them and disseminating information to them, we need to make certain that we have trustworthy people that are doing this.

We also at the Deep South Center do a lot of work in training. We have been doing it for 15 years, under funding from the National Institute of Environmental Health Sciences, NIEHS, and more recently, from the Department of Labor. We have been doing the 40-hour hazardous waste worker training for 15 years. That is the type of training that is needed for individuals who are answering the call of going out and cleaning up this oil spill. We have had hundreds of calls, however, in recent weeks from people who want this training, who want the opportunity to go out and make this money, and we are trying to screen them carefully, letting them know that this is not easy work and you need to have some experience to bring to bear.

In training in this area, we are finding that often the training that is being given, especially to the fishermen, is the four-hour training that BP is offering, which we know is inadequate. We met with a group of fishermen just last week, and that is their main concern, that for them the four-hour training boiled down to 30 minutes of training. They know they are ill prepared to be out there cleaning up oil with this kind of training.

So we need to get that message across. The people who go out there need to be well trained before they are positioned to deal with this oil spill.

Those are my remarks. Thank you.

DR. MAGEE: Diem Nguyen.

DR. NGUYEN: Thank you for being here.

They asked me to come and speak from the perspective of the Vietnamese fishermen. I have three comments to make on that.

One is, what their fear is right now is, financially, how are they going to take care of their families, as well as themselves? You have to understand, this is what they have been doing all their lives. Coming from Vietnam, that's what they know how to do. That's the only thing they know how to do.

Two is, where do I go from here? What am I supposed to do? There are language barriers that we have to take care of. You can't expect a 50-year-old man who has been fishing all his life to learn English now and tell him he has to go do something else. That's going to be hard.

Three is, this a domino effect. It starts from the water. Now they are out of jobs. They have no financial security. Then we have to talk about mental and physical health. It's a cycle, and it's a vicious cycle. I'm hoping that, with you guys being here, we can come to some -- there is no solution, I think, but there is

collaboration that can be started. That's what I'm hoping for.

Thank you.

DR. MAGEE: Thanks very much for your comments.
Wilma Subra.

MS. SUBRA: Thank you for the invitation. My name is Wilma Subra. I'm providing these comments on behalf of Subra Company and Louisiana Environmental Action Network, which are grassroots umbrella organizations for all the grassroots groups throughout the state of Louisiana.

First of all, please let us not forget the 11 workers that were killed on the BP Horizon.

I would like to talk to you about a couple of the populations that are having a health impact. The crude, as it comes to the surface and forms a slick on the Gulf of Mexico, is changed into aerosol, into the air, and this aerosol is blown onshore way ahead of the slick coming onshore. It has made populations across Louisiana, Mississippi, Alabama, and the upper coast of Florida very, very ill. They are experiencing headaches, nausea, dizziness, respiratory problems, burning eyes, sore throats, whenever the winds blow from the south or southeast or southwest. These health impacts will diminish

when the winds start blowing from the north and then pick up again when the winds start blowing from the southerly direction.

I would also like to talk to you about the fishermen. The fishermen had their ability to earn a living completely removed when the fishing grounds were closed due to the oil from the BP spill. They desperately wanted the jobs with BP. A lot of them received the jobs. Then they became ill when they went out and worked in close proximity to the crude oil spilt. They couldn't complain, because they were threatened by BP that if they complained of illnesses, they would be fired. Their wives complained. Then the message got to the wives, "If you don't shut up, your husband is going to lose his job."

Then a lot of them tried to wear protective gear and respirators, a lot of which was provided by the Louisiana Environmental Action Network, and BP once again said, "We will fire you if you wear a respirator."

So this population is being made sick on a daily basis as they go out and try to protect their wetlands, their marshes. This is the only mechanism for them to earn a living right now.

One of the things I would like to tell you is that they will not take care of medical services, because

then that admits they are having a problem and they will be fired by BP. When we talk about doing surveys, they will not participate in that, because they will be fired by BP. I have been assured often by several officials that the application of dispersant is not impacting human health, not being sprayed near people, and not being sprayed where there are dolphins. Yet I get constant complaints from people in the offshore area near the wellheads that they are being spread by the dispersants and have resulting health impacts.

This is a workplace environment. In 2010, we should not be putting workers in a workplace environment that causes them to have health impacts.

Thank you.

DR. MAGEE: Thank you for your important point of view. Now our fourth demonstrator is John Hosey.

MR. HOSEY: Good afternoon. My name is John Hosey. I'm with the Mississippi Coast Interfaith Disaster Task Force. We have been around since 1979, after Hurricane Frederick. I'm also with South Mississippi VOAD. VOAD stands for Voluntary Organizations Active in Disaster, a national organization.

We at this time, like many others, are asked a lot of questions and have very few answers. The answers

that people are getting are much like the oil that's coming out of the floor of the ocean: There's a lot of it coming up, but none of it is really worth very much.

We are putting together a summit -- and hopefully this will lead to a regional summit -- to deal with the emotional and spiritual and behavioral issues, the economic issues as well, involving businesses across the coast, and eventually the businesses of Louisiana, Mississippi, Alabama, and Florida, coming together and developing a policy statement that shows the nation that we stand together. This is not just a Gulf Coast problem. This is a national problem, and I fear that eventually, over time, it will become a global problem. The oil is not frozen in one place. It is potentially going to reach currents that will carry it to the eastern seaboard, which probably means that then somebody will do something about it.

We are very concerned about our way of life here. The water here is a part of who we are. It's a part of our existence. Hurricanes we are used to. You have 72 hours. One comes ashore. Even as bad as Katrina, recovery is nearing completion in many regards. The disaster -- the behavioral health issues, the area that I work in -- there are still some ongoing issues in that area.

But an oil spill, how do you deal with that -- an

oil disaster, a technological disaster? We are gathering experts and people from across the country, people locally, businesses to address these issues and try to define what our purpose and what our role is and then strategize on how we are going to recover from this disaster.

We are very resilient people. We love our gumbo and our oyster po' boys. We love to fish. This has been taken away from us. We are frustrated by it. There's a lot of anger. Eleven people that I know were laid off from a shipbuilding industry. They were told that they were laid off because of the oil spill. Then, when they went to file a claim with BP, BP said, "The organization that you work for said you were laid off just because you were temporary." These guys had been working there for 15 years.

There are a lot of problems to be remedied. There is no one group -- let me close with this. I encourage that if you do research on the Gulf Coast, you bring something back to show for it. People here are weary of research. Katrina -- there were so many universities down here, asking questions and getting research and using that research. Then the returns were not there. The outcomes were not shared. The findings were not here to help us. That's not across the board; there were some

universities that did that.

So be careful. The people here have already been through enough. They need your support. I would encourage you to collaborate with the local people, the clergy, the mental health clinicians, the regional people, that people that live and work here. They are the ones that know how to fix and hold out hope to their communities.

Thank you.

DR. MAGEE: Thank you, John, and thank all four of you for getting the ball rolling.

I invite others of you now to line up at either of these microphones. We will take them one after the other.

As you are doing that, let me just say that with these four individuals, we have already seen four very different voices, four very different points of view. It points out why it's so important that we hear as many of your voices as possible.

I want to thank John for mentioning the issue of collaboration and also the issue, which is controversial, of geographic disparity. You can feel that in his comments -- the difference between being on the Gulf Coast and being on the East Coast, for example.

Let's move right ahead. Let's stay to three

minutes or less. Let's start with the front microphone. Identify yourself and your organization, please, and then give your comment.

Agenda Item: Open Dialogue with Audience

MS. ROBERTS: Thank you. I'm Casey DeMoss Roberts. I'm with the Gulf Restoration Network. We are an environmental advocacy nonprofit here on the Gulf Coast. We are based in New Orleans. Our mission is to unite and empower communities across the Gulf Coast to restore and protect our natural resources.

I really want to thank the IOM for hosting this conference. I feel that it's going to be very helpful in the long run.

I have five points to make.

One is on vulnerability. One thing I didn't hear mentioned today is the fishing community. That's a fairly large community across the Gulf Coast, as people depend on the Gulf for food to feed their families, as well as people who make a living on fishing. We have fat years and lean years. During the lean years, people don't go hungry because you can still just go out and catch dinner. That has been lost during this crisis. It's the loss of a safety net. I don't think you can underestimate the significance of the impact on how that's going to affect

people's diets, how they are going to feed their families, as well as people who go ahead and fish in the oily water and possibly get contamination that way.

The Vietnamese community is another vulnerable community that I didn't hear mentioned. They have low English proficiency. I would hope you wouldn't forget about the Vietnamese community.

Also our communities are lab rat-weary, for lack of a better term. We have definitely been studied for a while.

The other point with the dead zone -- I'm glad to hear that mentioned -- one thing we have been hearing is bioremediation. That is a reliance on the bacteria to eat up all the oil. However, they also use oxygen in that process. We are worried about a much larger dead zone this year through that (?)

Dispersants: I have seen - not 9527. There are two different dispersants being used. The 9527, I think, has more toxicity. EPA released the chemical structure, but then they listed what those chemicals were used in. It's kind of a benign fallacy, where even if chemicals don't seem bad in Windex or whatever, but if you have all of these chemicals together, there is a synergistic problem that medicine and toxicologists haven't really solved, how

to use steady chemicals in concert.

Other long-term impacts: There is the municipal and industrial waste sites and staging areas. I'm worried that people aren't going to be studying these areas for their impact onshore. As well, we are hoping that there is an independent scientific inquiry. This is absolutely critical.

Just one last thing. Everyone keeps calling it an oil spill. It's really not a spill. It's a drilling disaster. I think we need a different terminology to describe what has happened.

Thanks.

DR. MAGEE: Thank you very much, Casey. We appreciate your remarks.

Let's go to the first person in the back.

DR. TRAPIDO: I'm Ed Trapido. I'm at the LSU Health Sciences Center in New Orleans. I coordinate all the research related to the Gulf oil spill.

People have asked about cancer. The problem is that all of the studies that have been done so far have been short-term, mostly cross-sectional studies. There are enough agents in the oil that are classified as Class I carcinogens by the International Agency for Research on Cancer, and crude oil itself is classified as a Group III,

meaning a possible risk, but it's not clear. Exposure to some of these chemicals results in lung cancer, multiple myeloma, acute lymphocytic leukemia, and chronic myeloid leukemia. So there are reasons to potentially be concerned.

What we don't know is the extent to which those could or could not be due to exposure to the oil. The other thing is that people over the course of time have their own risk factors. Cancers will occur in these populations that have nothing to do with the oil spill. It's important to use this period to find answers to questions that have not been asked about cancer and other chronic diseases. But that will require a long-term commitment to following individuals. Without that, it really can't be done.

DR. MAGEE: Thank you, sir. Appreciate it.

Warren?

DR. JONES: Good afternoon. Thank you for the opportunity to be here. My name is Warren Jones. I'm a professor of family medicine and health policy at the University of Mississippi Medical Center. I run an institute that deals with health disparities, the Institute for Health Disparities in the Delta Region. Our areas of focus are Louisiana, Mississippi, and Alabama, three of the

primary states affected here.

My concern, and why we speak with you, is something that was alluded to earlier, but, to my mind, not shouted loudly enough. The area that has been affected by this drilling disaster is an area that already has significant health disparities. It is something that is going to complicate and confound whatever we do to deal with health about populations. I would like to ask you to consider a few things.

First of all, there was discussion about the health of pregnant women. I would like to ask you to focus on adolescents, who often don't even know they are pregnant, and the potential risks that we have there. We have among the youngest mothers in the nation in this region. It's a unique population that requires unique messaging. We have to help them with the stress of unemployment, self-esteem, and other things that are impacted as a result of this.

Second, we have to leverage technology. The federal government -- and from your position at the IOM, you can encourage Health and Human Services and other aspects of the federal government to retarget and repurpose some of those technology dollars that are out there now towards Health and Human Services activities such as

electronic health records. There were two programs that were recently awarded, the regional extension centers and the Beacon Communities grants, both of which have awards in each of the three states that are primarily affected, and I believe on the panhandle of Florida. Those can be asked to expand and target their activities towards the areas that have been impacted.

Lastly, I'm a native Orleanian, and it pains me -- I drove the first non-government vehicle allowed in New Orleans after Katrina. I saw my family and friends walking through the streets as though they were in a disaster zone. I have not seen the mental health recovery yet. The infrastructure is crumbling from lack of support. I would ask that whatever you do in the recommendations you make, help to reassure and reestablish the mental health infrastructure that we need to give people the wherewithal to take on another challenge and to fight another day.

Thank you for the opportunity to be here.

DR. MAGEE: Thank you. Next speaker.

DR. SPRINGGATE: My name is Ben Springgate, from Tulane School of Medicine and RAND Health and REACH NOLA, which is a local community-academic collaboration dedicated to improving access to quality health care through partnered programs, services, and research.

I want to emphasize something that we heard from John Hosey and Diem Nguyen, two of my friends from the initial four speakers who spoke, as well as something that my friend Dr. Jones mentioned. There are a lot of people here in this community who are interested in contributing to the researchers' question for what the right questions are, interested in participating in collecting the information, interested in sharing it with their community members and in building lasting capacity to ensure that whatever research is going to be undertaken -- it sounds like, hopefully, there will be some -- it's actually going to have a meaningful and longstanding impact in this community.

Already we know that BP has proposed to fund \$500 million worth of research that is going to be vetted through a panel. There is hopefully going to be some federal support for research or philanthropic support. If it doesn't involve the local community agencies, community members, neighborhood groups, the faith-based organizations, or others that are going to give their information and experience the impacts, then I would suggest that maybe it shouldn't be done at all. Already a lot of people in this room are writing proposals related to this spill and the health impacts. There are plenty of

folks here that are interested in learning from and in participating in this process and helping to mitigate the impacts in their own communities, for their family members, for their neighbors. You have the opportunity to do something about that now. You can contribute in that way.

I would also like to briefly point out that the mental health services and the mental health services responses obviously are a major challenge. BP, of course, has put in over \$20 billion, but the \$20 billion is for direct remuneration for injury or for loss of income to businesses and individuals. That's not going to pay for services. That's not the way that that deal was structured.

So if we want to ensure that there is going to be some type of support for people to actually get health services that are necessary to support recovery from the challenges that are likely to emerge from this that we heard so eloquently from Dr. Palinkas, Dr. Abramson, Dr. Redlener, and others, there has to be another mechanism. So far it appears that each of the government entities, of course, is saying BP needs to pay for it, and BP hasn't yet ponied up in that regard. If we don't pay attention to this issue and simply expect that there's \$20 billion out there somewhere -- that's not going to cover it. At least

the way the deal is currently written, that's not going to cover it.

I appreciate your time. Thank you for listening.

DR. MAGEE: Thank you very much. Just to amplify one of your points, the capacity in survey research and other types of basic social science research nowadays to involve both the people and the people caring for the people, as Dr. Abramson hinted at in some of the research in New York, is much greater now with the use of new technologies. So perhaps one of the things that people might think about on a local level is how to leverage new information technology to involve the broadest number of people in some of the research that will be required as we move ahead.

Next speaker.

DR. VALLIERE: I'm Jean Valliere, from LSU Health Sciences Center and Maternal and Child Health here in Louisiana.

My concern is, hopefully, prayerfully, in a month, a month and a half, they will stop the leak. But I think another area where people really need information now is in some kind of direction into what happens with the millions of barrels of oil that are sitting off the coast of Louisiana and Mississippi. Are they going to come up in

a water column and give us these volatiles? What kind of long-term risk to reproductive health and child health are we looking for here? I know we don't have, certainly, all the answers, but I think we had better pay attention to it. Does this mean that no kid on the Louisiana coast, the Mississippi coast can go swimming again, even when the beaches don't have oil? Does this mean that no pregnant moms should be involved with ever eating any seafood again? Does this mean all of our young men who work in whatever is left of industry, who may have these volatiles that can produce problems as far as their sperm, whatever it is, is concerned, need to be afraid for the next 20 years?

We do need short-term solutions, but we need to look long-term as well. I can't find any information on it, and if you could possibly help us head in that direction, I would appreciate it. Thanks.

DR. MAGEE: Thanks for those important comments. As everyone is aware here, there are risks and benefits to everything we do every day. What people really want to know is, what's a reasonable risk? What's going to happen to us both short- and long-term? So thank very much for those comments.

Next speaker.

MS. HRYBYK: My name is Anna Hrybyk. I'm from

the Louisiana Bucket Brigade. We are an environmental health and justice organization that works with communities affected by pollution throughout the state.

I want to bring two things to your attention.

The first is a tool that we have developed called the Oil Spill Crisis Map. Crisis mapping is a new field of technology that is participatory and transparent. What that means is that citizens who are impacted by the spill can text into this map, they can email into this map, they can Twitter into the map, anything that they are experiencing. We have received 900 reports on the map since May 1. Those reports deal with everything from oil onshore, oil in the water, marine and wildlife, health impacts, odors, livelihood threats, and needs and resources that people are experiencing. For example, in the odors and health impacts, we have received over 125 reports from E City(?), Texas all the way to Coral Gables, near Miami. Those are reports of petroleum smells, burning smells, and citrus solvent smells. The associated health impacts that we have been discussing here all day are readily accessible on that website. Anyone can look at those reports. Anyone can look at the photographs that people are submitting.

Just yesterday we received a YouTube video from a woman in Mobile, Alabama, who waded into the water around

the second week after the disaster, and has now videoed open blisters and sores on her legs.

These are the things that are coming through this map. I think it's a very valuable tool for anyone who is looking at tracking health impacts over the long term, and it's also valuable for response agencies that want to know where the hotspots are.

The second thing I want to bring to your attention is that, from working on the ground in Grand Isle and the other affected places, I have seen two systems of medical treatment. One is from the state, the Department of Health and Hospitals. The West Jefferson Medical tent, for example, provides a first-aid tent inside the BP worker compound. They are extremely limited by BP in what they can do and what they can treat inside that tent. They are only allowed to have Band-Aids, ibuprofen, sunscreen, and Gatorade. They are not allowed to deal with any other issues.

All more serious issues are referred to BP's EMS system, which is heavily guarded. It's very difficult for anyone to get in there. No one right now knows where those incident reports are and where those workers are going. So the oil spill surveillance that the DHH has going on is very limited. No one yet knows what the BP EMS is tracking

and where those workers are going.

I would ask all of us to start seriously looking at that issue.

Thank you very much.

DR. MAGEE: Thank you.

We have about 15 minutes left. That means if everybody hits three minutes or less, we have room for five or six or seven more speakers. Go ahead.

DR. VIAMONTE ROS: (Sound system malfunction)
Good afternoon. My name is Ana Viamonte Ros. I'm the secretary of health in the state of Florida. As we have heard many wonderful presentations this morning, there really is a consensus on the importance of (inaudible) the biomarkers and psycho-markers and conducting really long-term studies in regards to (inaudible). Even though we have heard of many, many spills in the past, we really have not conducted any, nor do we have any data to look at.

My comment is to consider working very closely with funding and BP to create a long-term monitoring process, where we can include the dedicated reference labs, especially for long-term seafood sampling.

Thank you.

DR. MAGEE: Thank you very much.

MR. COLOMB: My name is Alvin Colomb. I'm the

executive director of Project New Hope, a social service agency, nonprofit. Our primary focus is mental health and substance abuse.

I am working with the average person on the street that is looking at the information they receive on television and still dealing with the second of two major crises in the last five years. Personally, I'm not in my house from the first catastrophe.

I think we can look at all the academic research that is being done. We have a government in this state that puts every department before education and health. When we have deficits in this state, the first two departments we cut are health and education. We don't have adequate resources to provide for the mental health, substance abuse treatment, family and children's counseling that is of vital importance at this point in our lives, and particularly with these two still existing catastrophes. We have not recovered from Katrina. We may have a beautiful city down here, but I would advise you all who are here visiting to take a trip around the rural areas outside the district of New Orleans, and you can see that we have not recovered.

Then we have this oil spill. The mental and social effects that it has had, not only on children, but

on older adults, is overwhelming. We have mental health facilities that have been moved from the city of New Orleans to across the lake. It's bad enough to be able to get bus service up to uptown New Orleans, as opposed to having to travel across the lake to get those vital mental health services.

I would encourage you all to really consider working with smaller agencies directly, because government has not been successful, both on the state and the local levels. I may be biting my tongue, but I'm telling it like it is. I'm tired of it. If we want to get our citizens organized and we want to work as a community, we have to prepare them for this disaster and the stress that goes along with breaking up families. In rooms of recovery, we are seeing numbers doubling. If you count the number of beds where we have to treat individuals that have diseases like alcoholism and drug addition, you can probably count them on two hands.

So I really appreciate you all taking the time. I didn't plan to speak today, but I just could not help but get up here and take advantage of this opportunity. I want to thank you all for listening.

DR. MAGEE: Thank you.

DR. HUTTON: Good afternoon my name is Dr.

Charlotte Hutton. I'm a child and adolescent psychiatrist here in New Orleans.

I want to thank you for the opportunity to both express how distressful it really is to continue to serve. I came here three months before Hurricane Katrina, from Boston, Massachusetts. Needless to say, it has been an unending and certainly a tireless effort to continue to serve communities that were underserved before the hurricane.

But some salient issues that need to be addressed are:

One, the fact that technology alone is not going to solve the whole issue. Using telemedicine and telepsychiatry certainly has its benefits, but it has its limitations. Specifically, we do need a workforce to support those mechanisms of assessment and ongoing treatment.

Two, the community-based services need to be enhanced. We continue to have a workforce deficit, as it pertains to behavioral health, specifically substance abuse, and mental health issues.

There needs to be ongoing monitoring for the developmental disabilities and ongoing treatment of current developmental disabilities in this community, and a public

health address into how to improve the quality of those children who are brought into our society here to forward.

Lastly, the cultural diversity issues are broad and complex, from indigenous people -- we have not spoken about the Latino population and their language needs, offering them an entrée to join us, as well as many of the other populations that have experienced serial -- more than, in some cases, four to five generations -- distress, oppression, and mistrust, as well as bridging language barriers for indigenous people, who we assume speak English, but may not, and to increase and empower those individuals who feel that all of our dialogue does not apply to them. This is critically important.

I thank you for your time.

DR. MAGEE: Thank you.

DR. HERON: My name is Dr. Richard Heron. I'm also the vice president for health for BP.

I really just wanted to stand up and acknowledge the great level of concern expressed in the audience and to thank the Institute of Medicine for holding this conference. I have principally come to listen, and not to talk. What I would say is thank you for mentioning the 11 people earlier. I think not enough has been said about that.

I wanted to share my personal approach to what we are trying to do. I think it is in everybody's interests to better understand the hazards, all the hazards, whether they be physical hazards, heat stress, chemical hazards, crude oil, dispersants, or others, biological and psychological hazards, and to work tirelessly to reduce the potential risks of those harming any more people. I thank the government departments who are helping us to do that -- NIOSH, which is looking at the results of anything we do and doing health hazard evaluations and rechecking exposure data and methods of control; CDC and NIOSH, looking at trying to identify responders, volunteers who are involved in the study, and trying to get as many people as possible to be identified so they can be tracked for long-term studies. I fully support the idea of long-term studies.

To acknowledge that I asked early in May the National Academies, through the Institute of Medicine, specifically for the best, most credible, most independent and trusted scientists to lead this agenda. That's what I'm here to listen for, to go back to the company and to tell them the way I think research should be supported.

Thank you.

DR. MAGEE: Thank you, Doctor, for your comments. We appreciate them.

Ma'am?

DR. LANGHINRICHSEN-ROHLING: My name is Dr. Jennifer Langhinrichsen-Rohling, and I'm a professor at the University of South Alabama. I just have a couple quick things to say.

The first is that I think there is a lot of concern in the room that I have heard about people again being lab rats, or that kind of expression. I think you are in a unique role, because there are four states involved, at least, at this point, if not more as it goes on. There are numerous universities that are already here, situated on the Gulf Coast. If we take the money and it's all divvied up to this person, that person, this university, and that university, and everyone is collecting a little bit of the same data, people are going to feel used. That's really what happened in a lot of places after Katrina. Plus, that is a lot of money to leave us with less answers, if we divvy it up in all these small ways.

I think there is a sense that sometimes in these disasters the rich get richer and the poor get poorer. The first people in Mobile that filed claims were people who have beach houses. Those are the people who already the most affluent.

So when we talk about using these new

technologies, the Gulf people don't have access to computers. The people who live in Prichard and Mobile, Alabama -- the average income is \$10,000 a year or less. We are talking, like, Third World country status. If we are all going to go on the Internet and fill out surveys -- I don't know if you are connected to the reality of the kinds of places and situations that we are talking about.

So what I would really like to see is that we get all the voices together, but we have a unified plan, even at the science end of it, that includes all the local universities, as well as people coming in -- to make a plan so that the people here are not just part of a used professor agenda.

DR. MAGEE: Thanks very much for your comments.

Just so that you don't think I'm delusional in terms of technology, we began to talk about "techmanity," I would say, three or four years ago, the idea that you could leverage technology on behalf of empathy and on behalf of humanistic responses to a lot of different things, including crises. The reason we did was because in Philadelphia we found that in our really high-risk populations that, although they didn't have computers, they did have mobile phones, and that perhaps we were underutilizing something that was sitting there waiting to

help us, waiting to connect, waiting to create a network, that needed to be connected.

I agree completely with what you are saying. On the other hand, in terms of a digital divide, there is a digital divide there because we have not properly yet leveraged some of these devices that are actually widespread. It's just worth a fresh look. That's all I was raising.

MS. GRIFFIN: I am Jane Griffin. I'm with Cerner Corporation, which is a provider of electronic health-care technologies to health-care institutions.

I just want to throw out there that another option -- I know there has been lots of discussion about research data, which, of course, is extremely valuable -- similar to initiatives that were put in place to monitor the flu pandemic, electronic health record data can be used. If you pull it at a very high level, summary data, you are pulling any personal health information. Those electronic health records can be used to monitor what's actually happening day to day in the real world, what health-care institutions are seeing across the Gulf region. We are actually partnering with our clients to set up an initiative whereby those institutions work with us -- again, we did the same thing for the flu pandemic -- where

we are pulling very high-level information and aggregating it and putting it in a very simple map view so that the participants can see what's happening in various states and various regions.

I wanted to put that out there. I know the government is putting lots of funding into electronic health records. We should use that for surveillance for signal detection and/or signal confirmation.

DR. MAGEE: Thank you very much.

DR. EMMETT: Ted Emmett, from the University of Pennsylvania.

We are not in this region, but we work with very impacted communities, and I would hate that we would finish on a note of technology and a note of monitoring and surveillance. What we have found is that, as Dr. Abramson said, people need help with very difficult and very personal decisions that they need to make about the circumstances that, generally through no fault of their own, they find themselves in. Monitoring and surveillance can be long-term activities from which there is no feedback to the people. There is basically no utility that group. There may be utility to science, but I would say that is an audience that ought to be second in priority.

So I hope that we are looking at all of these

activities as they are being done: How and what and how quickly can we get some information, something that helps the people with those decisions that they alone can take about their lives?

DR. MAGEE: Thank you very much.

Just to amplify what you were saying, which I totally agree with, we did a series of studies a decade ago in six countries looking at caregiving relationships. The three characteristics that the people themselves and their caring professionals defined as instrumental in their relationships with each other were compassion, understanding, and partnership. Nobody mentioned technology.

I think what you are saying is totally on the mark. At the same time, if we have new tools in our mix that could be of potential value, it just seems foolish not to advance them to whatever advantage we can.

Ma'am?

DR. BRIGHT: I'm Dr. Patty Bright, with the U.S. Geological Survey. I'm actually a veterinary epidemiologist, with a background in public health.

I actually just want to thank and acknowledge Dr. Maureen Lichtveld. When she spoke this morning, one of her slides talked about the fact that human health, animal

health, and environmental health are inextricably linked. That's not something that comes up very often, so I appreciate her bringing that up.

For many of you in the health community, you know there is a new paradigm, One Health. It's kind of a global strategy for sharing and collaborating information among the three legs of the stool. I had lunch today with one of my colleagues, and we were lamenting the fact that we spend a lot of time talking about the need to be linking the environmental, the human, and the animal health, but that when something like this happens, we often fall right back into our individual stovepipes. Unfortunately, I can't think of a better example than this disaster of where that kind of One Health approach is needed.

I just would really like to encourage IOM to promote that kind of sharing and collaboration. One of the women who spoke about three speakers before me was talking about her concern about chopping up data among universities and among groups. I would kind of bring that up to the next level. We also don't want to chop it up among those three legs of the stool. IOM could really play an important role in promoting that collaboration. There is a lot of work to be done. We don't need to duplicate efforts. We need to look for the opportunities to reach

across and share information.

Thank you.

DR. MAGEE: You will be our final speaker.

PARTICIPANT: You're being double-teamed by the U.S. Geological Survey. I'm the associate director for geology. We are going to be working with NOAA and EPA and states, universities, researchers, and many others to look at the natural environment and look at the pervasiveness and persistence of the oil and the dispersants, now and in the future, to try to understand it, model it, and predict it. We want to freely share these data and make sure that they get paired up with the health data. We have found that where we have worked with the medical community, we have gotten results and better understanding, improving epidemiological studies and improving the overall ability for us to target resources to affected communities that get affected by these disasters.

We have done environmental looks after Katrina, to look at ways disasters can cause impacts on the environment that cause health effects. We have looked at it after 9/11, and we have looked at it after earthquakes and volcanoes. We really think that the kinds of data that can bring can really help with the medical community. We look forward to collaborating with them.

DR. MAGEE: Thanks to all of you.

We are now going to toss it back to Dr. Adler and the planning committee.

I have to read one comment. There was one comment that they wanted read rather than spoken. So here it is.

A statement was made that oil was found in a personal swimming pool. This means oil is in the local water system. Shouldn't the government step in and evacuate the area? If you can't swim in the water, you can't bathe in it, cook with it, or drink it. This is a huge safety and health issue.

That completes, I think, all of the input from all of you directly. Now I will hand it back to Dr. Adler.

Agenda Item: Day 1 Closing Remarks

DR. ADLER: Thank you. I will take just a couple of minutes.

There is no way to summarize today. As difficult as it was to prepare talks in 72 hours, it's even harder to try to summarize the very rich data and ideas that were presented, including this last session, which was extraordinarily helpful. I want to thank everyone who spoke. What you presented was really important, to a person. You added an important component to our thinking

and enriched it. We greatly appreciate that and will be taking that into account.

It really, just thinking about it, has already changed how I think about tomorrow's efforts to think about a framework for surveillance and monitoring, with the idea that we really need to start also thinking about how these data will be useful to the residents here, and not just the scientific approach, but starting with the kinds of data people can use and need, and then using the best science to do that. How do we put those together? I hope tomorrow we can deal with what may be a tension and a complexity in doing so.

We will be doing this tomorrow, starting at 9:00 a.m. If we can reflect tonight, we will try to feed back some ideas in structuring tomorrow.

I want to thank everybody for their participation and welcome you back tomorrow. Thank you all. See you tomorrow.

(Whereupon, the meeting adjourned at 4:25 p.m.)