U.S. CHEMICAL SAFETY AND HAZARD INVESTIGATION BOARD

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COMBUSTIBLE DUST AND EXPLOSION HAZARDS

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PUBLIC HEARING

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WEDNESDAY

JUNE 22, 2005

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The public hearing was held in the Horizon Ballroom in the Ronald Reagan Building and International Trade Center, 1300 Pennsylvania Avenue, N.W., Washington, D.C., at 8:30 a.m., CAROLYN MERRITT, CEO and Chairman, presiding.

PRESENT:

CAROLYN MERRITT	CEO and Chairman
JOHN BRESLAND	Board Member
GARY VISSCHER	Board Member
CHRIS WARNER	General Counsel

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(8:30 a.m.)

OPENING REMARKS

CHAIRPERSON MERRITT: Good morning. And welcome to this public hearing of the U.S. Chemical Safety and Hazard Investigation Board, the CSB. Today the hearing will focus on combustible dust, which the Board has come to recognize as a serious industrial safety problem.

I'm Carolyn Merritt, Chairman of the Board and CEO. And with me today are Mr. Bresland, also on the Board; and Mr. Gary Visscher, also a Board member; and Chris Warner, who is our General Counsel.

I would also like to recognize the many members of the CSB staff, who have worked very hard to put this together. And without their help, it wouldn't have been possible.

Before we begin, I would like to point out a couple of safety features. Number one, the door you came in is one of the exits in the event of an emergency and this door behind me. And both of these doors exit directly to the street.

If you would, if you have cell phones or pagers, if you would please turn them off or mute them so that you do not disturb these proceedings, I would appreciate it.

And also an important feature, the restrooms are out the door to your left and through the double glass doors to your left. So I'd like to thank the panelists this morning who have come some great distance to be here with us this morning. After today, I hope that everyone will take back to their respective groups information that they have learned from today's proceedings and share it, that we might spread the information concerning combustible dust.

Before we move on to our first panel, I'd like to take a minute for a few personal thoughts and then also ask the other Board members if they have any other comments.

I personally observed the immediate impact of a combustible dust explosion during the CSB's initial employment to the investigation in Kinston, North Carolina in January 2003. That night at the West Pharmaceutical plant, I witnessed devastation, both in loss of life, loss of business in a small community that people recognize the devastation of these immediate impacts. The negative impact on this small community was obvious.

One of Kinston's largest employers, this company was forced to suspend operations because the physical destruction was so severe. The facility was rebuilt, but production was not resumed for over 18 months. Six workers died, and nearly 40 more were injured.

Dust explosions are preventable, but tragedies continue to occur. There are many serious dust explosions in the 1990s. Following the West incident and two other major dust explosions at Corbin, Kentucky and Huntington, Indiana.

The Board decided to pursue a broader study of combustible dust. The final report on West investigation was released in September of 2004. The CTA final report was released in February of 2005. And the Hayes-Lammerz report is still pending but will be released soon.

Dust explosions often cause serious loss of life and terrible economic consequences. While some programs to mitigate dust hazards exist at the state and local level, we recognize there is no comprehensive federal program that addresses this problem.

This is why the Board decided to pursue this study and this hearing. We wanted to find out more information about the scope of this serious problem. After the study is complete, we will be better able to recommend measures to help avoid dust explosions and fires like those that we witnessed at West, CTA, and Hayes-Lammerz.

I would like to thank the dust study investigative team and all of today's panelists for their strong commitment to helping us gather information about this hazard of combustible dust.

If anyone in the audience wishes to comment at the conclusion of today's formal presentations, please sign up at the table in the check-in area. I'll call your name at the appropriate time. Please note that we would like to limit comments to five minutes per person.

I will now recognize any other Board members who would like to make an opening statement. Mr. Bresland?

MEMBER BRESLAND: Thank you, Chairman Merritt.

Again, I would also like to thank the panel participants who are here today and also the members of the audience who are here. I guess I would like to recognize one person who I'm sure came the longest distance, one of the better known experts on the issue of dust explosion, Dr. Eckhoff, who arrived in from Bergen, Norway last night at 9:00 o'clock. Welcome and thank you for coming. Thank you for coming such a long way to talk to us.

I've been to the scene of two of the dust explosions that we have investigated. And I have been struck by both how catastrophic these are in terms of the human toll and the economic toll on the businesses.

I worked in the chemical industry for many years. And I have been involved in some chemical plant accidents, but I was really struck by the amount of damage that can be done by a dust explosion in a way that is easily preventable just by people having the knowledge of the hazard.

I am looking forward today to hearing more about this issue from all of the experts who are here today. And I am particularly interested in several issues. One is, do we need a broader combustible dust regulation? Second issue, how do we educate the manufacturing community? How do we get out this message on the hazards of dust explosions to the manufacturing community? And, finally, how do we improve hazard communication, both to employers and to employees?

So I'm looking forward to a very interesting day today. And, again, thank you all for participating.

MEMBER VISSCHER: Thank you, Madam Chairman.

I just want to also join and say thank you particularly to our panelists for coming and sharing your experience and expertise with us and look forward to today's testimony. Thank you.

PANEL A: COMBUSTIBLE DUST FIRES AND EXPLOSIONS

CHAIRPERSON MERRITT: Well, then, at this time I would like to introduce our first panel. Ms. Angela Blair is a lead investigator for the CSB, dust explosion hazard study. She holds a Bachelor's degree of chemical engineering from Auburn University and is a registered professional engineer in the State of Alabama. She has performed numerous process safety compliance audits, process hazard analyses, and incident investigations.

Second is Mr. Giby Joseph, who holds a Bachelor of Science degree in chemical engineering from the University of Houston and a Master's degree in safety engineering from Texas A&M. Mr. Joseph has worked as a technical writer and a consultant specializing in OSHA process safety management, EPA risk management programs, and other regulatory issues. Mr. Joseph has been with the agency since the Fall of 2000.

So thank you, Angela and Giby. And now we'll hear your beginning presentation.

MS. BLAIR: Thank you. And good morning,

Chairman Merritt, members of the Board, and distinguished guests.

The staff has investigated three fatal dust explosions that all occurred in 2003. I will briefly review the results of those three investigations this morning. Giby Joseph will present the results of our preliminary data search for dust, fires, and explosions over the past 25 years.

This presentation also covers the objectives of the Chemical Safety Board's ongoing study of the fire and explosion hazards of combustible dust.

Finally, I will review some of the issues that we hope today's hearing will address.

Before we get started, I would like to introduce all of the members of the investigative team who have been working on the combustible dust issue for us.

The investigation manager is Bill Hoyle. And if you're in the room, would you please stand briefly while we introduce you? The recommendations manager is Jordan Barab. Jordan, where are you?

Thank you.

I am your lead investigator for this study. Giby Joseph is an investigator on this team. Tiffney Cates is our investigative intern. Is she still signing in in the lobby?

I would also like to recognize the contributions of Mark Kaszniak and Cheryl MacKenzie, who both worked very hard with us in the early stages to plan this hearing today and to set the objectives for the study.

I am sure many of you here today are already quite familiar with the anatomy of a dust explosion. However, we thought it might be helpful to remind everyone that dust explosions are somewhat different from vapor explosions.

This familiar triangle of fire, oxygen, and ignition necessary for a fire to occur must be expanded to include two other elements. First, the combustible dust must be dispersed in air in the necessary concentration to ignite. And, secondly, confinement in a building or some other container is needed to cause the damaging pressure associated with an explosion.

It is also not uncommon for more than one dust explosion to occur at a facility where combustible dust is present. When combustible dust is involved, the worst damage and injuries can often occur some distance away from the initiating events.

The pressure wave from the first explosion shakes loose dust from flat building surfaces, forming a cloud, which is then ignited by the flame front following it. This phenomenon is called a secondary explosion.

And here is a simple graphic to illustrate this mechanism. First, dust settles out on flat surfaces in the plant. These are usually overhead surface and, unfortunately, the dust that settles the highest is also the most fine, the smallest particles.

Some events, whether it's an explosion of a different sort or turbulent ignition or some other event, disturbs settled dust into a cloud. And that cloud is ignited and explodes. And then the initial explosion, the turbulence and the flame front, and the pressure wave generated from the initial explosion loft additional dust, which then explodes. And the explosion would propagate throughout the building wherever it can encounter combustible dust that can be lofted into an explosive mixture and the flame front is still alive to ignite it. So then we have a chain effect of one explosion after another after another.

Thank you, Giby. The National Fire Protection Association standard for combustible dust in general industry, NFPA-654, states that dust layers one-thirty-secondth of an inch can create hazardous conditions. To put this into perspective, one-thirty-secondth of an inch is thinner than the thickness of a U.S. dime.

Fine particles of coal, aluminum, plastic, vitamins, pharmaceutical compounds, and cornstarch are all examples of dust that can be explosive under certain conditions.

I would like to briefly review the three cases that CSB has investigated of dust explosions that all occurred in one single calendar year. We'll begin with the dust explosion in Kinston, North Carolina at the West Pharmaceutical Services facility.

This was a polyethylene powder explosion that happened on January 29th, 2003. The West facility compounded various types and color of rubber and was molded into projects, such as syringe plungers and fittings for IV drug delivery systems.

This is an aerial photograph of the West facility that was taken just a few hours after the explosion. The tower structure that you see here originally housed the rubber compounding process. You can see from this photograph that the steel cladding and the roof were blown off the building in the initial blast. And we have witnessed descriptions of coming down around the corner and looking at the building and just seeing the cover just fly off the building in one instant.

Employees in the plant describe to us the sound of rolling thunder as secondary dust explosions quickly propagated through the building.

The fire that you see burning in the corner is in the raw materials warehouse, where West stored their bales and pallets of rubber, both synthetic and natural.

Debris from this explosion was blown or carried by the wind as far as two miles away and set off numerous woods fires. The video footage that I'm about to show you was taken by the emergency responders from Lenoir County, North Carolina on the day of the explosion at West.

The CSB gratefully acknowledges the Lenoir County Department of Emergency Services and especially Fire Marshal Deral Raynor for providing this video for our use today. Deral was going to be a speaker for us, but his wife is having twins this week. So we gave him a break.

I will let this video play for a few minutes and just point out some of the key features. What is amazing about this is you are seeing an employee who just suddenly emerged out of the structure. And it was amazing to everyone that someone could survive such devastation. I am very happy, as you will see here, to say that this man was rescued fairly shortly thereafter. There he goes.

This was a difficult fire to extinguish. And it ended up burning for quite some time; for days, in fact, before the last fires were extinguished. As anyone who has ever seen a tire fire can understand, once you get rubber burning, it's hard to put it out.

What you are seeing is as close as most of us will ever get to the firsthand experience of being out there on the front lines trying to fight an industrial fire like this.

In the foreground is a piece of the building that was propelled several hundred yards. This aerial shot gives you a better look at just how significant the damage was. And it also helps to put into perspective the size of this building.

As the video concludes, you are going to see fire-fighters on the roof of the building. Somebody asked me yesterday why was the grass yellow. Because it was wintertime in the South.

This is the stored material in the raw material warehouse continuing to burn. And there is an aerial shot of the compounding facility. Just to give you an idea of the size of scale we're looking at, those roof panels are 8 to 16 feet wide.

Could I have the lights, please? Thank

you. The result of this explosion where the 6 people died and 38 others were injured, as you can see from the video, the facility was virtually destroyed. Although there were parts of the manufacturing facility that sustained relatively minor damage, the damage was everywhere in the plant. And West decided to not rebuild at this location but to construct a new facility elsewhere in Kinston.

The center of the explosion was located in the area where the rubber was compounded. Chemical Safety Board determined that the fuel for this explosion was polyethylene powder. This polyethylene was used in the plant as an antitack agent to keep sheets of rubber from sticking together as the long strips of fresh rubber were folded for either shipment or for molding elsewhere in the building.

Fine polyethylene powder in a slurry of water and surfactant was called slab dip. The freshly formed rubber sheets ran through a tank containing this slurry. This also helped to cool the rubber. As the slab dip dried on the rubber, some residue was carried by air currents to the space above the ceiling tiles, where it settled out.

The dust layer on the ceiling tiles and other surfaces above the ceiling varied from very, very thin deposits to several inches deep on some beams.

The Chemical Safety Board's estimate is that considering the witness descriptions of the depth of the settlement and the size of the area, there may have been as much as one ton of polyethylene above that ceiling.

This photograph shows the structure of the rubber compounding building. And from this photograph, you can clearly see where the wall beams were bent by the explosion, especially in this area here.

This part of the structure was above what they call the kitchen, where the ingredients were mixed and put into bales that were taken up to the mixing machines.

The Chemical Safety Board's report on this investigation is available in hard copy form and on CD. And most of you should have a copy of that. I would like to highlight some of the findings that were in that report.

We found that the Material Safety Data Sheet for slab dip did not convey the dust hazards, did not even address the hazards of combustible dust if that polyethylene in this material was dried to a powder form. And the workers at West, especially the ones who had been above the ceiling and knew there was dust up there, were not informed of the dust explosion hazard.

When West changed antitack agent to polyethylene, they performed a hazard review. But that review did not include combustible dust issues.

There had been prior inspections by North Carolina OSHA, by the insurance providers for West, and other professionals, all of whom failed to identify the combustible dust hazard.

In fairness to them, West put a lot of effort into keeping this facility very clean. They made pharmaceutical devices. It's very important for them that these devices be as clean and uncontaminated as possible and that a very clean-appearing work site was maintained.

So, therefore, although the areas below the ceiling were very clean, it was the accumulation above the ceiling that caused the explosion. And that area was not cleaned. Any inspector walking into that plant would not have immediately noticed a dust problem.

Finally, the North Carolina fire code had incorporated NFPA dust standards by reference, but the design and operation of this facility did not meet those requirements.

The second combustible dust explosion that CSB had occasion to investigate happened just a few weeks after West. On February 20th, 2003, a phenolic resin dust explosion shook the facility of CTA Acoustics in Corbin, Kentucky, another small town whose major employer was rocked by explosion.

This facility manufactured automotive insulation forms from fiberglass mats that were impregnated with phenolic resin. And these formed parts were cured in gas-fired ovens.

This photograph shows some of the extent of damage to the CTA Acoustics' production facility. Its secondary dust explosions propagated throughout the building.

The effects of this explosion included the fact that 7 people died from their injuries and 37 others were injured. The damage to the facility was quite widespread. And this facility also had to be completely rebuilt.

The largest customer for CTA Acoustics was the Ford Motor Company, who temporarily suspended operations at four of their automotive assembly plants, which resulted in numerous layoffs from those facilities.

CSB determined that the fuel for this explosion was a phenolic resin, that it was lofted by cleaning activities and likely united by flames from the open door of one of the curing ovens. Witnesses describe actually seeing the secondary explosions igniting and traveling through the facility.

This resin used at CTA was a very fine talcum-like powder. This material is easily lofted, has a low ignition energy, and is relatively more explosive than other plastics, such as polyethylene.

This is a close-up photograph of the open curing oven that may have ignited the first of a series of resin dust explosions. The Chemical Safety Board's report on CTA Acoustics' investigation has been completed and published and is available on the CD-ROM that you were given when you initially signed in this morning. Here are some of the selective findings from that report.

CTA management was aware of the explosive potential of dust but did not implement effective measures to prevent explosions or communicate the explosion hazard to the general workforce.

The CSB found that inefficient baghouse operation and the lack of effective housekeeping resulted in unsafe dust accumulations on many surfaces.

Similar to the North Carolina case, Kentucky OSHA and risk insurance providers had also been in and inspected this facility before the explosion, but they did not identify the combustible dust hazard. CTA management had not applied the principles of pertinent and applicable fire standards to prevent dust explosions.

And, finally, the lack of effective fire walls and blast-resistant physical barriers also contributed to the propagation of damage and dust explosions throughout the facility.

Later the same year as West and CTA explosions, there was an aluminum dust explosion at the Hayes-Lemmerz Center national facility in Huntington, Indiana. This was on October 29th, 2003.

The Hayes-Lemmerz facility manufactured cast aluminum and aluminum alloy wheels at this Huntington, Indiana facility. These wheels that were produced at this plant went on the new cars for nearly every major automotive manufacturer in the United States. Newly cast wheels were polished and machined. This proceed produced scrap that was returned to the foundry area for remelting.

This photograph was taken by a photo journalist while the fire was still in progress. The bright light that you see at the left, in this area here, is the dust collector, which at the time of the photograph was still involved in a fire.

This photo also shows the damage to the roof. And you can to some extent -- okay. In this area here, you can somewhat see explosion and fire damage to the walls.

There was one person who was killed in this explosion. And six others sustained injuries, ranging from serious to minor. The explosion centered in the scrap remelting equipment and the dust collector, which were both damaged.

Unfortunately, I cannot really send you any additional details on this investigation because our report is still pending and we expect to release it sometime in the next few months.

There have been other dust explosions that are notable and worth mentioning here. In 1995, there was the Malden Mills explosion followed by Ford River Ridge power plant in '99, Jahn Foundry explosion also in '99, and the Rouse Polymerics explosion in Mississippi in 2002.

Malden Mills Industries was located in Massachusetts, the little town of Methuen. On

December 11th, 1995, there was a nylon fiber explosion at the plant.

Thirty-seven people were injured. And ultimately the company was sold, although the owner did a valiant effort to keep this facility at least on paper in business and kept all of the employees on the payroll for many, many months following the explosion.

On February 1st, 1999, a natural gas explosion at the power plant for the Ford River Rouge facility triggered subsequent secondary explosions of coal dust that accumulated on surfaces in the plant. Six people died, and another 30 were injured. The power plant had to be completely rebuilt. This accident also had significant impact on the automotive industry.

Nearly three years to the day before CTA Acoustics' explosion, a phenolic resin explosion at the Jahn Foundry in Springfield, Massachusetts resulted in the deaths of three people and caused injuries to nine others.

The resin that fueled this explosion was quite similar to and, in fact, made by the same company as the resin that exploded at CTA Acoustics. This manufacturer did not warn their customers of the explosion hazard after the Jahn Foundry explosion.

On May 16th, 2002, Rouse Polymerics in Vicksburg, Mississippi was rocked by an explosion of rubber dust that injured 12 people. Although no one was killed in the initial explosion, five of the victims eventually perished from their injuries.

At this time I would like to turn the podium over to my colleague Giby Joseph, who will present some of our preliminary findings on combustible dust explosion incidents.

MR. JOSEPH: Thank you, Angela. Good morning, Board members.

One of the objectives of the combustible dust hazards study is to collect dust incident data and to analyze this data to better understand the magnitude of the problem. We plan to do this by evaluating the number, severity, and causes of the incidents that we collect.

This is a quick overview of what we found from our data collection efforts so far. Since 1980, we have identified that combustible dust has caused 197 incidents, resulting in 109 fatalities and nearly 600 injuries.

Incidents that met the following definition were included in the data. We defined a combustible dust incident as a fire, an explosion fueled by any finely divided solid material, 420 microns or less in diameter, that caused or has the potential to cause serious harm to people, property, or the environment.

Our search for combustible dust incidents that have occurred in industrial facilities throughout the U.S., that's what we focused on, but our search excluded incidents that occurred in facilities covered by the OSHA grain-handling standard. The standard covers grain elevators, rice and flour mills, feed mills, and so on.

The search also excluded incidents that took place in the non-manufacturing sector, such as coal mines, universities, hospitals, military installations, and retail shops. Incidents occurring outside the U.S. were also excluded.

Our data collection efforts are not finished. For example, we need to gather information regarding causal data and property damage and business interruption costs.

Also, we need to look at more data sources for potential incidence. With that said, the results of this preliminary analysis are acknowledged as only a sampling of dust incidence. Data limitations preclude the CSB from drawing statistical conclusions on trends in the number or severity of dust incidence.

Our first graph is a breakdown of the 197 dust incidents by year. The highest number of incidents that we found so far in any one year is 16 in 1998.

This is a breakdown of the fatalities by year. Two thousand three had the highest number of fatalities within the 25-year period. Two thousand three also had the highest number of injuries.

This pie chart shows the distribution of the incidents by the type of dust. It indicates that various industrial material can create a combustible dust hazard. Metals such as aluminum and magnesium caused the largest percentage of incidents. Wood and food particulates also caused a significant portion of the incidents.

Plastic material such as phenolic resins and polyethylene led to nearly 15 percent of the 197 incidents. Other materials, such as coal, paint powder, pharmaceuticals, like vitamins, have also caused dust incidents.

Combustible dust hazards exist in many different types of industrial sectors. Metals which cause the largest number of incidents primarily occur in facilities that fabricate metal products or in foundries, which are classified under the primary metal industries, 11 percent.

Wood-related incidents occurred in the lumber industry or in furniture manufacturing. Coal dust incidents occurred primarily within the electrical services industry, such as power plants.

This slide lists states in terms of number of combustible dust incidents. Numerous other states have had multiple numbers of incidents, but this indicates that combustible dust incidents occur nationwide.

In summary, many fatalities and injuries have resulted from combustible dust incidents. Also, various industrial materials pose a combustible dust hazard. And, finally, incidents have occurred in many manufacturing industrial sectors throughout the nation.

Thank you.

CHAIRPERSON MERRITT: Thank you.

MS. BLAIR: I would like to at this point discuss some of the objectives for our continuing hazards study on fire and explosions hazard of combustible dust.

You have seen and heard some of the reasons why CSB chose to study general industry dust explosions in more depth. Here is some of the motivation for this.

Dust explosions cause significant damage, serious and often fatal injuries and job losses, as well as sharp community economic impact.

Investigations of West, CTA, and Hayes-Lemmerz accidents highlighted that there is no federal regulation that addresses dust explosion prevention in general industry.

There are also some other common issues from these investigations. That would be the inadequacy of MSDSs to convey the dust explosion hazard, inconsistency in fire code adoption and enforcement, -- and this was especially striking to the investigation teams -- the lack of awareness of the hazard by people at all levels of the organization, including management, engineers, safety professionals, and the workers.

Before you can adequately address a problem, you have to understand the scope and the scale of the problem. So we need to determine the number and effects of combustible dust fires and explosions in the United States. And we have chosen a 25-year time period.

The data that Giby has shown you is just the very beginning of our work in that area. And we encourage any of you who have access to data sources or even anecdotal information about dust explosions to contact us and let us know about that so that we can dig a little bit more deeply into that and add to our data.

We also want to evaluate the extent and effectiveness of the ongoing efforts by state and local officials to prevent combustible dust fires and explosions.

We need to evaluate the effectiveness of hazard communication programs and regulations with regard to combustible dust hazards. We also need to determine if additional state, federal, or private sector activities are necessary to prevent future combustible dust fires and explosions.

There are some additional issues that we hope to address along the way. The first one is a question as much for the people located in this room today as it is for the world at large.

The Chemical Safety Board's mission was originally foreseen to impact the chemical industry. Yet, we find ourselves deploying to investigations that don't appear to be chemical in nature until we get there and start understanding the chemistry that was involved.

But our question for you is, should the CSB limit the study scope to those traditional chemicals such as the ones that are addressed by NFPA-654 or should we keep the scope broad and continue to look at would dust explosions, food processing, and metal dust explosions?

Secondly, what can be done to more effectively communicate to facility owners, to managers, and as well as the workforce this hazard of combustible dust?

And finally is a question we will be hearing answers to today I hope. Is there a need for any additional research to resolve any technical issues or barriers to dust explosion prevention or to settle issues for which industry has been unable to reach consensus?

We expect to release a study of our findings from this investigation, to release that report sometime next year. And that report will include recommendations to improve dust, fire, and explosion hazard knowledge, understanding, and prevention. As always, additional information on this and other CSB investigations can be found at our Web site at www.csb.gov.

Madam Chairman, do you or other members of the Board have questions for the staff at this point?

CHAIRPERSON MERRITT: Yes. I would like to open it to the other Board members. Do you have questions for the first panel?

MEMBER VISSCHER: A couple of questions.

CHAIRPERSON MERRITT: Mr. Visscher?

MEMBER VISSCHER: Thank you. A couple of questions for Mr. Joseph.

I noticed in the definition of the combustible dust incidents that you looked at. You had a size of the particle?

MR. JOSEPH: Yes.

MEMBER VISSCHER: Have you been able to identify -- on the reports of the incidents, are you actually able to go back and get that information or --

MR. JOSEPH: At this time we have not identified the sizes of different particles, but that is something that we are working on.

MEMBER VISSCHER: Could you give a quick summary of what databases you have been using, --

MR. JOSEPH: Yes.

MEMBER VISSCHER: -- where you are getting the information from?

MR. JOSEPH: The majority of our incidents, about 70 percent, came out of the OSHA IMIS database. It's an inspection database that OSHA uses to track incidents.

Also, we have gathered a lot of data from the IChem E Accident database, which is an international database that includes U.S. incidents. And we have also gathered information from the NFPA fire journals. We have actually had NFPA do a search for us in their data, and they have provided some data.

And also we have done some searches in MARSH database. It's another international database that has U.S. incidents.

MEMBER VISSCHER: Other than the OSHA database, the other ones are reported by the company or they are picking up news media reports?

MR. JOSEPH: I think it is pretty much picked up from the newspapers and journal articles and so on.

MEMBER VISSCHER: Thank you.

CHAIRPERSON MERRITT: Mr. Bresland?

MEMBER BRESLAND: I am sure this question will get answered as we go through the rest of the day, but what is the current -- just a quick overview of what the current regulatory or code situation is in the U.S. regarding prevention of dust explosions?

MS. BLAIR: The current law of the land, if you will, in this area is primarily the state fire codes. California has a state statute on combustible dust hazards, but there is no federal safety standard that deals specifically with dust in these particular general industries. So what we have right now are the state fire codes, which include by adoption and reference the NFPA or International Code Council standards.

MEMBER BRESLAND: And if facilities were to comply with the International Code Council standards or NFPA, would that have prevented the accidents that we're seeing here in your listing?

MS. BLAIR: Well, that is one of the questions that we have to answer as we go through our study. We can say that from the investigations we have done so far by the CSB, that we were able to draw that conclusion that had the NFPA standards been adequately applied at those facilities, that the explosions would have at least been minimized, if not prevented.

MEMBER BRESLAND: I think when I look at the statistics, the number of accidents that have happened, it's obvious that a manufacturing facility doesn't want to have an explosion. And these explosions seem to be easily preventable. They're not complicated chemical processes which get out of control. They're really explosions because the dust has accumulated, and then there is something that sets it off.

Why is it happening, then? If somebody doesn't want to have an explosion, is it lack of knowledge or lack of knowledge of the hazards?

MS. BLAIR: Absolutely. Take West

Pharmaceutical, for example. This is a very good company that spent a lot of money to keep their plant clean. And had they been aware that there was dust accumulated above that ceiling that had the power to create an explosion, I have no doubt they would have cleaned it up. But again and again we're finding that awareness is one of the key issues that they simply don't understand.

And if you will recall from our public hearing in the first public meeting we conducted in North Carolina and also at CTA Acoustics in Kentucky, there was a great degree of disbelief that dust would actually do this to this plant. So we had to prove it. We had to do a demonstration for them.

MEMBER BRESLAND: Now, there aren't any OSHA regulations around the incidents that we have investigated, but there are OSHA regulations around grain elevators, for example? In my previous existence, I worked in grain manufacturing, a mill that exploded after I left and did a lot of damage.

Do we know what OSHA's requirements are for deciding that it's time to have a regulation? And is it X number of incidents? How do they decide that the situation with grain elevators was serious enough that it became time for the regulation? And if we were to go with OSHA with these statistics, would they decide that yes, the situation is serious enough that something needs to be done?

You may not be the right person to ask this question of. And I'm sure it will come up during the rest of the day.

MR. JOSEPH: That is a good question. And maybe you can direct that to some of the other panelists that we --

MEMBER BRESLAND: Okay.

MS. BLAIR: I do know that from having watched the rollout of the process safety management standard and other OSHA regulations that have come out since my tenure as a safety professional, that there are a lot of issues that have to be considered when a regulation is to be promulgated. And certainly the incident data are a key factor, but also the economic and societal impacts of the accidents that you are seeking to prevent. And it doesn't seem to be necessarily weighted just on the number of incidents or fatalities.

To give you an example, I believe when the benzene standard was promulgated, there was a fairly small number of actual injuries. That standard was promulgated mostly to prevent future injuries because we were talking about long-term exposure causing cancer. So we had a known hazard, and there was a standard promulgated to address it.

MEMBER BRESLAND: Well, I would certainly encourage all of the participants in the meeting today if they have other information on accidents to contact Giby and Angela with that information, with the statistics.

MR. JOSEPH: That would be very useful.

MS. BLAIR: And the easiest way to get in touch with us to remember, dust@csb.gov.

CHAIRPERSON MERRITT: One question I have is I was struck by a couple of your graphs up here. One indicated that Illinois and California seemed to have the most incidence in the state. At this point, do you have any idea why that might be?

MR. JOSEPH: One of our hypotheses or guesses is that Illinois and California are pretty industrialized states. So that is one of our initial I guess guesses. We're trying to prove if that is the case or not. But we are going to be studying that issue a little bit further as the investigation goes on.

CHAIRPERSON MERRITT: And also one of your graphs, I know that graphs can be deceiving and statistics can be deceiving unless you have the whole picture, but one of them appeared to indicate that there has been a significant rise in incidents over the last five or so years in your study or ten years.

Do you believe that is real? And is that something that you are going to be investigating as you go forward?

MR. JOSEPH: That is right, Ms. Merritt. That is one of the things that we are going to be looking real hard at as the study goes further on. One of the things that maybe the panelists and the whole group as itself could help us with is is to try to answer that question to see if what we're seeing is real or if it is related to data limitations.

CHAIRPERSON MERRITT: So, in other words, it may be that some of the recordkeeping earlier on is not as good as it is now or they were attributed to something else?

MR. JOSEPH: Yes. It could be that we are just now picking up incidents in the '80s. And we have better data to collect as the years go by. You know, in the '90s and 2000s, we just might be getting more data that is reported.

MS. BLAIR: It could be interesting to try and correlate this apparent rise with also the proliferation of information available on the internet and the way that information travels much faster now than it did before.

CHAIRPERSON MERRITT: Do you have any indication that there have been changes in manufacturing that might have contributed to some of this or is that something you are going to be looking at?

MS. BLAIR: We are looking at it. Anecdotally we're hearing things from manufacturers saying that, well, we used to, for instance, use liquid paint and solvent suspension. And for the reason of environmental regulations or other reasons, they have decided to go to powder-applied point.

So if we've got more people using power-coated, powder or static-adhered, powder-coated paint, instead of paint that is put on a liquid form and then dried, logic says there might be an increase in dust hazards resulted from that, but we really don't have the data to show that yet.

So this is one of the many issues that we are going to have to try and unravel.

CHAIRPERSON MERRITT: Thank you.

Are there any other questions?

MEMBER BRESLAND: Yes, one other question.

CHAIRPERSON MERRITT: Mr. Bresland?

MEMBER BRESLAND: Do we have any information on the impact of the OSHA grain dust standard in terms of the number of dust explosions prior to the promulgation of that standard and the number of explosions after the promulgation of the standard?

MS. BLAIR: We have a retrospective that OSHA conducted themselves wherein they indicate that there was a positive effect of the standard, but we also have access to the -- we have a data review contract currently ongoing with Dr. Robert Sheff, who was the source of much of the explosion data that OSHA used in their studies. So we're going to be able to go back to the original source data and take a close look at that.

MEMBER BRESLAND: And will that look at the impact of the regulation?

MS. BLAIR: Yes.

MEMBER BRESLAND: Okay. Thank you.

CHAIRPERSON MERRITT: Mr. Visscher, do you have any other questions?

MEMBER VISSCHER: Just one more question again for Mr. Joseph regarding data that you have been able to get at. Are you able to look into the incidents or is it kind of the results only?

I guess, really, the question I have is the incidents that the Board has looked at, these three incidents, recently, I think were all incidents in which there had been considerable build-up of dust over a period of time.

That had been removed on a daily or weekly basis as Angela has planned out in the West case. It wasn't obvious. So I'm not saying it was ignored necessarily, but it was built up over a period of time.

Are you able to look at the incidents enough to see whether that has generally been the case, that it takes some prolonged kind of build-up of the dust in most cases?

MR. JOSEPH: One of the things that we are having is finding causal information. So we have got some reports that we have been able to get some information that you just stated, but one of the problems that we are having with the majority of the incidents is trying to identify causes. And what you state is a causal type of effect out of some of these incidents.

One of the things that we are doing is once we identify the incidents, we are actually going back to companies that had these incidents and trying to get company reports that might give us a better idea of the causal information. So at the end of this study, we might be able to better answer your question.

MEMBER VISSCHER: Thank you.

CHAIRPERSON MERRITT: Well, if there are no further questions, thank you, Angela and Giby, very much for your presentation. And we move on to I think a somewhat unusual panel.

PANEL B: SOCIETAL IMPACTS OF DUST FIRES AND EXPLOSIONS

CHAIRPERSON MERRITT: We have a panel that will begin with a video of Mr. James Edwards, who was a victim of West Pharmaceutical Services' explosion and fire. This footage was courtesy of WRAL.

Next we'll view some clips from the Discovery Channel video of the CTA Acoustics' burn victims aftermath that was taken at Vanderbilt Hospital.

And, finally, Mr. Michael Wright, who is Director of Health, Safety, and Environment for the United Steelworkers of America, will discuss the impact of dust explosions in the U.S. workplace.

So, with that, I would like to ask that that panel begin and, Mr. Wright, if you would to please come to the front.

MS. BLAIR: Saving lives by preventing accidents is at the heart of what we do at the CSB. That is our mission, and that is what this dust hazard investigation is all about. It's one thing to talk about dust explosions in the abstract, but there are human consequences. And we thought it would be appropriate to share two extraordinary video clips with you this morning that deal with those human effects of these explosions.

The first video is about a victim of the West Pharmaceutical explosion and fire. His name is Jim Edwards. He was blinded and burned in the accident and could not be with us today to testify. However, Raleigh TV station WRAL kindly granted us permission to play this tape today. We have edited excerpts from a very fine series on WRAL about Jim Edwards, about his father, and his rehabilitation.

(Whereupon, a videotape was played.)

MS. BLAIR: The CTA Acoustics explosion and fire occurred on February 20th, 2003. And it just so happens that on that same date, Discovery's TLC Channel was taping a special segment of The Resident Life at the highly regarded burn unit of Vanderbilt University in Nashville, Tennessee. That is where several of the victims of the CTA explosion and fire were flown for treatment.

TLC and the Discovery Channel have graciously granted us permission to show excerpts of their one-hour document. This was episode number 106 of The Resident Life. We have selected a few moments from that program, which poignantly tells the story of the Corbin plant victims who arrived at Vanderbilt that morning.

(Whereupon, a videotape was played.)

MS. BLAIR: Jim Edwards, Robbie Baker, and Mrs. Philpott are brave spirits. They live on, but these are lives that will forever be changed.

We at the Chemical Safety Board constantly remind ourselves that our mission is to prevent these kinds of accidents and the tragedy of best and life-altering injuries.

We hope that these stories, those of North Carolina and Kentucky victims, graphic as they were, show the human dimension of what we are discussing today.

Thank you.

CHAIRPERSON MERRITT: Thank you, Angela.

At this time, do we need questions? Introduce Mr. Weight. Mr. Wright, you have the floor. Mr. Wright is the Director of Health, Safety, and Environment for the United Steelworkers of America. And he will discuss the impact of dust explosions in the U.S. workplace.

MR. WRIGHT: Just before I begin, let me say how moved I was by that last presentation and how much I congratulate the Board for doing it. We lost 37 members of our union last year. One or another of our staff investigated most of those fatalities on the ground and a lot of other serious injuries.

And there is often such a disconnect between going out and meeting with victims and trying to help victims and sort of understand what happened and then coming to this town and dealing with regulatory agencies that sometimes forget what it's all about. I want to congratulate you for putting that up front. That's very important.

I have got a written statement, which I will read. And I will leave some copies in the back at the end for those who might want one.

My name is Mike Wright. I am the Director of Health, Safety, and Environment for -- actually, the new name of the union is the United Steel, Paper, and Forestry, Rubber Manufacturing, Energy, Allied, Industrial, and Service Workers International Union.

(Laughter.)

MR. WRIGHT: That name is quite new. We merged with several other unions back in April. And most of us who work for the union still have not memorized the entire name of the organization we work for.

We are now the largest industrial union in North America. And we represent more than 850,000 workers in a variety of industries. And we answer, for short, to the United Steelworkers still or to the

USW.

I would like to thank the Board for convening this hearing and for the opportunity to talk about this issue and also for the opportunity to learn something from the other distinguished participants.

Dust explosions are a hazard in many of the industries that our union represents. As the Board knows, almost any solid capable of being oxidized can do so explosively under the right conditions and if it's divided into sufficiently small particles.

Every year the union provides training to several thousand of our plant-level safety and health reps. We like to do demonstrations when we do that. And one of the ones we do involves combustible dust explosions. We take a particular solid, shake it up in a Baggie, and then empty the Baggie over a cigarette lighter or candle or some kind of open flame. The resulting flash is very impressive. That material we use is non-dairy creamer, a pretty common material.

I thought about actually doing that this morning. And then I figured that setting off an explosion in a federal building in Washington, D.C. probably was not a good idea.

Earlier we heard about the recent Board investigations of explosions involving polyethylene powder, phenolic resin dust, and aluminum dust. Let me cite a few other examples.

In March of 1995, a worker named Al Jones was replacing a canister used to collect magnesium powder at the Timet Corporation in Henderson, Nevada. Timet is short for Titanium Metal Corporation. When some of the powder dropped out of a feed line and exploded, Mr. Jones was severely burned and died about three weeks later.

Timet is a primary producer of titanium. Magnesium is used in the process. Both metals can exist in that plant and other titanium producers in finely divided form. And we have had fires and explosions in that plant and others from both metals.

Several years ago, in fact, in 1999, the titanium industry experienced three major explosions and fires from metal fines, thankfully with no injuries. But that was a matter of sheer luck.

Other workers in 1999 in other industries were not so lucky. In October, a malfunctioning mixing machine emitted a large cloud of carbon black at a Titan tire plant in Naches, Mississippi. Cloud found a source of ignition and some electrical equipment that was not explosion-proof and exploded, badly injuring two workers. Both of them survived but were badly burned.

In fact, the rubber and tire industry has had a number of dust explosions over the years involving a variety of materials. In the mid 1980s, an employee at the Goodyear plant in Akron, Ohio was using a vacuum cleaner to remove dust from the inside of a resin tower in order to prepare the tower for a different batch. He had not been properly trained, was working on the night shift, and he neglected to ground the vacuum. Nobody had ever told him that was necessary.

Static electricity ignited the resin. That fire spread to the exhaust ducts and the filtering system before it was finally contained. And it was just short of spreading to a chemical plant with thousands of pounds of highly flammable liquids. Amazingly, the operator himself survived because the flash moved away from him, instead of toward him.

Two dust explosions have occurred in the industry in just this year. On February 25th, another resin explosion occurred in a Continental General tire plant in Mayfield, Kentucky, this time in a compounding room as the resin was being dispensed into a hopper.

One worker was burned, but his life was probably saved by the water deluge system. Others suffered from smoke inhalation. The fire reached the rooftop dust collectors before it was finally put out. It could have been a lot worse.

Just three weeks ago, on June 1st, at the Bridgestone-Firestone plant in Des Moines, Iowa, which makes large agricultural tires primarily, several workers were using a cutting torch to remove some decking from a process unit.

A loose flange, not one that they had cut away but something that had apparently been loose for years, fell into a dust collector and created a cloud of dust, which then came down over them. That was ignited by the torch.

Two workers were burned in the flash. The injuries to one were exacerbated when part of his Tyvek suit melted to his skin. Both survived, and they're both doing fine. But, again, that's a matter of luck.

The exact composition of the dust is still under investigation. The collector handled waste dust from different parts of the process. And the dust it handled could vary as the process varied with different batches from day to day.

I could continue with this from experiences from our Canadian members in forest products, who suffered, of course, from wood dust explosions, or the paper industry, who have been injured by paper dust, but perhaps I made the point that dust explosions can occur in a wide variety of processes and industries.

Let me say quickly that I am not an expert in the physics or chemistry of dust explosions. We have people on our staff who are, but I'm not one of them. And in the present regulatory climate, we have not petitioned OSHA for new standards in this area.

We are hoping that one of these days, OSHA will get around to adopting, for example, the previous Board recommendation on highly reactive chemicals. But this OSHA doesn't seem to be interested in adopting many new regulations.

So far we have not initiated in the union a specific project on dust explosions per se, singling them out from other hazards, but we do, of course, include it in our major training programs, where it is appropriate. And we look for that kind of hazard in the workplace inspections we do.

As a result of the Board's interest, we are considering starting such a project, working with you. And we appreciate that opportunity to work with you and with the industries whose members we represent.

It is still too early I think for the union to answer for ourselves, let alone for the Board, in public testimony the questions that you posed in your May 9th Federal Register notice, but I'd like to suggest a few principles that might guide future work.

First, whatever program the Board recommends should be comprehensive. It should not exclude any workplaces. And we should not attempt to provide or produce a list of specific combustible dusts to which the program applies, as, for example, is done by OSHA under the process safety management standard.

Such a list could never include everything that would be of concern. Non-dairy creamer probably would not make the list, for example. But if we can use it in demonstrations, then the plants that produce it should and probably do -- I hope they do -- worry about explosions.

Further, the risk of an explosion depends on many factors other than the identity of the dust itself, particle size and humidity being just two. The only answer is a workplace-specific, process-based risk assessment methodology for all combustible dusts, not just a restricted list of the dusts to which it applies.

Second, we need to worry, not just about dust explosions in the ambient workplace environment, but also in duct work collectors and the like. And since explosive concentrations of dust and air usually are assembled accidentally, the program should focus mostly on the consequences of process upsets and unusual circumstances. Here the OSHA process safety management standard does provide a better model along with perhaps an even better model. And that's the EPA risk management program.

Third, any effective program should address the entire fire triangle: fuel, oxygen, and heat or in this case ignition. In the rubber industry explosions I cited earlier, OSHA's only specific regulatory tool was to cite for the lack of explosion through fixtures, in effect, addressing only the source of ignition.

In contrast, the grain dust standard also addresses fuel by limiting the build-up of combustible dust. And some specific controls in metals plants addressed the oxygen leg by, for example, handling powders in a nitrogen atmosphere or in some other inert atmosphere. So we have got to look at all three legs of the fire triangle.

Finally, the product of the Board's work should ultimately be used by OSHA and perhaps by other agencies to draft appropriate regulations. Of course, many companies and trade associations are willing and able to make effective use of voluntary programs. And we work with some of those companies on this issue, and they do a terrific job. They don't need regulations.

But the fundamental problem with a voluntary program is that not everybody volunteers. And workers in those enterprises and members of the public living near them also deserve protection.

I want to thank you again for the opportunity to testify. And on behalf of the USW, let me commend the Board for all of your fine work, not only this hearing, but we're seeing a pretty good example of some terrific work by the Board in the Texas City BP-Amoco investigation. We represent those workers. And your people down there have been superb in investigating that accident.

Thank you.

CHAIRPERSON MERRITT: Thank you. Can you remain here --

MR. WRIGHT: Sure.

CHAIRPERSON MERRITT: -- if we have any questions?

MR. WRIGHT: Be glad to.

CHAIRPERSON MERRITT: Do we have any questions by the Board members? Mr. Bresland, do you have one?

MEMBER BRESLAND: Do you have anyone within your union organization or your union leadership who would be -- who the Chemical Safety Board should be working with to think more about the statistics we showed earlier in terms of are there some accidents we haven't seen? Do you have other statistics within your organization that would help us in our study?

MR. WRIGHT: It is mostly episodic. I think that one of the problems with gathering statistics is knowing at what level to sort of quit.

When I go into a tire plant, for example, we talk about dust fires. And they're common, not every day but several that are of concern a year in almost any working tire plant.

Usually nobody gets hurt. There isn't a lot of property damage, but there certainly could be. So sort of deciding what scale you want to work at is I think an important issue.

We can probably go back and reconstruct some of the history of dust explosions in at least some particular plants. There are some places where either the union safety committee or the management structure keeps pretty good records. And we could certainly help with that. But I think doing something comprehensive across the board in every one of our workplaces would be tough.

MEMBER BRESLAND: I used to work in the chemical industry. Generally workers and managers in the chemical industry were pretty well-aware of the hazards of the chemicals that they were dealing with, which ones were toxic, which ones were corrosive.

What is the level of awareness of workers that you represent in terms of their awareness of the hazards of combustible dusts? And you represent right across the board many different types of industries. What is your gut feeling about the level of awareness of the potential for a dust explosion?

MR. WRIGHT: I think it varies. I think that, for example, at places like Timet, where they have had dust problems, dust explosions from both magnesium and from titanium, although the titanium ones are much less common because titanium forms an oxide coating rather quickly.

But I think there the awareness is very high because people have seen it with their own eyes. If you work there for a few years, you've seen some fire explosion from especially magnesium.

I think that is also true for people who work in, for example, compounding rooms in the rubber industry. We have tried to raise awareness of dust explosions when we do training in industries like metal industries, where you can get finely divided powders or especially the rubber industry.

We just merged with the union that

represents paper workers, but from what I have seen, they have a fairly active training program around, for example, paper dust.

And the wood workers in Canada, another group that we represent, first products, people who work in sawmills know about that hazard as well.

I think, though, that when it gets a little less common; for example, the West Pharmaceutical explosion, I don't think the workers possess knowledge that, for example, management didn't have.

From what I understand from your investigation, nobody would have seen that one. And I've got to confess that if one of our investigators from the union had gone in there, I'm not sure we would have seen it either. So I think it's really all over the map.

The one thing I can tell you is that when we do, for example, that non-dairy creamer little demonstration, people are surprised by it. People generally don't know widespread this hazard is, especially outside their own industry.

MEMBER BRESLAND: Okay. Thank you.

CHAIRPERSON MERRITT: Mr. Visscher, do you have a question?

MEMBER VISSCHER: Thank you. Can I still address a question to the panel here?

CHAIRPERSON MERRITT: Certainly.

MEMBER VISSCHER: Okay. This may go to Mr. Wright or to --

CHAIRPERSON MERRITT: You are on the Board. You can --

MEMBER VISSCHER: Thanks.

-- or to Mr. Joseph. I noticed in some of the examples you gave like that, those are kind of like -- I don't know what the right term is but direct explosions, as compared to secondary explosions, which are the ones that -- these three the Board has been looking at are -- I guess I am curious.

First of all, in the numbers that we have given, number of incidents, are we including both types of explosions in that number?

MR. JOSEPH: That is right, Mr. Visscher.

MEMBER VISSCHER: Okay. Is there a

sensible way of dividing those two? I guess in terms of work practices, there would be to some extent dividing between kind of -- like the explosion you mentioned at Timet. They're working directly with the material. It's not a secondary explosion. It's stuff that cropped out.

So is there a sensible way in terms of work practices or something to look at those in two different ways or should we just consider dust explosion as dust explosions?

MR. JOSEPH: We have been including them as one.

MEMBER VISSCHER: Okay.

MR. JOSEPH: But I don't know if there are other recommendations. If there is an easy way to divide it, then we can do it.

MEMBER VISSCHER: It kind of gets to the question earlier in terms of looking behind all of these numbers and what really caused the accident in each of these, I guess.

MR. JOSEPH: And I guess that is where we are still working on issues because we don't have the causal information to several of these incidents that we have in our data.

MEMBER VISSCHER: Did you have the ones that Mike highlighted?

MR. JOSEPH: We are working on it.

MEMBER VISSCHER: I appreciate that.

MR. WRIGHT: I would be surprised if he had all of them.

MEMBER VISSCHER: Okay.

MR. WRIGHT: To just answer your question a little bit, Mr. Visscher, some of the ones in the rubber industry that I mentioned may have been secondary explosions.

For example, people will mix a lot of material in a big device called a bandbury mixer. And you get out of that both flammable vapors and depending on how they're compounding that batch of rubber, you will also get some kind of combustible dust. And sometimes a big cloud of stuff comes out of the bandbury, finds a source of ignition, and explodes.

It's hard to separate at that point how

much of it was basically a primary dust explosion and whether the initiating event was really a vapor cloud explosion that spread to the dust.

So it's a difficult problem. But I think one certainly has to look at both.

MEMBER VISSCHER: I noticed, for example, you mentioned in the rubber industry explosions. And you said that OSHA's only specific regulatory tool had to do with the electrical. I guess they didn't have reg classification for the electrical connections?

MR. WRIGHT: Yes, yes.

MEMBER VISSCHER: Were they cited under either the housekeeping standard or general duty clause as well?

MR. WRIGHT: They could have been cited under the general duty clause. I don't know. In some of those cases, housekeeping really didn't apply because it was again -- it wasn't settled dust on a surface as much as it was dust emitted during a kind of a mixing process.

For example, the worker who was cleaning out the big resin storage unit, that unit was --

that's not a housekeeping issue. You're supposed to have resin in there. He was inside cleaning it because they wanted to put another batch of resin in, a different resin.

And, of course, using a vacuum in that kind of situation can create a cloud. And because the vacuum wasn't grounded, it created a spark.

They don't do that the same way anymore either. They've got other lines of defense besides just grounding the equipment.

MEMBER VISSCHER: If it is accumulating dust, then the housekeeping standard, I believe, has been applied by OSHA. You're saying that this part of the explosion occurred as part of the process. So there wasn't really a housekeeping issue.

Thank you.

CHAIRPERSON MERRITT: We have spoken about housekeeping and a number of other issues. One of the things that truck me in our investigations had to do with the information in Material Safety Data Sheets. From a worker's perspective, that's I think their number one source of information about materials, but it also is management's number one source of information from the supplier as to what that information is.

Do you have any comments concerning the quality or level of information on Material Safety Data Sheets that supplies information in an adequate or inadequate way to workers and management.

MR. WRIGHT: Yes. We have actually got a lot of comments about that. We are big fans of the OSHA hazard communications standard, but one of its widely acknowledged shortcomings is that the information on some Material Safety Data Sheets is just dreadful. Even where the information is there, it can be represented in a way that is incomprehensible.

My favorite example of that -- and this isn't a dust problem, but one of our local unions got two Material Safety Data Sheets for two identical products from different manufacturers. The product was refractory ceramic fiber, which is a carcinogen.

One of the MSDSs said, "Note: This product has been associated with malignant and nonmalignant neoplasms of experimental animals exposed by an interperitoneal installation. As this routed exposure does not mimic the human experience, the significance of this finding is uncertain."

CHAIRPERSON MERRITT: Of course.

MR. WRIGHT: The other one said, "Warning: Causes cancer." I guess you could say that both pieces of information were basically equivalent.

What was ironic is that the local union members were far more frightened of the first material than the second. They handled stuff that caused cancer all the time. They figured, boy, if the lawyers and the scientists came up with this kind of hazard warning, it must be really bad stuff. So that's the kind of thing you run into.

There is a path forward. And that is there is now a new world-level system called the globally harmonized system that has been put together, which attempts to standardize hazard warnings, attempts to also standardize the way we classify things into different areas so everybody will have the same definition of, let's say, a combustible dust or any other kind of hazard.

If the U.S. adopts that, ultimately it will be a major step forward. And MSDSs will get a lot better.

CHAIRPERSON MERRITT: Another question I had is, with regard to housekeeping issues, I know that in some instances, facilities, even those that we have investigated, looked at this powder problem as a housekeeping problem, rather than as a hazard, certainly due to lack of information, maybe due to some technical information or technical expertise.

What do you think -- I mean, the level of understanding among the general workforce is that if you go into a warehouse where you are recycling paper and there's paper dust all over everything, it's more than a housekeeping issue. What do you think their level of understanding is for the common worker about this as a hazard?

MR. WRIGHT: I think it's really all over the map. It depends on how good the company's training program is. It depends on what their history of past incidence is. It depends on how recently that workers has been hired. It depends on whether the union knows about this problem or if there is indeed a union in the plant. It's sort of all of those things.

I guess we have been in plenty of places where worker knowledge of hazards is really quite good and, unfortunately, an even larger number where it's pretty bad. It's just all over the map. That's one reason why focusing on this hazard, which I think is one in which the training probably isn't as effective is I think especially important.

Usually we find there's a lot more awareness of the more common events. Dust explosions in most places don't happen every day. And there's always the problem of people taking seriously and having some knowledge of these low probability, high consequence kind of --

CHAIRPERSON MERRITT: Do you think that the recognition of a dust explosion is usually there? I know you do investigations with many accidents. You know, we get notification all the time of incidents that have occurred through our news reports.

Often it's at a magnesium plant or a

wood-processing plant or a paper facility. And they report it as a fire or an explosion and fire but no mention of dust.

Do you feel like that there probably have been events that have been identified as unknown source fire that may have been dust explosions?

MR. WRIGHT: I am pretty sure there have been. One of the problems we have is that we can't investigate every accident in every one of our facilities. We have about 5,000 workplaces. And so we investigate facilities and very serious ones.

The way we find out about the accidents or the fires that have smaller consequences in terms of injuries or the near misses is we'll go into a plant where the union has asked us to do an inspection or where the company has asked that because we get those kinds of requests, too.

We're a free service essentially. And in talking about hazards with people, we will learn about those things. But they're not reported often. There will be a company accident investigation report, which just says there was a fire in the van barrier, there was a fire in a certain part of the paper-processing line or something like that.

CHAIRPERSON MERRITT: It's hard to learn from those, isn't it?

MR. WRIGHT: It's hard to learn from those.

CHAIRPERSON MERRITT: Right. Does anybody else have a question?

MEMBER BRESLAND: I don't have a question. I just want to make a comment. When we had our West Pharmaceutical public hearing that was held in Kinston last fall, Mr. Edwards, who is the gentleman who was featured in the movie, came to hearing with his father.

I had the privilege of meeting him there, and I was quite amazed at how gracious he was, in spite of his terrible accidents. I didn't realize that he was blind until he told me that he had been blinded.

He wasn't blinded in the incidents themselves. The blindness occurred as a result of some of the injuries that happened. And it was certainly for me an experience I will not forget, having met him and met his father and having had the opportunity to speak to him for a few minutes at our meeting.

CHAIRPERSON MERRITT: Thank you. Thank you, panelists.

I think it's important to recognize that at the beginning of this, we're going to be doing a lot of discussion talk about the technical events and the technical understanding of dust explosions throughout the rest of the day. And I think it's important to understand that each of these has a human impact. And that's indeed what we're trying to prevent, the human impact.

The detail and the engineering and the science are interesting, but the outcome is how do we prevent these very tragic and very human-impacting -- both physically and economically, how do we prevent these events?

So I thank you very much, the panel this morning, for the presentation. Thank you, Mr. Wright.

At this time, we are ahead of schedule.

Don't you love that? We're going to take a break. We're going to take 15 minutes. I am going to call us back at exactly 10:20, which gives you a few minutes. And then we will convene our second panel. And so we would ask that panel to convene up here before the end of the break.

Thank you very much.

(Whereupon, the foregoing matter went off the record at 10:05 a.m. and went back on the record at 10:21 a.m.)

CHAIRPERSON MERRITT: I would like to thank the panel -- this is Panel C this morning -- for your attendance and your contribution. I'd like to introduce the panel. It's not in any particular order, so -- I don't think. We'll see how well we've organized this.

First, I'd like to welcome Mr. Al Mitchell. He's State of Kentucky Fire Marshal. Thank you. Mr. Chris Noles, he is North Carolina Office of the State Fire Marshal; and Mr. George Miller, National Association of State Fire Marshals; Mr. Guy Colonna of the National Fire Protection Association;

Mr. Dave Conover of the International Code Council; and Mr. Tom O'Connell of North Carolina Department of Labor. Is Mr. O'Connell here? Has he signed in?

So, well, thank you. Hopefully he shows up here. If not, then we'll proceed. I'd like to begin, then, with Mr. Mitchell, if you would, please. Thank you very much for being here, and we are anxious to hear all of your testimonies.

MR. MITCHELL: Thank you, Madam Chairman. I'm very glad to be here also. I would like to address one issue you all had asked about the MSDS sheets. The MSDS sheets, so many times when they come into these manufacturers we're finding that they will say non- explosive, non -- they will not burn, this type thing.

But what is happening is that -- and they don't when they come in the plant. They come in these big tall barrels, and they're all packed in tight. So they won't explode or they won't burn. But when they get them out in the plant and start using them for the process that they go through, that's when they will become explosive.

We've got one on a particular industry in our state that has talcum, and it came in to them saying non- explosive, non-burnable. And as you know, talcum is very explosive. So, but that's the problem we are running into in our state.

What I'm going to do is I'm going to give you sort of a timeline of what has happened to the state fire marshal office in Kentucky with this -- dust fire and dust explosion conditions that we're addressing.

But since we -- we met with Steve Wallace of the U.S. Chemical and Safety Board in January 2005, and basically he gave us an outline of what he will be -- what the Chemical Safety Board would be presenting to London, Kentucky, in February of 2005. And we met with them and got an idea and got prepared for it, and he sort of let us know what our responsibility was going to be after that.

At that time, and I'd like to introduce him, my boss, Van Cook, set up biweekly meetings in our office to discuss the dust problems and the dust conditions in our state. And if Van would stand up, Van Cook is Executive Director of the Office of Housing in Kentucky, and he has been very interested and very instrumental in pushing things forward.

Let me -- and before I go on, I just happened to think, there's a couple other folks from Kentucky here also. The Commissioner of Labor is here, Phil Anderson; and one of our OSHA Directors, David Stumbo, is also here. So we -- Kentucky has taken this condition very seriously, and we're moving forward on it.

So I'll continue on. We went to London, Kentucky, for the CSB report in February 15th of 2005. What has happened since then, we've come a long way, I must say. The State Fire Marshal -- the CSB report did say that we were responsible, that it is our responsibility to investigate, to help prevent dust explosions in the state.

Since that time, we have been very involved, we've -- so to speak we've sort of put the rubber to the road I guess you'd say. We've had numerous meetings, and I'll go through the timeline of it. But it's -- what it boils down to in the state is the State Fire Marshall has the right in Kentucky to enter any building any time he decides -- if he suspects life or fire safety. And that's the way our statutes are written. So it does become our responsibility.

We also began a series of meetings with the Secretary's office, the Secretary of Environmental and Public Protection cabinet. They become involved, and then that's when we tie it in with the Labor Department. So since that time, we have had monthly meetings with our Secretary's office, the Labor Department, and the Fire Marshal's office.

We began inspecting businesses. I sent my people out, and we inspected a business and found major, major problems. This is the one that was using talcum to wrap around its product. My guys went in and about three weeks later they called and said that -- decided that I should go down with them.

So Mr. Cook and myself went down with our inspectors, and they had already started cleaning the plant. They had already made a major difference in it.

We got word of another one, a business in Georgetown. This is a plant that made magnesium, graphite automobile parts. This was -- I took pictures. I've got some pictures of this, and you wouldn't believe it. It's open seven days a week, 24 hours a day, and they have major problems. They have -- they have hired a specialist to come in and start working with them. They also came to the class we had, which I'll go into in a minute.

We had a dust explosion in Hopkinsville, where they had a tremendously clean plant, a very clean plant but they had a duct system, a bag system, that was all efficient and very good, but they forgot to check the ductwork. And they had a little ignition source, and it got up into that and it blew the corners, it blew -- it just -- it collapsed the whole system.

It just -- the explosion went through it. It sucked the pipes in, and then blew the corners and everything off. No one was killed. No one was hurt. I'm sure a bunch of people were scared to death.

We had nowhere to start. We did not have any idea what kind of businesses we had, what kind of problems we had in the state. We got together with the Department of Labor, obtained a list of 7,500 potential dust-producing facilities.

We sent a letter to every one of these facilities.

CHAIRPERSON MERRITT: How many?

MR. MITCHELL: 7,500.

CHAIRPERSON MERRITT: 7,500.

MR. MITCHELL: Well, let me clarify something here in a minute. This was the biggest mistake we've made.

(Laughter.)

We had probably -- we have a Mom and Pop store that I had one person call me and say, "Well, my wife makes quilts. When would you like to come by and inspect them?"

(Laughter.)

Another one making jewelry. And, you know, I said -- my comment to most of them was, "Well, I don't know whether I want to inspect them, but I'd like to come by and see your product sometime."

(Laughter.)

But we've decided -- I took it and gave it to my field supervisors, my field people. We've cut this list down to about 2,200 people. That's the people that's on the list right now that we need to inspect. But we have some that are not on it. We are in the process of trying to find and remain -- find out who are -- who we should leave on it, who needs to be added onto it. Some places have not been registered.

We had the small dust explosion Mr. Wright talked about in Western Kentucky. It was a plant -- it was a coal-producing plant that -- the system worked. It did its job.

We've had -- and one of the things that we've started doing that Mr. Cook has insisted on is building codes. Well, in our office building codes approves the building, the plans, the buildings, and up to their final construction. And they initial the CO, certificate of occupancy, and then they turn it over to the Fire Marshal's office.

Okay. Building codes is currently

flagging all plans that have potential dust problems, and they're letting us know about them. And then, after they give them the certificate of occupancy, they let us know that we need to start looking at them.

One of the things that we -- another thing we did right away was we got Guy Colonna, who is on the Board here, from the NFPA. We had a class, a four-hour class, on the NFPA 654 in our office. We scheduled it.

The response was so huge that I think we overpacked the room and the Fire Marshal could have gotten in trouble. But we had about 150 people show up to have this class, and they were from industry as well as departments from around the state. Very successful.

We had a Dr. Jack Valencia from our Labor cabinet, who also came in, and he's a very informative, very well-spoken person that talked about inspection processes and what we should do for inspections and how we should do them.

We have struggled -- we have taken and we have developed an inspection form to add to our facility and storage facility form. We take -- have developed one just for dust to -- when we start doing dust inspection, where we're doing dust inspection.

We are trying to decide, where else do we need to go? We've had in the past few weeks heating systems that have dust fires in them, HVAC systems that have had dust fires. So do we need to -- I mean, we're going to have to start looking at those, whether the grain storage facilities have been met.

We have a large amount of coal -- coal dust in Kentucky. These type things are all going to have to be inspected. We're going to have to get to the point that we need to see exactly what is considered dust and where we need to go.

We've had the storage facility about a year ago that had a graphite explosion. A forklift hit dust on the floor and exploded -- in the dust, and it blew the roof off and moved the building about two foot. We talked about grain elevators. I have no idea how many grain elevators are in Kentucky.

We are in the final stages of our --

completing our inspection process, and plans are also being made to -- it's going to take me probably about 10 more people to be able to do this job right, and to do the state right. And we're in -- we're in the process of even realigning our office to be able to do this.

If any of you would maybe like to see pictures sometime, I'll be glad to show them to you, to give you some pictures of idea of problems and things going on in the state.

Other than that, I'm glad to be here, and I'd be glad to help in any way. And if you've got any questions for me, I'd be glad to answer them.

CHAIRPERSON MERRITT: Thank you very much. We'll be eager to talk with you some more.

At this time, I'd like to introduce Mr. Noles. What we will be doing is asking questions of the entire panel at the end.

MR. NOLES: Good morning. My name is Chris Noles. I'd like to thank the panel for inviting me here today.

Before I read my statement, what I would like to say is that based on the CSB investigation we have made some changes within our local fire code, our state fire code. One of the two changes that were made was to take out some areas of the code that appear to be permissive.

Like, for example, there's one area of the code that talks about having permits and being required to go into permits. The first part of -- first chapter of the code goes into the fact of when you're required to have a permit and when it's up to the jurisdiction to demand that a permit be applied for. We've made that change, so that all permits are now mandatory.

We've made another change to Chapter 13 of our fire code that talks about, you know, when a code official has the authority to enforce a requirement of the code. You know, we've made that a little bit more stronger, so that it doesn't appear to be so permissive.

We've also gone in, we've increased the training that goes to -- to the fire inspector, so that they're familiar with dust hazards and they're familiar with these types of things that they weren't exposed to in the past.

But I'll go ahead and read my statement now. My position at the Office of State Fire Marshal is Chief Fire Protection Engineer. I'm responsible for interpretations relating to the 2002 North Carolina Fire Prevention Code, and our 2002 North Carolina Fire Prevention Code is based on the 2000 edition of the International Fire Code with North Carolina amendments. The International Fire Code is public -- is published by the International Code Council.

A successful fire marshal understands certain responsibilities be effective. A fire marshal needs to be expert in codes and reference standards, understanding the intent of the code when addressing an issue not prescriptively covered by the code.

A fire marshall also acts as an intermediary between the Fire Service and the public understanding how the Fire Department will respond during an emergency. Finally, a successful inspector is an expert in public relations by letting the building owners and representatives know that the codes and regulations are for their benefit.

Unfortunately, all of the training an inspector receives is ineffective when a building owner or building owner's representatives does not notify the jurisdiction of proposed work. This notification is made through the application of a permit, which notifies the Inspection Department that work will be done.

The 2002 North Carolina Fire Prevention Code identifies specific operations that are considered dangerous enough to require a permit. Without knowledge of the work being performed by way of the permit, the fire inspector is already at a disadvantage.

The application for a permit provides notice to the inspector that work is proposed to be performed. The inspector then may need sufficient information to verify a safe construction and, subsequently, a safe operation.

In the case of combustible dust hazards, the concern for safe operation is amplified. In many situations it may be the building owner or the representative's opinion that a combustible operation is not dangerous simply because there has not been a fire or an explosion in the past.

In many cases, this is an erroneous justification for businesses to move or install new equipment without notifying the jurisdiction through the application of a permit.

Until recently, the 2002 code involved the application -- or identified the application of permits that involve combustible dust operations as optional. This was not to imply that the safe guidelines in the codes were to be ignored, but was written to allow the jurisdiction not to require the paperwork to be filed.

However, a recent code change in the North Carolina code has modified this optional permit to a mandatory permit. This change eliminates any confusion about the applicability of the code and provides notification to the jurisdiction when a combustible dust operation is altered or started.

Even with the mandatory application for

the permit, one difficulty is educating the public, so that they know to apply for a permit. Once a permit is applied for, the inspector has the opportunity to request construction documents, evaluate hazardous material storage, and operations for the purpose of protecting the building's occupants and emergency responders.

Additional difficulties come from modifications that were not permitted, and become overlooked during later scheduled inspections. Without notification to the jurisdiction, the inspector would not be aware of these modifications within a concealed portion of the building.

Limiting the scope of the inspections to the occupied spaces is a level of trust that every fire inspector shows the building inspector -- the building owner or the representative. This is not to say that all building owners purposely avoid permits, but, rather, assume that a change would not be dangerous. This is the area where public education is the most beneficial.

For example, in regions of the country

where corn is harvested, persons are well aware of the dangers of corn dust by news reports of exploding grain silos. However, persons may not be aware of other dust hazards, such as the collection of magnesium or aluminum powders. These types of dangers are best addressed by the owner having full knowledge of the material in which they are dealing with.

The code references to the applicable standard -- the code references, the applicable standard, lead the inspector to take appropriate action. But without the appropriate knowledge, it becomes the inspector's job to inform the owner's representatives of safe designs, assuming that all of the information has been made available to the inspector.

North Carolina is in the process of expanding training for inspectors, with the understanding that the -- this may be the last stop between a design and a potentially dangerous operation. North Carolina has also made the application of a permit mandatory for all new and revised operations that involve combustible dust.

Looking forward, inspectors need more resources to identify when a material represents a dangerous combustible dust.

For example, we know that sawdust is defined as a combustible dust, but inspectors do not know when the material represents a dangerous condition. In this example, Factory Mutual has performed tests that identify what densities sawdust represents a dangerous condition. Other resources, such as the appendix of NFPA 69, could be made more user-friendly for inspectors and plan reviewers.

It's my recommendation that the industry improve the hazard data that describes various conditions that make the specific material dangerous in an easy-to- understand format. This information can be as simple as explaining the types of material concentrations that create an explosive environment, to explaining the safe use of the material.

CHAIRPERSON MERRITT: Thank you very much.

Mr. Miller?

MR. MILLER: Thank you, Chairman.

Good morning. I am George Miller, and I'm pleased to be here this morning on behalf of the National Association of State Fire Marshals to share our view on combustible dust fire and explosion hazards.

By way of background, NASFM -- and that is what we call ourselves -- our mission is to protect human life, property, and the environment from fire, and to improve the efficiency and effectiveness of safe fire marshals operations. NASFM's membership comprises the most senior fire officials in the United States.

I've been part of the association for many years, initially becoming involved as the Chief of Fire Code Enforcement in the State of New Jersey. After retiring from that position in February of this year, I've been working with NASFM to further its goals and objectives.

The state fire marshals responsibilities varies from state to state. But marshals tend to be responsible for fire safety code adoption and enforcement, fire and arson investigation, fire incident data reporting and analysis, public education, and advising governors and state legislatures on fire protection.

Some state fire marshals are responsible for firefighter training, hazardous materials incident response, wildland fires, and the regulation of natural gas and other pipelines.

Governors or other high-ranking state officials appoint most of our members. Our membership includes former state police officers, firefighters, fire protection engineers, state legislators, insurance experts, and labor union officials.

In the spring, the U.S. Chemical Safety and Hazard Investigation Board asked us to gather insights from our membership about the types of inspections being conducted by state fire marshals related to possible combustible dust fires and explosions.

This included getting a sense of the number of combustible dust fires and explosions that have occurred in the United States in the past five years. We receive responses from 19 state fire marshals offices throughout the country. In our survey, only three states -- Massachusetts, Nebraska, and Oklahoma -- were able to document any history of these types of dust explosions, generally occurring, of course, in industrial facilities.

Their recollections were of only four incidents in the past six years. In Nebraska and Oklahoma, two fires involved grains. Another Nebraska incident involving grain occurred at a dog food plant last year.

The worst dust explosion that was reported to us in this survey happened in Massachusetts in 1999 -- the phenolic rosin dust explosion that resulted in three deaths.

There may be numerous dust explosions occurring nationwide, but they may not always be brought to the attention of state fire marshals. This, in part, may be the result of a disconnect between state fire marshals offices and the agencies charged with overseeing combustible dust fires and explosions from a worker safety perspective, the Occupational Safety and Health Administration, and the National Institute for Occupational Safety and Health.

We also suspect that our e-mail survey was simply overlooked by a couple of states that do have information on these types of incidents. For instance, our survey did not produce information on the Kinston, North Carolina, combustible dust explosion in 2003, which the Board investigated.

However, in subsequent discussions with North Carolina, we learned that this -- his office, the state fire marshals office, was well informed in the matter. That dust explosion, as has been discussed, killed six workers and injured 38 others, including two firefighters, and could be felt 25 miles away.

Burning debris from the fire ignited wooded areas as far away as two miles. The plant burned for two days, further endangering the lives of fire safety personnel.

Likewise, our survey failed to pick up all of the agricultural dust explosions. The Department of Agriculture, in its 2004 annual report to Congress of the Federal Grain Inspection Service, reported that 21 such explosions have occurred since 2002.

In further studying this matter, we are left with the impression that there is a significant potential for incidents in several industries. Paper manufacturing plants are susceptible, because the cutting of paper and running rolls through conveyors and other machinery creates paper dust, subject to ignition if it is suddenly dislodged. And you're not going to see that sort of thing in an MSDS unless MSDSs are significantly revised to require some reporting of what occurs with the material when it is in process.

Combustible metal dusts are also subject to this hazard, so industries involved in milling of aluminum, magnesium, and other similar materials are sources of concern. There is clearly no single clearinghouse for this type of information. As this Board has already noted, NASFM's ability to help rests on the authority and adequacy of resources of individual state fire marshals.

The CSB's final report from the investigation into the Kinston incident called for the state to adopt a National Fire Code, NFPA 654, and increase training for North Carolina fire code officials. The CSB determined that a root cause of the fire was inadequate consultation with fire safety standards.

You found that properly adhering to the code and standards means fires would be averted because recognized good practices would be followed in the handling of combustible dust, and employees would receive regular training on the hazard.

The states with these types of active, aggressive fire prevention programs in industrial facilities such as Massachusetts, Nebraska, New Jersey, and Oklahoma, are ahead of the game, and we wholeheartedly support your recommendation for all states.

The New Jersey State Fire Marshal employs some 35 certified fire inspectors, and supports local fire inspection programs to the tune of more than $16 million annually. It provides for the training of all inspectors in the state at no charge to them.

We know, however, that few jurisdictions provide this kind of financial support for their programs to be effective. Most state fire marshals have limited or no involvement in the inspection of industrial facilities, where most combustible dust fires and explosions occur.

States like Connecticut that rely solely on OSHA to oversee manufacturing or industrial occupancies are at a distinct disadvantage. Currently state and federal agencies, including OSHA, do not routinely inspect industrial facilities in a prevention mode. Probably the best way to ensure greater prevention of combustible dust explosions and fires is to support state fire marshals and the fire safety personnel they oversee.

With the proper financial supports, state fire marshals could implement aggressive fire prevention programs in the environment where combustible dust incidents are likely to occur, because, as you know, the guidance is already in place.

The model fire codes, the National Fire Protection Association standards, all address some aspect of the overall dust explosion problem. For instance, BOCA National Fire Prevention Code, the 1996 edition, Chapter 12, deals with the overall dust explosion hazard.

NFPA standards and recommended practices 61, 65, 69, 91, 120, 490, 651, 654, 655, and 8503, each address some aspect of the overall dust explosion problem. Even the National Electrical Code, NFPA 70, contains provisions for special electrical equipment in industrial areas where combustible dusts may be present.

Another way to improve the situation would be to change the National Fire Incident Reporting System, NFIRS, to include reporting of first item ignited, which would capture the ignition of dust as the initiating event in an explosion. This action would significantly improve the awareness and understanding of these incidents by state fire marshals and other public safety officials.

We look forward to working with CSB to improve public safety related to the handling of combustible dust by industry through proper safety recommendations.

Once again, thank you for allowing me to speak to you on this important topic, and I'd be happy to answer any questions you may have on NASFM and its recent survey.

CHAIRPERSON MERRITT: Thank you very much.

Mr. Colonna?

MR. COLONNA: Thank you, Madam Chair.

Good morning, Madam Chair, CSB Board Members, and CSB staff, members of the panel, ladies and gentlemen. Before I begin, I would like to provide a brief introduction. I am Guy Colonna, the Assistant Vice President with the National Fire Protection Association, and I have worked at NFPA for 19 years.

I am a chemical engineer, registered in the State of Massachusetts. I have responsibilities for the NFPA fire protection applications and chemical engineering departments, and serve as the staff liaison to several NFPA technical committees responsible for documents dealing specifically with hazard recognition and control of dust hazard processes.

NFPA appreciates this opportunity to participate in this hearing and to be able to highlight those NFPA codes and standards related to dust hazard processes, the codes and standards development process, and the committee of experts that contribute their expertise to develop and maintain these documents.

After a brief background of NFPA, I will present a description of the relevant codes and standards that address dust hazard processes and conclude with discussion on how I believe these documents could be effective in identifying and controlling processes that store, handle, or use combustible dust or other combustible particulate solids.

NFPA is an international membership organization that develops voluntary consensus codes and standards that are adopted by state and local jurisdictions throughout the U.S. and the rest of the world. Many NFPA codes and standards appear as mandatory references cited in the Federal Regulations, such as the U.S. Department of Labor, OSHA, DOT, and

EPA.

All NFPA codes and standards are accredited by the American National Standards Institute, ANSI, and meet the criteria mandated by Congress in Public Law 104- 113, the National Technology Transfer and Advancement Act. In addition to its consensus codes and standards activities, NFPA also carries out its mission through public education and research.

And just one additional point to respond to a question from Board Member Visscher to Giby Joseph about the database, and it relates to what Mr. Miller just talked about. He mentioned the National Fire Incident Reporting System.

The NFPA data that Mr. Joseph alluded to in terms of his data search when he has looked at the NFPA data reports, much of our data are coming from the NFIR system, along with other news reports and things like that. But, again, our starting point in our case is the NFIR system.

We currently have over 79,000 members of the association in the United States and from 107 different countries. We convene more than 250 committees made up of about 7,000 experts who represent the affected parties in these diverse subject areas, such as enforcers, users, consumers, manufacturers, designers, researchers, and the insurance industry.

These experts in their various fields volunteer their time to serve as members of the technical committees to write nearly 300 codes and standards. NFPA codes and standards provide a broad-based and comprehensive set of requirements applicable to all forms of hazardous chemicals, including combustible dust.

As noted earlier by the CSB staff, many of the NFPA documents represent the basis for treatment of this subject within various model fire and building codes. NFPA addresses the hazardous chemical area in part based upon the physical nature of the material -- that is, solid, liquid or gas. In other instances, the treatment of the hazardous material may be derived in our codes and standards as a result of its actual use, such as in coal-handling operations or chemical laboratories.

Our Fire Code NFPA 1, the Uniform Fire Code, represents the most comprehensive means within the NFPA codes and standards system by which to address the storage, handling, and use of hazardous materials, whether liquids, gases, or solids.

The purpose of NFPA 1 is to prescribe minimum requirements necessary to establish a reasonable level of fire and life safety and property protection from the hazards created by fire, explosion, and dangerous conditions. The code establishes a sequence of steps that must be followed whenever hazardous materials are going to be stored, handled, or used.

The first step involves the classification of the hazard, and the most general terms is either physical hazards or health hazards. The code even addresses procedures for dealing with both mixtures as well as materials having multiple hazards. NFPA 1, the Uniform Fire Code, references some NFPA -- some 40 NFPA codes and standards on subject areas dealing with hazardous materials or special uses or operations.

Where more specific content is available, the code extracts text from those reference documents into NFPA 1, and NFPA 1 is currently adopted in 17 states. NFPA currently develops 10 specific documents that apply to dust hazard processes.

Several of these documents apply to a specific dust type -- agricultural, grain, woodworking, coal, or combustible metals -- while some are more broadly constructed, so that their application encompasses all dust and combustible particulate solids.

As noted during the CSB staff presentation, NFPA 654, standard for the prevention of fires and explosions from the manufacturing, processing, and handling of combustible particulate solids, represents a primary resource on this subject within the NFPA family of codes and standards.

NFPA 654 addresses the hazards of combustible dust in three simple steps. First, hazard identification, and that is in terms of the type of dust and its means for generation, and in terms of the ignition sources that pose a hazard to it. Hazard evaluation is the second step -- a risk-based assessment of the various processes and equipment used in dust hazard processes.

And, third, hazard control, whether they be active and passive measures, including building construction and location, explosion control and deflagration venting, housekeeping, and fire protection systems. The standard requires that qualified engineers oversee the design and installation of systems that handle combustible particulate solids.

All of these elements come together to create an effective fire and life safety plan when the plan is executed by a trained workforce. The need for trained workers cannot be overlooked. The hazards in an industrial workplace require constant attention by management and the workers to ensure that if a plan is developed that it is followed.

Any time a change in routine occurs, whether it is a new employee or a new process, there is the potential for something unexpected to occur. And it is important to note that new employees aren't necessarily those who have never worked at the facility before.

An experienced worker who is reassigned to a new process or new piece of equipment should be considered a new employee under those circumstances, and, therefore, be considered as one who needs additional training. In the end, the best plan, the proper classification of hazards, the proper labeling, proper storage, proper separation arrangement, are all ineffective if untrained workers are expected to implement the plan.

Provisions found in NFPA 1 and the specific NFPA reference documents form the basis for developing a comprehensive approach to insuring fire and life safety in environments where hazardous materials are processed, stored, handled, and used.

Through the ANSI process, NFPA and its committees ensure that the provisions in the codes and standards remain state of the art. As mentioned earlier, many of the reference documents contained in NFPA 1 are also the basis for requirements found in regulations for workplace safety and health issued by the Occupational Safety and Health Administration.

NFPA membership recently adopted the 2006 edition of NFPA 654. Included in the changes to the standard were some recommendations from the Chemical Safety Board to the committee and NFPA from one of their dust hazard incident investigations. The NFPA consensus process and the periodic revisions of all documents ensure the most current practices and safeguards are included.

A number of the other dust hazard documents are entering their revision cycles. NFPA encourages participation by all affected during these upcoming revisions. The committees have benefitted from the involvement of CSB staff in these meetings and looks forward to continued participation and input from CSB.

In addition to preparing the code, NFPA offers products and services to support NFPA 1, the Uniform Fire Code, including a training program, certification for fire inspectors, handbooks, and other staff assistance. We are also willing to train enforcers in those states and metropolitan jurisdictions where the code is adopted at no expense to those jurisdictions.

NFPA does not enforce its codes and standards, but does participate actively with those jurisdictions adopting our documents to support their understanding and implementation. And as you heard from Fire Marshall Mitchell, we have recently assisted the Commonwealth of Kentucky with training of their inspectors on the provisions of NFPA 654.

We have also included NFPA 654 in the list of documents made available free of charge for review through our online access program on the NFPA website. The safe practices found in NFPA 654, as well as in the other dust hazard NFPA codes and standards, reflect a current state of the art and the expertise of a broad contingent of industry, professional engineers, and equipment manufacturers, researchers, and enforcers.

The challenge for us all is to effectively disseminate the information, to provide training as needed, and ensure consistent enforcement. NFPA is committed to assist where appropriate in these activities.

Thank you for your attention and the opportunity to address this forum.

CHAIRPERSON MERRITT: Thank you, Mr. Colonna.

Mr. Conover?

MR. CONOVER: Good morning. I'd like to certainly thank the CSB for your leadership on this issue. I'm Dave Conover. I'm Senior Advisor for the International Code Council. I have graduate and undergraduate degrees in mechanical engineering and have been involved in code/standards development, implementation, adoption, and conformity assessment practices at international, national, state, and local level for about 30 years.

To best use my time today, I'm not going to provide background on ICC mission or process of code development, etcetera. Certainly I can provide that at a later time to the Board. What I'd really like to do is use my time to focus on the development, adoption, and implementation, and enforcement, of building construction regulations and fire prevention regulations within the United States, in the hopes that we can have some discussion and get you thinking about kind of what I call the overall U.S. citizen, which is something I find extremely challenging to present to, for instance, a delegation from Central Asia, who do not understand and recognize what you'd call voluntary sector things.

The U.S. system of building regulations -- and I have a tendency to say building regulations, but I intend to mean fire, mechanical, plumbing, etcetera, is founded on cooperation between public and private sectors at all levels.

The system can be summarized as follows: development and maintenance of criteria -- we'll call that model codes, standards, test methods, guidelines, etcetera -- within the voluntary sector, as well as in some instances federal regulatory development, where agencies have such authority to undertake that on their own.

Research, including incident reporting and investigations conducted by public and private sector interests that forms the basis for new criteria and enhancements to existing criteria. Adoption of the criteria via voluntary sector model codes and standards, or what I call home-grown provisions that may be developed by federal, state, and local legislative or regulatory action, with possible amendment of model codes and standards to address specific needs of the adopting entity. And you heard an example of that with the North Carolina situation, adopting a code and making further modifications.

Adoption of the criteria by lenders, insurance interests, building owners, and others as not only minimum requirements, but in some instances we find what I call possible carrots for going beyond the minimum. That is, a building owner that decides voluntarily to do something above and beyond minimum code may get a break on their insurance, or may get some rating of the building, which they can use to their advantage from a marketing standpoint.

Implementation of what is adopted by designers, building owners, underwriters, and others responsible for ensuring building safety; then you have enforcement by the adopting agency or those under their authority, through plan review, field inspection, reliance on third-party certification, etcetera. And then certainly, finally, compliance by those regulated.

A simplistic way to picture the U.S. system is by thinking of a pyramid, with national activities at the top and moving down through regional and state activities to local activities at the bottom of the pyramid. Most development is done at the top, adoption throughout the vertical structure of the pyramid, and implementation and enforcement typically at the building site, the local level at the bottom.

In some instances, such as with OSHA, there is what I'll call a vertical stack within the pyramid within which federal initiatives at the top of the pyramid preempt or affect similar actions by state and local government.

The ICC international codes, or I-codes, which in turn reference many standards from numerous standards developers, are developed at the national level and provide federal, state, and local government, and private sector interests a basis for their building regulations.

The ICC International Fire Code, for instance, contains a chapter on dust-producing operations, which among other criteria references specific NFPA standards. A summary of the provisions of the IFC, and questions I might pose given the focus of this meeting today, are as follows. Permits are required from the fire official. Are permits being secured? And, if not, why?

And we heard from a previous speaker, if you don't -- if a permit isn't taken out, you may not be aware that action is going on within an existing building.

Combustible dust is defined in the code, which determines the applicability of the codes and standards. If you don't meet the definition, you're not within the scope. Is the definition correct? And if not, how should it be enhanced? Smoking, open flames, and sparking equipment are prohibited. Is this sufficient? How is compliance ensured on a continuing basis?

Keep dust accumulation to a minimum in the building interior. Is minimum sufficient? Is building interior clear enough? How is this enforced?

Collect accumulated dust by vacuum cleaning or other means, but do not use forced air. How is this implemented and enforced, and what provisions exist for maintenance and collection systems? The fire official is to enforce the provisions of reference, NFPA standards. Can the fire official do this more effectively? And what resources are needed to make that happen?

As suggested via the pyramid, building sites are where the explosions occur, yet many activities occur upstream that affect what happens in buildings. Some relevant questions at this meeting, and subsequent activities by -- the Board might address come to mind.

What is the status of development and revision of model codes and standards? What needs to occur to increase or enhance development or revision? Are the provisions in the model codes and standards sufficient? Are they clear and understandable? And if not, how might they be improved?

Are there research projects or enhancements to fire incident reporting systems that are needed to drive development of enhancements to these documents? What is the status of adoption? If not adopted, what needs to occur to secure adoptions. And I think back in my career folks will always say, "Well, how many states have a statewide code?" It's very difficult to say.

Pennsylvania just recently had a statewide building code enacted. Prior to that, 2,500 plus independent units of local government having their own control. And other than the Fire and Panic Act of 1922, and Act 222 that dealt with energy in 1980, you really had no statewide anything in Pennsylvania until recently.

Who is responsible for implementation and enforcement of these model codes and standards that are adopted? What awareness activities, procedures, and programs, such as education and training, are in place to facilitate adoption and enforcement? Are they sufficient? And if not, what needs to be done to enhance them?

Can new technology be applied to enhance administrative and technical activities associated with addressing these issues? Singapore and, secondly, Norway are now implementing or beginning to implement programs for automated e-plan check. The computer will automatically determine compliance and issue a report as to whether the plans and specifications meet.

That facilitates plan review, but it allows additional resources that are currently put by local government and plan review -- it allows those resources to be put in inspection. Other new technologies that come to mind are modeling, you know, as opposed to testing.

So if one considers the gap between a goal of zero dust fires and explosions and the current situation, which we've heard about in part this morning, the two endpoints of the gap could be pulled together by a chain that has multiple links. Those links are associated with research, development, adoption, implementation, enforcement, education, and compliance, on an ongoing and evolving basis.

Knowing what influences each of these links, and where the most room for improvement lies, can help strengthen the chain, and in so doing get us closer to the goal. I certainly don't have all the answers today, but the ICC is undertaking initiatives to respond to these and other questions posed in the May Federal Register notice.

Again, I want to thank the CSB for the opportunity to participate in the panel, and certainly commend you and staff for leadership in raising the issues and focusing everyone on this opportunity we have.

CHAIRPERSON MERRITT: Thank you very much.

Unfortunately, Mr. O'Connell will not be in this panel, and we are sorry that he was not able to make it.

At this time, thank you all for your testimony, and I'd like to open -- we do have extra time for questions. Does that make you happy?

(Laughter.)

And would like to ask the Board if you have questions. Haha. And who would like to begin?

Mr. Bresland?

MR. BRESLAND: This will be a general question to anybody who wants to answer it. I guess I -- in my background, I was never involved with fire codes. I never worried too much about them until I came to the Chemical Safety Board, and then -- now I try to understand them and try to figure out just how they work. And I must admit I have trouble trying to pull it all together.

Is anybody willing to sort of explain to me why the whole fire code system in the United States is so convoluted? If that's the right word to use. Or am I being unfair to you by -- well, not to you but to the system, by saying that? I mean, is it -- is it a complicated system when you've got NFPA, ICC --

MR. MILLER: There may be a number of people that want to -- at this panel that want to answer that question. But let me -- let me try a first stab here.

Fire codes -- essentially states can adopt fire codes, and we've got 50 states. It's the sort of thing you may not have where -- where that accident would indicate you come from.

(Laughter.)

However, we've got 50 states here who claim to have a great deal of independence relative to what sort of regulation goes on within their jurisdictions. And then, within each state, there are decisions that are made relative to if we're going to adopt this -- we heard reference to the fact that the State of Pennsylvania just recently adopted a statewide fire code. How will it then be enforced at the local level?

Well, many states adopt fire codes that are to be enforced statewide unless, of course, some local jurisdiction has decided to adopt something different, or has decided to enhance the document that's adopted by the state. And enhancements take various forms, and there can be arguments among those who are enhancing the code and those who adopted the code initially as to whether the enhancement actually is an enhancement. But that's the kind of thing that happens at state levels.

The State of New Jersey where I was

involved in code enforcement for over 33 years now has a state-enforced uniform construction code -- that is, the construction code that is adopted by the state. It's a mini-maxi code that cannot be amended by anyone at any local level. It is adopted by the state. It is enforced by state-licensed personnel, and it is enforced exactly the same, at least that's in theory, throughout the entire state.

The same thing has happened with our fire code. It's a state fire code that's adopted. The construction code explains how things are supposed to be built in the built environment. The fire code then follows up and follows that building from the day that the certificate of occupancy is issued until the day that the building is finally demolished.

So fire codes are maintenance documents. Construction codes provide instruction on how buildings are to be put together.

There's a patchwork of enforcement, because each state makes its own decision about how it's to be enforced. And within each state, there are varieties because -- the State of New York is a great example. Albany can make great decisions about what's to go on throughout all of the upstate areas.

However, New York City is the tail that wags the dog. So whenever New York State adopts a code, it's with the exception of the city of New York.

That's a general overview, if anyone else wants to give a stab.

MR. MITCHELL: If I can interject on -- on -- in Kentucky, we have also the Kentucky Building Code, Kentucky Residential Code. And they are -- just like New Jersey, they have the construction phase. But when it's finished, it is turned over to the state fire marshal's office. Then, that is a statewide -- and we adopt the NFPA codes for the fire marshal's office.

And the building codes are basically adopted with the international building codes, with some corrections, some adjustments made for the Kentucky building codes. And when they turn the building lose, they -- it's a statewide code. Sometimes county judges decide they're not going to enforce it, or something like that. But as far as the fire codes, what we say in our office goes statewide. We deputize fire departments throughout the state to do what we adopt and inspect by the codes that we adopt.

So in Kentucky the fire codes are pretty well standardized. I know there's other areas that -- that will not follow codes, I mean did not adopt them, but the State Fire Marshal in Kentucky -- it all boils back to the fire -- my mind just went -- the fire we had at the nightclub up in Northern Kentucky. And that's when the fire marshals -- Beverly Hills Supper Club, yes. That's when we really became the ultimate fire code in the state. So --

MR. CONOVER: I'll take a quick shot at three -- three answers, John. I think your question was: why is the fire code system so -- I think you used the word "convoluted." At least that's what I wrote down.

One is the Constitution of the United States, which protects the rights of state and local government. Number two, I guess it goes in the movie Endless Summer, "God, you should have been here yesterday." If you go back 30 years, or go back 50 years, or 70 years, it was a heck of a lot more convoluted.

I think if you try and picture that pyramid that I've described, we've been over time, through the voluntary sector and state and local government, building that national system, but we've been building it from the ground up. So you have many more states now with statewide codes. You have many more programs, as have been described now, and so it's not as -- as convoluted.

And I won't support that or comment on that term, but it's not as -- as it was 20 or 30 years ago, and it continues to get better. So I think eventually, like we're building it from the ground floor up, I think eventually the states will -- we're going to end up the same place that other countries have ended up, where they have preemptive authority in, you know, Berlin, and they just say, "This is the way it's going to be throughout Germany."

We're just building it from the ground up. It takes time to do it that way, and the Constitution pretty much provided us that road map 200 and some years ago.

MR. COLONNA: And one other thing, John. In preparation for today's hearing, I -- through our International Fire Marshals Association, one of the NFPA membership sections, we solicited input to the questions in the Federal Register issued in May.

And one of the states that is also in a state that is an OSHA state plan state indicated that their fire code enforcement is blended to some extent with the work that they do collaboratively with the workplace protection that comes through their state OSHA department.

And so what happens is that the implementation and the enforcement and the inspections and all of that vary by occupancy. The hazard classes that are -- that they're going to see at the top are going to get more attention. But initially the state and local fire code enforcement personnel are going to tend to concentrate on the -- inspecting the license and publicly occupied facilities, and the industrial facilities are going to tend to be more the purview of the state OSHA activities.

And only when there are complaints or incidents or issues does it bubble up, so that the fire building code side from the state, in terms of enforcing fire and building codes, do they jump in there along with OSHA for example. And it comes down to resources.

MR. BRESLAND: I'd like to commend Mr. Mitchell and his people in Kentucky for the good work that you've done as a followup to the recommendations that came out of the Chemical Safety Board investigation of the CTA incident.

MR. MITCHELL: Thank you, sir.

MR. BRESLAND: But I found it -- I think we were all surprised at the number of facilities that you find were potentially dust-producing 7,500 going down to 2,200 now.

MR. MITCHELL: Those -- we don't know actually whether they are or not yet. We just have -- we just know they make a product in there that has the potential to be a dust explosion. So --

MR. BRESLAND: Do you have any other --

I'll do this to Mr. Noles as well. Do you have any other data that would be useful to us in terms of dust explosion accident data that we could use? And if you do, can you submit it to us?

MR. MITCHELL: Oh, yes. We'll be sure to.

MR. BRESLAND: Thank you.

MR. MITCHELL: I was just telling Mr. Miller that I -- evidently the person I assigned that assignment to about getting the information to NASFM didn't follow up on it, and we'll be getting that in to them.

CHAIRPERSON MERRITT: I have a question for Mr. Colonna. There's a fire triangle or diamond. And is dust identified as a part of that fire diamond? Or how would it be included?

MR. COLONNA: You're talking about the NFPA 704 hazard rating system and the symbol that people describe as a diamond. But if you try to draw it as a diamond, you can't because it's really a square on point?

CHAIRPERSON MERRITT: Right.

MR. COLONNA: It involves three specific

hazards -- health, flammability, and instability or reactivity -- and then a fourth quadrant in the symbol that is based on special hazards. And the two primary special hazards are for oxidizer and avoid using water.

The characterization of the dust would be most prevalently in the flammability rating, and it currently is part of that system. And the problem with the dust right now is the inability to probably consistently characterize them in terms of their hazard level.

And so it's a much more qualitative system than the rest of the flammability aspects, because when you're dealing with flammable gases, vapors, and evaporating liquids, it's that -- the flammability rating is based on the flashpoint and the boiling point, to deal with the most volatile materials.

And those are ASTM standard test methodologies, and you can document that and rely on that pretty -- pretty confidently. But the dust part of it is a little bit more subjective in terms of characterizing the different forms of really combustible particulate solids, whether they're flakes or fibers or -- or you get down to the actual combustible dust, which meets that 420 micron criteria.

The one thing that the committee might do in examining the 704 system and revisions to it to enhance its ability to address dust a little bit more definitively might be to take the Kst of the dust and use the dust classifications, the Class 1, 2, and 3 dust, based on the Kst breakpoints, and decide whether or not certain levels, based on those Kst values, which presumes, then, that you've actually done dust characterization through tests, you could then apply that to those ratings.

And the rating system is a zero to a four rating system, zero being the least hazardous and four being the most hazardous. And if you look at the current criteria, the dust tend to be twos and threes in the flammability, but not with much confidence. It's subjective.

And so if I get some characterization off an MSDS -- and we've already heard about the limitations perhaps of MSDS -- of some MSDSs, I could -- depending on how I interpret what I read on that MSDS about that dust, I could determine -- if I'm trying to rate using the 704 system, I could decide that it's two, and you could decide that it's three.

Well, you make it more hazardous, because you made it a three and I made it a two, and so I -- it's moderately dangerous. You made it a little bit more significant, and that area could use some improvement, and that might be one way to do it.

But until we're really confident about characterizing dust, and even from dust -- if you do the dust characterization experiments, it's only applicable for that dust. And if I'm using one dust, and you're using the same dust 1,000 miles away, your dust characterization may produce a slightly different set of values than mine do, and we still might end up.

So dust are -- are -- one of the problems with dust is that -- just their characterization is difficult.

CHAIRPERSON MERRITT: What do you think is a better way? I mean, we've talked about the fact that we do inspections, but some of those are based on notification from companies, especially if they have changes in their operations. Another one is, you know, first of all you have to recognize that you have a dust hazard.

Some fire codes and fire inspectors and fire marshals are able to do things. Some are covered under OSHA inspections. You know, what do you think is a more -- most effective or more effective way of bringing these into the network to be able to identify them first as risk hazards?

Do you -- I mean, there's voluntary standards, there's voluntary codes, there's required standards, required codes, there's MSDSs with and without good information. Where do you think the best point to catch most of these operations is?

MR. MITCHELL: Is that addressed to me?

CHAIRPERSON MERRITT: To all of you, any of you.

MR. MILLER: If I may?

CHAIRPERSON MERRITT: Yes.

MR. MILLER: I made reference to it in my address. That is, I think it lies within the scope of the fire code, and let me give you an example. I started out in -- as a fire inspector, a firefighter inspector, in a career fire department in 1972. And my responsibility was the industrial area within the city of Bayonne, New Jersey, about a 15-minute drive from Times Square, New York.

There we had eight major chemical plants, ICI Americas as an example, where they manufactured fluon. And probably somewhere around 60 major warehouse facilities.

I watched one warehouser in my tenure there as an inspector go from the storage of ordinary combustible materials, just boxes of stuff on shelves, in a building that was protected for that particular hazard, a sprinkler system that was -- that was there to address an ordinary hazard in combustibility.

And then, the next year that I made an inspection -- and it was on an annual basis that I would make inspections of these -- of these warehouses, more frequently in the industry -- I discovered that the owner of the building had leased it to someone else, and now there was rolled paper storage in the building.

Well, let's stop everything, guys. There was no need for these people to go to the building department, to the zoning office, to planning, to anybody, because that change in storage didn't mean anything to zoning, to building, to anybody else. But it meant a great deal to me.

Now you've introduced into that same building a significantly greater hazard. You've got to upgrade the sprinkler system to -- to -- now to protect for a higher hazard, and that was done. It took several months, but it was done.

Several years later -- and, again, I'm contending it was the same inspector doing the same job -- I come into the same building and discover that now it's being used for grinding of spices -- a totally different hazard. However, now I'm the same inspector over the course, of seven or eight years, in the same municipality, going into the same buildings.

And over the course of that time I'm being further instructed in -- in my craft. I'm learning more and more about it. I'm elevated in rank as well, as a result of the recognition of, you know, my learning more about my trade.

So I walk into that building, see the spice grinding going on, and, again, I say, "Stop everything. Now we've got a combustible dust explosion hazard, totally unplanned for in the construction of this building, and in the protection that has been provided in the building. You've got to go back now to the Building Department. Let's upgrade all the protections you've got in this building, and let's make sure you institute the correct kind of program, you know, to clean up the combustible dusts."

So that's the kind of thing that a fire inspector can do, provided with the right resources. All of the codes are there within his jurisdiction to enforce, all of the things that NFPA has very carefully crafted with all of the assistance of professionals from every jurisdiction.

The same thing with the ICC. Here we have the International Code Council Conference putting together an incredible array of documents that can be utilized by code enforcers at the local level. Whether or not those things are implemented depends upon the man on the street -- the individual on the street, you'll pardon me.

Are they trained properly? Are they provided with the correct resources? And can they do their job well? We've tried to make sure that in the State of New Jersey at least we've got people on the street who are certified, who are trained, and who are given adequate resources by the state, who has adopted the code and requires them to enforce it.

$16 million is not a drop in the bucket, and when you're talking about providing an average of $20,000 a year to 800 jurisdictions to enforce a code at the local level. And that's what we do in the State of New Jersey. That's the sort of thing that's needed nationwide within every state.

CHAIRPERSON MERRITT: Mr. Mitchell?

MR. MITCHELL: Yes, ma'am. The training is probably the most important thing. But the thing that we -- the problem we're running into is when we go into these buildings, and these MSDS sheets say non- combustible, non-hazardous, or non-explosive, and then we're telling them, "Well, your dust is explosive," the testing of this dust is what the main problem is. The tests are very expensive. You're talking about $4- or $5,000 every time you need a test done, and no state fire marshal has a budget to convince them.

So we're trying -- I think regulations as to how to prove -- who proves that the dust is explosive? I mean, when they're getting manufacturers' data sheets telling them it's safe, don't worry about it, and then we walk in and say, "You've got magnesium, you've got talcum, you've got graphite, you need to -- you've got a potential dust hazard here."

And I think it all boils down to us trying to make them clean up. I think that's the ultimate goal is just to walk in the plants and have them perfectly clean. And no hidden dust above ceilings and things like that is in some of them, but -- but that's our main problem with it. And that's how -- that's the type thing we need help with on convincing dust.

CHAIRPERSON MERRITT: So the generation and the information provided by suppliers is really critical --

MR. MITCHELL: Yes.

CHAIRPERSON MERRITT: -- in probably all phases of what is done.

Are there any other questions? Mr. Visscher? We have about three minutes.

(Laughter.)

But go ahead.

(Laughter.)

MR. VISSCHER: Now I've used up 30 seconds. I appreciate this panel. I think it was very excellent testimony. Like John, I think the whole building code structure and fire code structure in the United States has been a little bit of a mystery to me, too, so I appreciate your help in -- in trying to understand that, and also join John in saying I think both Kentucky and North Carolina -- the work that you've done following up on the incidents that the CSB has investigated has been very good.

Appreciate that.

A question for Mr. Colonna. I think you mentioned in your testimony that there are individual NFPA standards on metal dust, grain dust, coal dust, and then there's kind of the general one -- 654 -- that I guess people focus on, right?

MR. COLONNA: Also woodworking, sir.

MR. VISSCHER: And woodworking. How much difference is there between all of those in terms of what is prescribed or directed and recommended?

MR. COLONNA: Their approach is along the lines of what I describe from 654 standpoint. In fact, in some instances, some of the committee members cross- pollinate the committees, because their expertise is more the general side as safety engineers, loss prevention, fire protection engineers. So we have some of the same members on each of the committees. So some of the features in the documents start to resemble each other.

What happens in each of them is that they're looking at characterizing the dust hazard, the dust processes, the ignition sources. So, again, from the fire triangle side, looking at all of the elements of the fire triangle, when it comes -- and in the hazard evaluation, determining what aspects raise the dust problem to the greatest hazards, and, therefore, what needs to be done, and then looking at controls.

And in some instances, when you get to the control features, if it's peculiar to the dust -- coal, wood, metals, ag dust -- then those documents are going to have the specific unique control features that are more applicable in those documents because it is particular to that dust.

If it's a more generic control, then they're probably going to actually send you to 654. 654 has the overarching approach that would apply to any category of dust if it's a non-specific categorized dust.

And the other place it takes you is -- one of the control features is to take you to another NFPA document where you have explosion prevention method, which is NFPA 69, and that may be a number of features including one that we heard today, which is that industry sometimes chooses to operate processes under inert atmospheres. And that's one of the features that are described in NFPA 69.

So all of those, whether it's the dust-specific or NFPA 654, which is the more general, they may also take you -- rather than write all those control features and duplicate that there, they may send you to 69 where the expertise on those actual control methodologies is contained in that committee, and, therefore, in that document.

CHAIRPERSON MERRITT: One more. Okay.

MR. VISSCHER: Sort of a followup on this I guess for Mr. Mitchell -- Mr. Miller -- is when you go into a manufacturing plant, for example, and there is -- you've identified some type of combustible dust, I guess you said one of the questions that comes up is a disagreement as to whether there is, in fact, something that might explode or be combustible.

But the second question I would expect is -- how much dust is -- is a hazard? How do you handle that I guess?

MR. MITCHELL: We try to make them understand the size and the -- you can have some dust that's bigger than others, of course.

MR. VISSCHER: Right.

MR. MITCHELL: And I think it's -- I can't remember the size, but if it's bigger than a pencil point, then they've got a hazard.

MR. VISSCHER: But if you --

MR. MITCHELL: That's basically what we're doing it with, and -- and we are at the time -- at the time now telling them to prove to us that it's not combustible.

MR. VISSCHER: And how much, though, I mean, in terms of they say we keep a pretty clean place here, we keep it as clean as we can, what's the --

MR. MITCHELL: Well, we take them and show them the rafters, show them -- and we -- like the one in Hopkinsville we just had that -- their collection system was stacked about that high, they had a sprinkler system in their collection system, and it -- it would just shoot out water periodically whenever there was a spark or something. And that collection system backed up the dust, and it -- it was scary to look at after it was over.

But that's -- they -- we make them responsible, really, to tell us that it's not, because they think they've got a clean plant until they get up high. And that's where -- that's where the stuff, if there's an earthquake or if there's an airplane that goes by, or something shakes a little bit of that dust off and goes down to the guy doing some welding, that's when it ignites and then you get your --

CHAIRPERSON MERRITT: Mr. Bresland, you get one more brief question.

MR. BRESLAND: One more brief question. Thank you.

I want to obviously say that we've got the leading experts on this whole topic here, and I really appreciate your coming. We could probably go on with questions and discussions on this much longer, but I'm -- I'm going to be meeting -- I'm going to be attending the meeting of the National Association of State Fire Marshals, which is in a couple of weeks, and I know Mr. Mitchell will be there and Mr. Miller will be there. I don't know if --

MR. MITCHELL: Be nice to us. I get to introduce you.

MR. BRESLAND: Yes. Thank you.

(Laughter.)

This isn't a question, but if you could think about this in terms of the meeting. I'd be curious as to what you would say would be sort of a model organization for developing a state program for protection against combustible dust explosions.

I'm not asking for an answer to that now, but it's just something to think about. I mean, what -- and I know every state is going to be different. But if there was a perfect -- a perfect state organization, politically what -- how would that look?

CHAIRPERSON MERRITT: Well, with that, our time is up. I would like to thank all of you.

As we go through our investigations, I'd like to reiterate, or iterate for the first time, how important you are and what you do. Fire marshals and the coding organizations always tend to be a linchpin for where we find -- there was information out there, there was an opportunity, and you are very important in this process of prevention. And I applaud you for the work you do, I know with limited resources.

One question I have before I dismiss you is: if we were going to want to say how important it is in what you do, and what limited resources you have, and that you should have more resources to do what you do, who would we speak to?

(Laughter.)

MR. MITCHELL: I guess our part would be through the legislatures and our cabinets, our secretary of our EPPC, and even our governors. But I -- that type thing.

CHAIRPERSON MERRITT: Anybody else want to try that?

MR. NOLES: I would have to agree.

MR. MILLER: Yes, I'd have to agree. National Governors Association.

CHAIRPERSON MERRITT: National Governors Association.

MR. MILLER: Or the Association of State Legislators.

CHAIRPERSON MERRITT: Okay. Thank you

all.

Now, we will be back here and reconvene exactly at 12:30, and please be prompt. We thank you all. Enjoy your lunch, and we'll back here at 12:30.

(Whereupon, at 11:36 a.m., the proceedings in the foregoing matter recessed for lunch.)

???A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N (12:31 p.m.)

CHAIRPERSON MERRITT: I would like to reconvene this hearing of the U.S. Chemical Safety and Hazard Investigation Board hearing on dust hazards, and thank everybody for coming back promptly and for our panelists for being here. I appreciate that.

I'd like to introduce you at this time. This is Panel D. First, I'd like to introduce Mr. Tom Hoppe. Is that right?

MR. HOPPE: That's right.

CHAIRPERSON MERRITT: Of CIBA Specialty Chemicals.

MR. HOPPE: Thank you.

CHAIRPERSON MERRITT: Followed by Mr. Chuck Johnson of Aluminum Association, and David Oberholtzer, right, of -- is that Valimet?

MR. OBERHOLTZER: Valimet. That's correct.

CHAIRPERSON MERRITT: Valimet. Mr. Randy Davis of Kidde-Fenwal. Did I say that right?

MR. DAVIS: Yes.

CHAIRPERSON MERRITT: And, finally, Mr.

Henry Febo of FM Global. Thank you all for being here.

With that, I'd like to start with Mr. Hoppe.

MR. HOPPE: Thank you.

Madam Chairman, members of this Chemical Safety Board, colleagues, and members of the public, I'd first like to thank you for this opportunity to present what CIBA Specialty Chemicals does to prevent or to mitigate the effects of dust explosions or fires at our manufacturing facilities.

My name is Tom Hoppe. I have worked for CIBA for over 40 years in a variety of manufacturing and safety-related positions. Presently, I am the Director of Process Safety for CIBA's expert services business unit.

CIBA Specialty Chemicals, and its predecessor company, CIBA-Geigy, dust fire and explosion prevention program have been in existence since the 1970s. Initiation of the program was basically driven by business needs and societal responsibilities.

CIBA produces large quantities of organic powders, which when handled can create combustible dust clouds. Consequently, the design and protection of manufacturing equipment is essential in order to supply products to our customers in a safe, cost effective, and timely manner.

The safety of our workers and customers has always been a primary concern and considered to be an intrinsic part of doing business. This philosophy is clearly defined in internal safety and health guidelines that are available to all CIBA personnel on our intranet.

CIBA's overall risk management system for the control of dust explosion hazards consists of four elements -- guidelines and guidance notes, which outline the scope, technical requirements for controlling the hazards; technology, which consists of a laboratory for testing combustible dust -- powders and dust; and internal consultants who provide advice on engineering solutions; free training courses for CIBA employees and our customers; and, finally, compliance.

For powder-handling safety, our guidelines are based on specific unit operations that create dust clouds during handling or processing. There are guidelines for milling, drying, dust collection, pneumatic transfer, blending, mixing, charging, and discharging.

The rationale for this approach is that each particular unit operation can constitute a unique set of hazards, and, therefore, a unique set of engineering solutions are possible. For example, a milling operation, with its high potential for mechanical energy input due to rapidly-rotating parts, represents a different set of hazards than discharging a powder into a package for shipment.

CIBA believes that these unique hazards are quantifiable. So each guideline -- so in each guideline there is a specific set of requirements to test the combustion characteristics of the dust. In NAFTA, the testing is performed at our safety testing laboratory, which is located at our production facility in MacIntosh, Alabama.

Based on the results of the testing,

specific engineering solutions are recommended. At CIBA, no material is allowed to be processed or handled at a pilot or plant scale without having these types of testing completed and required protective measures installed.

These guidelines are considered minimum standards. Where local and federal regulations are more stringent, they apply. However, in practice, this is seldom the case.

To help ensure our understanding of requirements of our guideline, training is required. Detailed internal courses have been developed in the area of powder-handling safety. Subjects covered include recent history and dust explosions, basic elements of dust fires and explosions, fundamentals of electrostatic discharges, ignition sensitivity of fuels, and protective measures.

These courses are mandatory for personnel responsible for operations involving the processing or handling of combustible dust. In many cases, these courses have also been presented to bargaining unit personnel.

Training in dust explosion hazards is also offered to our customers as part of a product stewardship under our Responsible Care Program. This can be voluntary, based on a customer's request, or mandatory. For example, we will not sell certain product packaging combinations to a customer without having performed training in potential dust explosion hazards.

Compliance with our guidelines is monitored during periodic audits. Specialists from within the environmental safety and health groups of our corporate and regional headquarters perform these audits.

The dust fire explosion prevention program has been in effect at CIBA Specialty Chemicals and the former CIBA-Geigy for approximately 30 years. Overall, it has been very effective at reducing the number of dust explosions and mitigating their effects.

As one would expect, this has been a long process of continuous improvement and learning. Over the years, it has been our policy to share our research and experience and lessons learned with industry and the public via publications and papers given at various seminars and symposiums. We are committed to continue this policy.

At this point, I would like to make some general comments based on all lessons learned over the past 30 years. Prevention of dust fires or explosions in industrial operations is not a trivial exercise. It takes significant allocation of resources and specialized training.

Neither safety professionals or engineers obtain adequate training in dust explosion hazards or prevention in the normal course of their university studies. As a result of the insufficient training, the complexity of the subject matter, and the lack of applied resources, the risk of dust fires or explosions within the process industry is not well understood, and, therefore, not adequately addressed.

This problem is particularly acute in small- and medium-sized companies, where large quantities of ignition-sensitive dusts are handled daily. In many cases, they are unaware of what they don't know.

For many combustible dusts, the numerical data that CIBA has found to be essential in order to make the appropriate decisions from managing potential dust fires or explosions is not readily available. Dust explosion for individual operations are low probability events.

Consequently, it is often difficult for safety professionals to justify allocations of resources for the control of a hazard that has never been experienced in the life cycle of a plant operation.

Given the observations mentioned above, there are still many examples of successful risk management systems for the control of dust fires and explosions in the industry. These programs are based on knowledge that is readily available in the literature and published in consensus engineering standards.

The widespread application of this existing knowledge appears to be the primary gap in effective prevention of dust explosions and fires in the processing industries. In an optimistic view, continued education and access to technical experts will improve the situation over time.

Unfortunately, the present educational evolution appears to be a slow process. In order to prevent further instances, ways to accelerate this learning curve need to be identified and aggressively pursued.

I would like to thank you again, Madam Chairman, members of the Chemical Safety Board, for this opportunity to share our knowledge and experience at this hearing on combustible dust fires and explosion hazards.

CHAIRPERSON MERRITT: Thank you very much. At this time, I'd like to introduce Chuck Johnson, and the floor is yours.

MR. JOHNSON: Thank you. Thank you, Madam Chair, and CSB Board Members. Thank you, Angela, and your team specifically for the work you've done to address this issue.

Again, I'm Chuck Johnson, Manager of Environment Health and Safety for the aluminum industry -- for the Aluminum Association.

We're the trade association for the North American aluminum industry. We are comprised at this point of 87 producing and supplying companies that operate over 300 plants in 40 states in the United States. We account for approximately 85 percent of the aluminum shipped in the United States at this time.

We know at the association that virtually all aluminum producers deal with aluminum dust hazards due to dust generated during fabrication processes. In addition to this issue of dust as a byproduct hazard, we are aware that the production of aluminum powder and paste represents a separate hazard.

And, Mr. Visscher, this gets to your point you were making earlier this morning about the differences between incidences which arise from dust which is deposited during industrial processes versus instances which arise from processes involving combustible dust.

We at the association view those two hazards as entirely separate processes, and we address them separately within our industry. I'd like to speak to the aluminum powder and paste production hazards first.

For over 25 years, the Pigment and Powder Division within the Aluminum Association has been addressing hazards which arise from the production of aluminum fines for specific industrial purposes. That's the utilization of aluminum in its massive form in an industrial process to produce deliberately an aluminum fine, which may or may not be combustible.

Currently, the Powder and Paste Division carries out several voluntary projects to address the hazards associated with their product and their processes. The most notable of those is a powder and paste safety workshop, which has been conducted since 1979 on a bi- annual basis.

We are currently producing -- conducting that workshop in partnership with the European powder and paste producers. We conduct it every other year, and it's a venue at which powder and paste producers can gather and share industry best practices and processes and new developments in the area of safety for their processes.

That group -- the Pigment and Powder Safety Division, safety and property protection group, has also published guidelines for -- titled "Recommendations for Storage and Handling of Aluminum Powders and Paste," which we have disseminated as widely as possible within the industry to help disseminate best practices.

In addition, that group has carried out research to address several issues, such as personal protective equipment, electrostatic hazard issues, exclusivity and flammability of dust. And, Mr. Bresland, this is -- this gets back to your question from earlier this morning regarding the specific dusts and what the specific characteristics are for different micron sizes, and so forth.

We have recently completed research which specifically characterizes the hazards of different micron particle fractions as well as particle shapes and finishes. And that work is being incorporated into new NFPA standards for -- actually, it's number 484 I believe for metal powders. And, actually, Mr.

Oberholtzer is going to address that in a little more detail.

We've also had extensive participation in other organizations to develop best practices and fire codes, and so forth, to address pigment and powder production, specifically in the promulgation of NFPA 484.

Now, as a separate issue we address the hazards associated with aluminum fines generated as a byproduct of other industrial processes. We do that for the general aluminum industry. And this is an area in which we get into more of the issues that this group has been talking about today. The general fabrication hazards arise from grinding, sawing, and cutting of aluminum in its massive form.

And fire and explosion hazards occur both from the deposited fines as well as from dust collection devices, which have become more prevalent as -- as environmental standards have become more prevalent, specifically the promulgation of secondary MACT standards. That's national air mission standards for hazardous air pollutants -- has just been completed, and a lot of compliance work has been done in that area to install a lot of new ducting.

And we've heard anecdotal evidence that there has been an increase in small incidences with dust based on that. It's something we've been trying to address.

Also in this area we have published guidelines for -- in this case guidelines for handling aluminum fines generated during various aluminum fabrication -- fabricating operations. So, again, we promulgated best -- best practices guidelines and tried to disseminate them as widely as possible.

We conduct -- separately from the powder and paste safety workshops, we conduct twice yearly a cast house safety workshop series dealing primarily with molten metal safety issues, but as a component of that workshop we also address fines issues in manufacturing and production of aluminum in general.

We have heard at almost every recent cast house safety workshop of at least one incident involving aluminum fines. At the last workshop, which occurred just last month, we heard of an incident that occurred in Australia at a primary plant with -- in the cast house of a primary plant in which contracted labor was welding in the overhead rafters. Started a small dust fire at that point.

The contracted labor used a halon fire extinguisher to try to extinguish the fire. Fortunately, the blast pattern was -- the flash pattern was away from the worker. Had he not been using fall protection on the cherrypicker he was in, he would have been blown from the equipment. He had no injuries.

When emergency response arrived to put out the fire, they had to be restrained from using pressurized water to try to put out the fire, because they had not been properly trained on a response for that type of fire in that environment. The fire burned for over four hours in the rafters, causing extensive property damage, no injuries.

It was eventually extinguished by emergency response personnel and cherrypickers using extinguishers that had to be I believe acquired from offsite. So we are aware of those issues, and we do address them. Incidentally, that -- representatives from that company came to our cast house safety workshop to share that incident and to find out what best practices they should put into place to address those issues.

I had some specific comments to -- to address the hazard emergence incident specifically, but I think I will -- I will keep those for another time.

In closing, I would say that the Aluminum Association supports the CSB's current initiative. We do believe, and have stated previously, that we believe that the NFPA standards should be incorporated at the state and local level for all states, specifically 68 for venting, 77 for static hazards, 654, which we've already spoken about, 70 for electric hazards, and 484 for our industry, which is for metal fines.

Regarding some of the questions you had this morning for the scope of the initiative that you're carrying out right now, we believe the study scope should not be restricted just to specific chemicals but should address other hazards that you've been addressing and the incidents that you've been investigating recently.

And to address one of Mr. Mitchell's points from earlier today, we also believe that no dust lists should be promulgated. It should, instead, be a process-based risk assessment, and we do believe -- as a separate issue, we believe that the incorporation of NFPA standards at the state and local level is a separate issue from the promulgation of a possible federal standard at the OSHA level.

We believe that the NFPA work should go forward at the state and local level anyway, because we -- we see the fire marshals themselves as an excellent education tool for specific plant locations, because, as Mr. Mitchell said, a voluntary program is great, but you have to have volunteers. And not everyone is ever going to volunteer.

And so if we -- when we try to communicate these issues to specific plant locations that are not involved in our association, it's pushing on a rope. We can't get that information out there to everyone, and fire marshals can -- can reach places where we cannot.

Thank you for this opportunity to comment.

CHAIRPERSON MERRITT: Thank you very much.

Mr. Oberholtzer?

MR. OBERHOLTZER: Yes. Thank you, Madam Chairman, members of the Board, and, again, specifically to Angela and her group for the opportunity to address some comments on what we feel is a really vital issue.

Just quickly by way of introduction, again, my name is David Oberholtzer. I am the Director of Corporate Services for Valimet, Incorporated, in Stockton, California. We are a producer of atomized aluminum and aluminum alloy powders, and I'm speaking today actually as a representative of the Aluminum Association, Powder and Pigment Safety Committee.

I have over 30 years of experience in the production of aluminum and aluminum alloy powders. I've spent some 15 years as my company representative on the Aluminum Association, Powder and Pigment

Division Safety Committee, and over 12 years representing the Aluminum Association on the NFPA Technical Committee for Combustible Metals and Metal Dusts.

As we've heard several times today, and just as a quick review of the nature of the hazard that we're dealing with here, you must have -- in order to have a hazard situation with dust, the dust, of course, must be combustible. You need to have it in a form that it's capable of forming a suspension within air. Obviously, the presence of oxygen is required, as well as a sufficiently energetic source of ignition.

And I go through those again, because those are the four major points that have to be addressed in any kind of a protection program. And, in fact, as we've seen in the discussion earlier this morning about coffee creamer, almost any finely divided material in the proper form and under the proper conditions can be considered to be combustible.

And many industrial processes have the possibility of generating dust clouds or suspensions of fines. Sometimes by design, as in our industry, we purposely produce finely-divided materials. But, in fact, also fugitive dust accumulations are a major issue, both on obviously observable surfaces as well as in inaccessible areas that may not be readily apparent.

And most dusts are, at some point in time, generated or handled in air. There's been some discussion about inerting, which is a major facet of the types of protection systems that we employ in the aluminum powder industry, but, in fact, are not practical in many areas.

And, again, we are surrounded by potential ignition sources. Depending on the nature of the materials that you're dealing with -- electrical devices, light bulbs, just standard electrical fixtures -- combustion devices, whether they be furnaces or other types of combustion, what we define in our industry and what NFPA defines as hot work -- that is, welding, maintenance activities, cutting, grinding, simply drilling, an electrical drill with an open brush motor is an ignition source that needs to be controlled.

And, of course, static electricity, which is a major issue and a major source in many cases for these -- for these unfortunate events, particularly in our industry where we're dealing with metal dusts and aluminum dusts, which are constantly referred to as the major bad actor, the really sensitive materials.

And, in fact, that is the case. Metal dust, and aluminum in particular, are suspended in air -- are, in fact, explosable over a very wide range of concentrations. The minimum ignition energies for these materials are extremely low in comparison with other types of dusts.

We have measured minimum ignition energies as low as one to two millijoules, which is well below that level of energy that can be generated by a human being walking across a floor and flipping a light switch. So these are significant risks and significant issues that need to be addressed.

Now, one of the questions that has come up, was addressed to me personally by Angela and her group, as well as I believe in the Federal Register notice, has to do with whether dust collection is inherently unsafe. Some of this I believe stems from comments in the appendices to some of the NFPA standards, particularly NFPA 484, where statements are made regarding the inevitability of an explosion in a dry- type dust collector collecting aluminum fines.

We believe that these are basically based on the historical record. There have been incidences on a relatively regular basis worldwide involving collection of aluminum fines. We also feel as an industry that, in fact, these materials can be and are handled in a safe manner if proper best practices and guidelines are followed.

We handle in our industry literally millions of pounds of these materials every year in a safe manner. We transport them worldwide. Our customers handle them in a safe manner. The key is understanding the hazard, approaching the hazard from a reasonable engineering standpoint, training, and understanding what you're dealing with.

If you look at the reports of the CSB on several past incidences where you're talking about root cause determinations, there is a commonality of a failure to properly characterize the materials being handled. That, coupled with the failure to follow established best practices. And I see this as a I read these reports over and over again.

It has also been our experience in those incidences that have occurred within our industry that often the cause -- the root causes are a failure to follow best practices and to clearly understand the nature of the risk involved.

As far as voluntary efforts within the aluminum powder and paste industry, as Mr. Johnson referred to, there are several that we have adopted and continue to follow. All of these are based on essentially a free and open exchange of information. The industry- sponsored safety workshops that we run every two years, and have been doing for almost 25 years now, are based on a commonality of a desire to protect the people that work for us, and the plants that we operate.

This is an open exchange of information. It's done in conjunction with our European partners.

We run these workshops every two years, and we started out about 25 years ago with four people from four different companies.

We currently have attendance lists of over 100 to 150 representatives from companies from all over the world, from the United States, Germany, the United Kingdom, Sweden, France, Belgium, Austria, Poland, South America, Australia, South Africa, Japan. We all come together in the spirit of safe operations and an open exchange of information.

One thing that we find is very important in the success of these operations is that we don't just do this with management-level people. We include line operators, the folks that are out on the shop floor running the equipment, day-to-day exposure, day-to-day experience. We want to be sure that they understand the nature of the risk and that they are well trained and have a clear understanding of the best practices that are required to minimize that risk.

One of the key factors in these workshops is what we call the incident reporting session, where we basically talk about things that have occurred in the past two years in terms of whether nor -- they can fires, they can be major incidences, or very small minor incidences.

One of the things we like to focus on are what we call near misses, those incidences that wouldn't normally be reported, don't result in any major injury or any major property damage, but can serve as a warning flag to say that this occurred and it's a precursor, it's a sign that there may be a deeper problem that could lead to a major incident. We want to understand those. We want to investigate those. We want to establish the root causes, so we can prevent the big incident.

We also spend quite a bit of time in discussing engineering and operating controls, best practices, what's new in the industry, what has one company found out, and what have they done, and will they share that with all the rest of the companies in the group, so that we can all learn from experience.

We've had presentations on fire suppression, static electricity hazards, powder characteristic testing. We've developed video training tools on why dusts explode, firefighting techniques, personal protective equipment, ergonomic issues, explosion prevention measures, dust recovery systems, health and safety systems, injury and illness prevention plans, hazard communication.

As Mr. Johnson mentioned, we've sponsored industry- wide studies on static electricity hazards, the characteristics of personal protective equipment -- that is, in selection of it. What's the best equipment for a given use in a given area in terms of its ability to protect against fire, also the static electricity characteristics of materials.

Again, as I emphasize, one of our major issues in our industry is the generation of static electricity. If we put an operator in a flame-retardant piece of personal equipment, protective equipment, and it turns out that that fabric has a propensity to generate static electric charges, we're not helping the situation.

So we need to evaluate the full spectrum of characteristics based on our understanding of the nature of the risk. And we have done that.

We have also, as Mr. Johnson mentioned, just completed a study on explosability characteristics of aluminum powders over a wide range of particle sizes, both nodular and spherical shapes, and we felt there was a lack of information out in the literature, so we had a comprehensive program where samples were submitted by several member companies to a single laboratory for testing under consistent conditions in order to establish some baseline information on the characteristics that are important to understand the risk.

And we will be sharing this data. It will be appearing in the next edition of NFPA 484, so that the information can be disseminated widely.

Other activities of our committee -- as Mr. Johnson mentioned, we have developed guidelines for the safe handling of aluminum powders and pigments. These are readily available to both the industry as well as on the Aluminum Association website. Anyone who is interested can go onto that website and readily obtain these guidelines. We have them in both printed and video and on CD form. They are very useful as training tools.

We also have focused on dissemination of information to our product users. We have conducted user workshops, and we spend a lot of time in our companies on training of local emergency response personnel. We go out to the fire departments and fire marshals, because we recognize that the specific nature of the hazards that we're dealing with with metal powders are entirely different than most other materials.

Most of the techniques that firefighters -- and I would, as an aside, like to express my tremendous respect for the Fire Service and the work that they do. But, in fact, they're trained to come in and knock a fire down, get the water going as fast as they can, which is absolutely the worst thing you can do in the case of a combustible metal fire.

So we know and we recognize that we have to have an outreach program that's effective to our local emergency response personnel, to train them for those hazards so that when and if an incident does occur they are prepared and they can be protected also.

Primarily, our purpose in the aluminum powder and pigment industry is for the engineering of our processes to be as safe as they can be with a primary emphasis first on life safety, and second on protection of property. And, again, the important aspects of dealing with this hazard is a characterization of materials.

You have to understand what you're working with. You have to evaluate your process with that in mind. The selection location, equipment, and engineering controls, using proven technology, is critical. Training is absolutely mandatory. Management of change -- we've had some discussion about that.

You have to understand that if you change your process you change the characteristics and you modify the hazard. And you need to be prepared to deal with that, and then again you need to train to that. If you make a change, everyone who is involved needs to understand that change.

And that pretty much winds up my comments. And, again, I thank all of you for the opportunity to speak today.

CHAIRPERSON MERRITT: Thank you very much.

We now come to Mr. Randy Davis of -- you say it.

MR. DAVIS: Kidde-Fenwal.

CHAIRPERSON MERRITT: Kidde-Fenwal. Thank you.

MR. DAVIS: Thank you, Madam Chairman, members of the Board, and Ms. Blair, for allowing me to speak today. Again, my name is Randy Davis. I'm with the Industrial Explosion Protection Group Kidde-Fenwal. Fenwal is designed to provide dust explosion protection systems to the wood, food, grain, pharmaceutical, and other industries for over 50 years.

Over this time, we have found that the knowledge required to recognize dust hazards and apply the applicable codes vary greatly from industry to industry, organization to organization, and individual to individual.

While conducting educational seminars on explosion hazard awareness across the United States, it is clear that the number of industry professionals who are not aware of the hazards which can be present with -- when processing such common materials as sugar, starch, and plastic is alarming.

In conjunction with this lack of hazard awareness is a misunderstanding of the fundamental protection capabilities available today, as evident with the widely-held misconception that dust explosions are instantaneous events and, therefore, cannot be mitigated. They can be and are mitigated every day of the week across this country using the methods outlined in NFPA 69.

In general, awareness of fire hazards and prevention are very high in the United States. In fact, the fire standards in the U.S. are arguably stronger than any other country. As such, most individual companies in the United States have implemented comprehensive fire protection -- prevention programs for their facilities.

However, these same companies that have

combustible dust hazards often have a greater understanding of the requirements for fire protection, such as the number of sprinkler heads, handheld extinguishers, and hose requirements than they do for the requirements for dust explosion prevention.

A number of leading companies, some on this panel here -- CIBA-Geigy, Anheuser-Busch, National Starch, along with consultants and explosion and fire protection system providers, are working to increase awareness of the hazards associated with handling combustible dust.

Efforts by NFPA, OSHA, Factory Mutual, and others continue to enhance and strengthen existing codes.

Considerable time and effort has been expended educating industry and authorities having jurisdiction, or HJs, on recognizing dust hazards and the solutions available to mitigate these risks. Seminars are conducted throughout -- through industry trade shows, such as the powder and bulk handling technical seminars, continuing education seminars, such as the University of Wisconsin, College of

Engineering, fire and explosion protection seminars, and voluntary industry programs such as the wood industry's Composite Panel Association Safety Seminar Program, and other regional and industry-specific seminars.

These seminars focus on educating facility operators, safety personnel, HJs, and others on the hazards of processing combustible dust. But even with these efforts, the United States lags Western Europe and Canada in hazard awareness, and also in the enforcement of codes addressing dust explosion and fire hazards.

As we sit here today, there remain thousands of facilities that currently have potentially hazardous processes that have not been adequately protected because they are not aware of the hazard, or because budget priorities have not permitted them to take appropriate actions.

Each country in the European Union has adopted the ATEX codes for dust explosion and fire protection as law, and has a governmental authority and power to enforce the codes. If the processors of combustible dust do not meet these stringent codes, including conducting a hazard risk analysis, and implementing suitable protection methods, the authority can prevent the hazardous process from operating until appropriate safety measures have been implemented.

In Canada, Ontario has adopted the National Fire Protection Codes as law. Every company processing combustible dust must have at least one individual in the company responsible for company compliance with the codes. Those that do not comply face civil and possible criminal penalties, up to and including closure of the facility.

One example where the U.S. has been successful in a similar type of situation is the grain industry that was mentioned previously. Numerous deaths occurred in the 1970s and 1980s from the grain elevator explosions. A concerted effort by industry operators, trade organizations, and OSHA, increased hazard awareness and protection requirements, and led to a decrease in the number of grain elevator explosions and resultant deaths.

Other than what was undertaken in this industry, enforcement of dust explosion prevention codes has been limited in the United States. Fenwal's experience has been that between two-thirds and three-fourths of all prevention system inquiries for identified combustible dust hazards are not acted upon. The primary reason given is that the protection systems have a low budget priority. Without a stronger enforcement environment, addressing these risks will remain a low priority.

As an example, in 1989 the facility on the west coast identified a process with a potential dust hazard. After receiving a proposal for dust explosion protection system, they decided that they had other higher priority budget -- they had other projects with higher budget priorities.

Several years later, they had a dust explosion in that same process. They again revisited the dust explosion protection system, but decided that the odds of having a second explosion in this process were very low, and today they continue to operate this process in the same conditions that led to the first explosion.

The role of the HJ, which is usually in the United States the fire marshal or fire inspector, is extremely varied and demanding. A typical fire inspector must not only review facility fire protection but also must be knowledgeable of the hazards and complicated manufacturing processes.

We are asking the HJs to perform risk analysis instead of verifying that the operator has conducted such a thorough risk analysis and implemented appropriate protection methods.

Without adoption and consistent enforcement of appropriate codes, implementation of effective prevention programs will be limited. Enforcement of existing codes has lagged largely because, one, there is no central jurisdictional enforcement authority; two, HJs have limited knowledge of explosion hazards associated with complicated processes; and, three, most industries have not made it a high priority.

In summary, it should be the goal of all companies that handle combustible dust, as well as safety organizations, insurance companies, and government authorities, to reduce risks associated with handling of these dusts.

This can best be accomplished with: 1) increased awareness of the hazards associated with processing combustible dust through increased education by industry trade groups and by updating process safety training requirements; and 2) increased familiarization and implementation of prevention methods by industries that process combustible dust; and 3) finally, and most importantly, the burden of performing risk analysis must be placed on the shoulders of the facility operators, and the HJ should only be asked to audit the protection methods determined by this risk analysis.

We cannot ask the HJs to be the only point of protection and enforcement for explosion hazards. Process owners must be held accountable for their facilities.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

Mr. Febo?

MR. FEBO: Thank you. I'd like to thank the Board for allowing me to participate in this hearing. My name is Henry Febo. I'm an Assistant Vice President and Senior Engineering Technical Specialist with commercial and industrial property insurer, FM Global.

I'm a chemical engineer, and I've worked with FM Global for almost 35 years. I'm also a member of several NFPA committees, including 654, that has been mentioned before. FM Global is headquartered in Johnston, Rhode Island, with more than 50 offices worldwide. More than one out of every three of the Fortune 1000 companies rely on FM Global for property insurance and our property loss prevention engineering services.

We employ more than 1,500 engineers to serve our clients in more than 100 countries through regular inspections, assistance on new construction, and response to specific property loss control issues. During our 170 years in business, we see that year after year property-related threats, such as fire and explosions, natural hazards, our equipment breakdown can adversely affect business operations of companies, if such threats are left unaddressed.

For a recent 20-year period, I examined the FM Global loss experience related to combustible dust at locations insured by FM Global. The review showed, very similar to what CSB came up with when they looked at their loss history, that by number the woodworking industry was at 40 percent the top incident producer, followed by food, metals, chemicals and pharmaceutical, each producing about 10 or 15 percent of the incidents, and then utility, mineral, pulp and paper, and the plastic and rubber-working industry each producing about five percent of the incidents.

Breaking these losses down by successive five-years periods, there is a downward trend in both the number and total dollar loss from the earliest to the latest period. I have provided the Board with a couple of bar graphs that show this data.

FM Global engineering staff are all graduate engineers from many disciplines. FM Global trains them in the specifics of property loss prevention and control. This training encompasses a wide range of topics, including construction, fire protection systems, flammable liquids, gas and combustible dust hazard, warehouse storage, natural hazards such as windstorm, flood, and earthquake, and equipment hazards, such as boilers, pressure vessels, rotating equipment, and electric power systems.

Training also is provided one on one by our more experienced FM Global engineers onsite at our client's facilities, as well as in classroom-based setting in a curriculum that spans several weeks. After FM Global engineers have worked a few years developing a good real-world understanding of general property loss prevention issues, they often begin to develop specialties in one or more areas.

We provide them with advanced training, both one on one and on a group setting. As it relates to dust hazard, FM Global provides a three-day training program covering both the fundamental science of dust explosions as well as practical aspects of dust loss prevention and protection.

The training addresses the hazards of the equipment and the processes that handle and create dust, as well as dust control systems like dust collectors and cyclones. We also address explosion venting and housekeeping, as well as explosion suppression and blocking systems.

In this training program, FM Global engineers learn how to use our proprietary explosion vent design software that allows our engineers to specify the amount of explosion venting required to minimize damage in the event of an explosion in a building, room, or piece of equipment.

Our engineers learn not just what data goes in the box in the software, but also the science behind the software, so that they understand how each data requirement affects the accuracy of the answer. About 150 FM Global engineers have taken this training.

FM Global engineers conduct regular inspections at our clients' sites based on several factors, including the dollar value of the property underwritten. A large site might be visited annually, while a smaller site may be visited once every three years.

These inspections allow our engineers to gather data that our account teams, including underwriters and engineers, use to evaluate the risk of loss at a location and help determine the client's insurance premium. The premium also includes FM Global's engineering services.

As an aside, I might mention that many insurance companies write on a statistical basis. They look at the statistics and then they figure out what the loss is going to be, and they underwrite that way. We underwrite on a risk-by-risk basis and evaluate what we think the risk is and evaluate individually.

Information on hazards identified during our site visit is shared directly with onsite plant management one on one, and in a printed report. This report includes a description of the hazard and the recommendations for reducing the hazard to an acceptable level for underwriting purposes.

Our inspections and recommendations are for evaluation of the risk from an underwriting perspective. So our clients have a choice to complete the recommendations or not. Often they have other locations that have greater hazards, and with limited funds they prioritize the improvements across the business. Some recommendations may take a number of years before they're completed.

While we would like to have FM Global engineers provide regular property loss prevention inspections to each of our clients, the practicalities of the business world, as well as our clients' desires, require us to focus our efforts where property risk is greatest.

Based on our extensive loss history files, we have developed guidance for FM Global engineers to focus their visits on key hazards of a particular industry. For example, we have found combustible dust to be key hazard in wood, plastic, and rubber working, food and beverage industries, as well as the chemical and pharmaceutical sectors.

Other industries are less likely to have combustible dust hazard, but if it exists our engineers are able to take the time to evaluate it.

In addition to providing property insurance coverage to our client, FM Global has numerous educational property loss prevention tools available to them -- our clients. For example, our clients can call their account engineer to discuss a specific property loss control issue. FM Global engineers can provide advice on a new project, so that hazards are engineered out, often called inherent safety, rather than corrected for or protected after construction.

The project could be as small as replacing a piece of equipment or as large as building a multi-million dollar grass-roots plant. These engineers can also provide short seminars, up to a day or two, on selected topics at a client's facility to help educate their staff in proper loss prevention measures. these additional consultation visits and short seminars are usually without additional cost to the client.

A second resource for our clients is FM Global's understanding the hazard tools that consist of brochures, video clips, photos, and loss lessons that discuss more than 130 different property hazards and loss prevention solutions. These tools are designed to be used by our engineers to help an untrained person understand a specific hazard using layman's terms.

For example, FM has developed an understanding of hazard tools specifically dealing with the topic of combustible dust. It discusses the factors that create a dust hazard, a little bit of science on how something like flour sitting in a storage silo becomes an explosion, and then an example of an actual dust explosion and its effects.

The tools include a four-page brochure that can be left with a client. There are also video clips, PowerPoint material, and other loss lessons that can be presented by our engineers to a client's management and plant staff. There are about eight tools related to various aspects of dust explosion, prevention, and protection.

FM Global also conducts a number of focused educational seminars and workshops for our clients that address various property hazards and loss prevention solutions, including fire, explosion, natural hazards, and equipment-related issues. These programs are updated regularly by FM Global technical specialists, such as myself, to reflect the latest research and industry information, current loss trends, and clients' needs.

FM Global's experienced training staff presents these seminars, possibly in the client's local language. The seminars can -- seminars address different levels of need and skill, and can be customized and delivered onsite at our client's location of choice.

Attendees receive detailed notes and supporting material, number of continuing education credits that have been earned, where that's applicable, and a certificate confirming participation.

Another resource is FM Global's property loss prevention data sheets, which provide indepth guidance on approximately 350 loss prevention topics. One of my responsibilities at FM is to develop, revise, and keep these standards up to date, so that our loss consulting engineers can have the latest information.

I also respond to field and staff questions on these standards where the standards are not clear. These are available to our clients and to the public. They are best used by people who have some level of knowledge of the subject. They are not training tools for the novice.

FM Global data sheet 7-76 provides recommendations for dealing with combustible dusts. This data sheet discusses such matters as appropriate locations, construction, maintenance, housekeeping, ignition source control, operating equipment, and protection systems. FM Global has also developed related data sheets for specific equipment or occupancies, such as dust collectors and collection systems and grain storage and milling.

In summary, FM Global operates on a philosophy that the majority of all property losses are preventable. Prevention requires a client whose management operate from a philosophy that is better to prevent a loss than to recover from one. That is why our clients rely on the support of FM Global's engineering staff who can help them recognize the hazards at their facilities and provide sound loss prevention solutions based on scientific research.

To make this team effort work, we train our engineers in specialized areas of property loss prevention engineering using the latest training techniques. Then, our engineers are provided with tools to help our clients understand the hazards that we have pinpointed and make the efforts to more effectively protect their property.

The savviest of companies realize that when it comes to property losses you don't have to roll the dice. There are engineering solutions to help take control of their destiny.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

At this time, I'd like to open the floor for questions. We'll start with the Board. Mr. Visscher, do you have a question?

MR. VISSCHER: Sure. This is a question to Mr. Davis. It says on the sheet that you're here on behalf of AFHA. I don't know who AFHA is.

MR. DAVIS: Excuse me?

MR. VISSCHER: AFHA -- that's the association?

MR. DAVIS: Yes, that's the -- I'm actually as a substitute for that.

MR. VISSCHER: Oh, okay.

MR. DAVIS: Their representative backed out, so --

(Laughter.)

MR. VISSCHER: Oh, okay.

MR. DAVIS: -- I was asked to fill that slot.

MR. VISSCHER: Your company sells, I guess you said, as compared to prevention, sort of protection systems, right? Is that correct?

MR. DAVIS: That's correct.

MR. VISSCHER: Explosion protection systems.

MR. DAVIS: We design and sell various explosion protection systems, yes.

MR. VISSCHER: Can you very briefly

describe what one would be like?

MR. DAVIS: There are several types. Explosion suppression would be one. That is where you actually, after an ignition source ignites, a dust cloud in a vessel or in some instances a room that is detected very quickly and then suppressed with a suitable suppressing agent to keep the resultant pressure from rupturing that vessel and starting a secondary explosion, and also to prevent it from propagating to other areas of the facility to start secondary explosions.

MR. VISSCHER: I see.

MR. DAVIS: Also explosion venting and different types of -- dealing with after the incident already occurs.

MR. VISSCHER: Okay. With regard to the aluminum issues, you produce powders, and then you would, for example, ship it in powder form?

MR. OBERHOLTZER: That's correct, yes.

MR. VISSCHER: And what kind of suppression or prevention systems work with regard to explosion prevention with regard to powders and that

-- shipped and --

MR. OBERHOLTZER: Well, it depends on the material. Primarily our focus is on best practices in terms of the primary source for prevention. If you design the equipment properly, select it properly, maintain it properly, best practices also include things like housekeeping, control of ignition sources, as I said.

You look at the four elements. You have four elements, right? You have a combustible dust. Well, we recognize that with our products. So then you need to say, "Okay. What else do I need in order to have a bad incident? I need an ignition source." So you develop the processes and practices to control that ignition source.

Grounding and bonding, again proper selection of materials. If you're, say, working a dust collection system with a dust collector at the end of it, you want to make sure that those are all conducted materials that you build. You bond across any insulating or non-conductive components. The best practices, again, will go to housekeeping, make sure the place is clean, control fugitive dust emissions. All of these things go to prevention.

Isolation and suppression are useful, but the problem has already occurred at that point. And, in particular, when you're dealing with aluminum, because of the tremendously rapid rate of pressure rise, and the tremendously high pressures that are generated, many suppression systems, in fact, are not effective, either they're not fast enough to isolate it, say if you're talking about a gate valve or something of that nature within a duct, or the suppression materials are not as effective as they need to be.

Many materials -- halon has been mentioned, I've seen that mentioned in some papers as a suppression device -- aluminum reacts negatively with halons and most other materials. So it's sort of a special case, because it's, again, at the top of the charts. The energy released is -- is higher than almost anything else.

So you may want to look at venting. Again, there are considerations there. It has to be, number one, large enough to effectively release the pressures generated. When you vent, then you've got a problem what's coming out of that vent. You've got a fireball. You've got burning material. So location, isolation, where you put these dust collectors, and how you vent them and the orientation of those vents, are critical factors.

Our primary approach in my company, and I think in general, and I -- there are some other folks from the aluminum industry in the audience who may slap me down a little bit when the public comment period arises -- is on best practices and good engineering controls and training for prevention.

We train our people all the time to be looking for static electric hazards, bonding and grounding, make sure, inspect it all the time, do connectivity tests all the time, maintain the equipment properly all the time, control fugitive dust emissions.

We use inerting in many of our processes as a control factor, a prevention factor, eliminate the oxygen. Again, it goes to those sources, understanding the sources of the problem, and then dealing with them. If you take one aspect of those four critical issues out, you don't have a problem. And we focus very much of our efforts on doing that.

CHAIRPERSON MERRITT: Thank you.

Mr. Bresland, do you have a question?

MR. BRESLAND: In the incidents that we talked about this morning, the West Pharmaceutical incident and the CTA combustible dust explosion, they were I guess what you'd call fugitive dust situations. You also deal with dust in enclosed situations where you don't want to have a dust explosion inside the piece of equipment that would explode and destroy the piece of equipment.

Do you look at -- how do you look at those two potential types of explosions? Do you look at them differently, or do you -- do you deal with them differently? I know in the pharmaceutical industry or the chemical industry that's -- that's certainly an issue as well, that Tom Hoppe talked about also.

So I'd just be interested to hear what your thoughts were on the frequency of events in enclosed processes/equipment versus fugitive dust type incidents, just a gut feeling of the --

MR. OBERHOLTZER: If you are speaking specifically to the metal dust --

MR. BRESLAND: Not necessarily.

MR. OBERHOLTZER: In general?

MR. BRESLAND: In general, yes.

MR. OBERHOLTZER: I think probably fugitive dusts are a major issue. Again, as has been mentioned before, these are infrequent events that have catastrophic consequences. They don't happen a lot. But when they do, it's generally pretty severe, and the fugitive dust issue is critical to that aspect of it. In other words, the severity.

As was mentioned and is certainly relevant in the metal powder industry, it's often not the first explosion or ignition that creates the problem. It's the second one that's the big one and does the most damage and creates the major injuries. And that's definitely a fugitive dust and housekeeping issue.

Within a controlled process, if you've designed it properly, and you've trained properly and this also goes to the I think critical factor of training for out-of-norm conditions, it's fairly easy to train someone -- okay, if this gauge is within the green zone, and you do these buttons here, and all of that, that's great.

What seems to be lacking, and I've seen it in some of the other incidences that I've read or heard about or understand about, is that there's insufficient training for, what do you do if the gauge goes to the red zone? What do you do if your pressures are too high? And that is lacking.

But other than that, within a process, in a contained vessel, generally these are rare -- more rare experiences than the fugitive dust issues where, for whatever reason, whatever the source of ignition, then the secondary and tertiary, all the way down the line, domino effect, takes over, and that's where the truly severe incidences stem from.

MR. HOPPE: John, I'd like to address that. You know, when you talk about the West Pharmaceutical issue, and you think about the fact that the dust was collected in a place that, to be quite frank, I would never look there, you know, we want to make sure that we -- when we move forward here that we address more than -- well, I'm sure we will address more than that -- but the so-called low-lying fruit, because the preventing of a secondary dust explosion is a housekeeping issue.

And the vast majority of the times housekeeping issues for an inspector, or even for management, is quite obvious. So you can say, "Look, we want to focus on making sure we have proper housekeeping," and that's -- that's a pretty obvious issue.

Where it becomes much more complex in addressing dust explosion hazards is the hazards that occur within the equipment, which is normally the primary source of the pressure wave in the first place. And there, when you start talking about the application of engineering solutions -- and there are a number of different engineering solutions you have -- you really have to do that on a risk-based concept.

A broad-brush approach to that is, you know, for example, we can say, "Well, I'll protect combustible dust." Or we say we want to have a definition of combustible dust on all material safety data sheets. It goes so much more deeper than that, because you really want -- if you're going to a risk-based assessment, the risk-based assessment is based on numerical values that you need to take, because risk is not only a function of severity, it's a function of probability.

And if we move in this direction, we have to make sure that anything that we address on a regulatory basis gives the option for people to make the assessment both on a severity perspective and a probability perspective. That's very critical. Or else you are going to be allocating resources which are limited, in many cases in the wrong direction.

CHAIRPERSON MERRITT: Yes, sir.

MR. DAVIS: I would like to address that. It is two different -- the question was the secondary versus the -- oftentimes the primary explosion. It is -- what our experience has been, it's 50 to 100 times more likely to have an explosion inside a vessel than the catastrophic secondary explosion that does destroy a vessel.

We currently have -- we have a different type system, but our suppression systems -- we have over 8,000. We average anywhere from one to two successful suppressions each week throughout all different types of industries, and this and that. We often get called in to facilities where they have had a minor pop, where they've had a low-grade explosion, maybe minor damage, no one hurt, but it has raised their eyes.

So it -- explosions in vessels are much more common than anybody outside our industry -- the explosion protection industry -- knows or would even have an idea, because if it's successfully suppressed, or if there's no damage, no one is injured, no one knows but that facility and possibly us or one of the other explosion protection suppliers. So it is a much bigger issue than what is -- what the public knows.

CHAIRPERSON MERRITT: Thank you.

A question I have is -- it's always an amazement to me when we do an investigation when some of the first things we hear from management is, "If we only knew about this hazard, we would have done something about it." In a lot of instances, the hazards are pretty obvious and nothing was done about it before it happened, or there were warning events that nobody seemed to follow up on.

One of the questions that I have is: what is the role -- and, Mr. Hoppe, I think you've already addressed it in a lot of ways -- the role of the supplier to let their customers know about the hazards of their products. I think CIBA does a wonderful job at, you know, working with their customers.

You know, it would seem to me this would be an entry point for information, because anybody who is supplying the product more than likely has a lot of the knowledge and is already taking care to prevent accidents at their own facilities, and then supplying it to people who may or may not be taking those same standards of care.

What do you think is the responsibility of the supplier to inform their customers about the need to take care with this particular product in certain circumstances? Tom, do you want to --

MR. HOPPE: Well, we take -- we obviously take that very seriously ourselves. We feel that it is the responsibility of the supplier to inform our customers on the hazards. And here it becomes an interesting problem in a sense, because if you go to your marketing people and say, "We're going to tell our customers that this is a potential dust explosion," their marketing sales people will say, "What are you, crazy?"

And we went through a lot of dialogue within our company, and what we try to do is try to -- well, one is the responsible care issue and feel obligated to -- obviously to tell them that, but it's a question of how you send the message.

And if you send the message in a concept of a value- added approach, that we are providing a service to you that will help you protect your facilities and continue your manufacturing and protect your people, then you find you get a lot of buy-in from a lot of different parts of the organization who are involved in these type of decisions.

So I think it is the responsibility of the supplier to -- but the problem you run into is that if you now tell this person the problems, and they sell their products to this person, this person, this person, is how far down the chain can you really get. And that is where you really start running into the problem where it can get to the secondary and a third party, which doesn't get the training, and doesn't get --

CHAIRPERSON MERRITT: Isn't getting any information. Hmm.

Yes, sir, Mr. Johnson?

MR. JOHNSON: Aluminum producers have -- own MSDSs, which have been much maligned today, which I think that they're better than nothing, but I do agree that the information provided on MSDSs can vary in quality quite widely.

But when aluminum is produced in its massive form and sold that way, and many times on an MSDS you'll have a statement that fines generated from the machining of this material can be combustible -- how far down the production line that information goes is open to debate.

How far down the line an MSDS from primary aluminum goes after, for instance, a wheel is made out of it, but it goes somewhere else for the machining of the load holes, and so forth. We don't know how far down that information does make it.

In terms of aluminum produced as a pigment or a powder that we've -- our group has undertaken an effort to standardize their MSDSs, so that the information is much more comparable from one company to another. Not only have they done that in the North American market, they are trying to rationalize MSDSs with the European Union equivalent, so that materials sold outside of this regulatory environment also contain similar information for a similar product.

CHAIRPERSON MERRITT: Mr. Febo, I mean, one of the questions -- this is sort of like the when did you stop beating your wife questions.

(Laughter.)

You know, I mean, where does regulation come into play? I mean, if there were regulatory standards, if there was an enforcement mechanism, do you feel like there would be a greater attention to this particular hazard with regard to standard of care that is taken in industries that use these powdered materials?

MR. FEBO: Well, from my standpoint, I don't get involved in regulation. We are outside of the -- from the standpoint of how we operate, we're outside of regulation. But when you look at the effect that -- the apparent effect that the OSHA regulation on grain- handling operations have had, it seems to be that a good regulation may be some improvements in existing regulations rather than a new one, would be a broad- based way of bringing this type of information to everybody's attention.

If you -- on the previous panel before lunch there was mention of the scattered codes and the different ways of doing things. What the OSHA regulation on grain-handling did was give everybody a standard code and a national target to shoot at.

It's possible that if you can make use of existing codes -- the PSM code, while you think process safety management has nothing to do with the food handling industry, process safety management as a philosophy has been a philosophy that we addressed 40 years ago.

CHAIRPERSON MERRITT: Right.

MR. FEBO: We had the 10 qualities of a fire-safe plant. You look at the qualities of PSM, and there's 10 standards and they're -- they're almost all of ours.

So I think you can overdo it with regulation, but improving regulation and getting some standard by which everybody can work to, whether it be by the national government doing it or by individual governments, there is probably getting people the information more directly

CHAIRPERSON MERRITT: Does anybody else want to comment to that?

MR. OBERHOLTZER: Well, I think we addressed it to some extent. Much of the regulatory framework I think is probably already in place. I think it's a matter of how it's applied, and we've talked earlier today about the individual states and how they approach fire codes.

I think the information that is necessary, certainly in terms of best practices, as well as suppression and prevention devices, so on and so forth, is out there, is available. I think a wider incorporation of the NFPA standards -- I'm going to wave the flag a little bit for NFPA here. I've been involved with them for many years. The Aluminum Association has been involved with them for probably 20, 25 years on their committees.

It's a wonderful consensus way to write standards with all players involved, and I really think these types of things should be incorporated in the fire codes across the board. You know, OSHA's regulations -- you've got the general duty clause that says, "You will provide a safe and healthful workplace." That can't be any more straightforward.

I don't think a list of this, this, and this is going to be effective, because you're bound to miss something. One thing you may notice in the hazard communication standard in the OSHA regulations, there is no mention of combustible dust. You have combustible liquid definitions, flammable solid definitions. Nowhere does it even mention or define combustible dust.

So I think if you want to do something that's -- maybe you -- to call attention, just about everybody at this point, one would hope, is at least looking at hazard communication. And if you make some reference to combustible dust, and there is an issue, and then you combine that with standardized -- as we're attempting to do -- MSDSs, improve that a little bit, outreach programs, use the available resources -- I'm not all that sure that you need much more regulation. You just need harmonization within the regulations as they exist.

CHAIRPERSON MERRITT: One question for Mr. Johnson. I mean, one of the things -- I think associations do an excellent job in helping to get information to their members, and they send people from their organizations to training sessions that you hold and that's wonderful.

The problem is is you don't represent everybody in the industry, and there are a lot of people who will not join an association, for whatever reason. What do you think -- and my concern is is I think those may be some of the highest risk people, because they're not getting the information they need in order to even understand what a minimum standard of protection would be.

What do you do to try to get information to people who won't come to your training sessions?

MR. JOHNSON: Our primary avenue to do that has been through the influencing of other consensus organizations. NFPA is one of them, ASTM, ISO. We work with all those other organizations at which other players are also involved. And once you start influencing consensus organizations, you reach another level of players within your industry that may not be involved in your own trade or organization, but are -- have to be, in today's regulatory landscape, involved in other consensus organizations.

We do obviously -- the work that we do for our members, and you know this through antitrust regulation has to be offered to everyone else, and, of course, we do that anyway -- but we are well aware that we will never reach everyone through a voluntary organization. That's the nature of a voluntary organization.

Conversely, there will be freeriders that don't join the organization but still reap the benefits of it, and that's exactly what companies are doing who repeat the benefits of this work through other consensus groups. That's a good thing, if it's making the industry safer.

The final answer is that we can't reach everyone, and so that's why we do work with other organizations out there and why we currently hope that the CSB effort goes forward.

CHAIRPERSON MERRITT: John, do have any other questions, or Mr. --

MR. BRESLAND: Yes. We talked earlier about confined dust. How is confined dust covered under NFPA regulations or NFPA codes? Are they referenced in the codes? I --

MR. OBERHOLTZER: You're talking about defined within a process of ductwork or collectors or process vessels, or what have you?

MR. BRESLAND: More in the process vessel area, dryers, reaction vessels, and the like.

MR. OBERHOLTZER: They're addressed in the standards. They're certainly in the -- 654 addresses that. Certainly, the standard that I'm most familiar with -- 484 -- has quite a bit of information on process controls, process safety design, location, proper equipment, maintenance procedures, references to National Electrical Code, as far as the classification of hazardous locations and the selection of the proper equipment, references to the codes dealing with industrial trucks, the right kind of forklift to have in an area that's classified for a given hazard.

So there's quite a bit of information within the NFPA codes on process and process control.

MR. HOPPE: John, I would like to address that. You know, when you look at the NFPA codes, and in particular 654, and 654, you know, kind of breaks down the requirements to protect by unit operations. You know, whether you're milling or your drying or something like that, it's not as specific as perhaps you would like it to be, but it does say you need to protect if you have a certain set of hazards.

And I think it's a very good -- a very good document in the sense that in the back of the document it also has an appendix which describes the type of information that you require to make the appropriate risk assessment, risk-based judgment, based on the type of unit operation you're dealing with.

So in moving forward, when you talk about the -- like the question Carolyn asked about, do we want another regulation, and, of course, industry never wants another regulation. But I would have to say, but incorporating some of the NFPA by reference, like they've done with some of the OSHA -- within some of the standards -- I don't -- we have a lawyer here. He can help me out with that.

But I think this is a really elegant way of bringing good technical information and consensus engineering standards into the regulatory atmosphere without having to create a totally new regulation.

And to kind of echo some of the -- you know, what has been said before, there are a lot of good consensus engineering standards out there already to address this hazard, so this is maybe one possible approach that the Board must consider.

CHAIRPERSON MERRITT: Okay. Any other questions?

MR. VISSCHER: Do I have time for a followup for Mr. Febo?

CHAIRPERSON MERRITT: Sure.

MR. VISSCHER: Thanks.

I think you said in your testimony -- and this sort of follows on this discussion of where consensus standards fit, and so on -- that in terms of what you -- your investigators look at, based on risk you've made the decision that not all workplaces are subject to this risk. You've picked out very specific operations for which they would look at dust hazards? Did I understand that correctly?

MR. FEBO: Sort of. What I was saying is because we insure so many different types of industries, and we don't have an infinite resource of engineers to go out and investigate, to evaluate, and our basis is to look at -- to try and get the 80/20 rule, get the 80 percent that's going to do -- you know, the issues that are going to hit 80 percent of our losses, and we cover the other ones by underwriting them.

So what we have to do is give our field engineers some guidance on what hazards are primary in a particular industry, because they may not be familiar with the industry when they go out there. We give them some guidance to say, hey, you go into a pharmaceutical plant, and you might want to look at combustible dusts, flammable liquids, corrosive materials, some other materials that we know by loss history has given us the big losses.

So our engineers are not spending the time looking in coat closets for the single sprinkler head that might be missing. We want to go out and look for the thing that's going to cause the biggest damage, that's going to be the biggest contributor to losses, not only cost us money but cost the client money.

We can insure against a loss, but we have limits on what we pay. So the client often has stuff as losses that are not paid by insurance, so it's important for them to recognize that we're not only, you know, out helping ourselves keep our costs down, and our clients' costs down because we are a mutual company, but we're also interested in helping them prevent the losses that just can't be underwritten, can't be insured.

MR. VISSCHER: Do you insist on the insured following 654?

MR. FEBO: No, we don't insist on them following anything, since we're not a policing type organization.

MR. VISSCHER: Although you could pull your insurance I guess.

MR. FEBO: We're insurance. What we can do is if we get a client that is continually not complying with our recommendations, and they don't have valid reasons why -- you know, we don't have an infinite amount of money, so they comply with certain ones.

But if we have a client that just doesn't accept our philosophy of all losses are preventable, we just have to work at it. We can stop writing the insurance, and we do that in many cases. We pick our clients and decide on a client -- on an overall basis of not only the individual risk at a location but the management philosophy.

If they recognize that losses are preventable, that goes a long way to preventing the losses and keeping the book of business that we write acceptable to us.

MR. VISSCHER: Are the industries or operations for which your engineers look at combustible dust hazards -- is that uniform throughout the insurance industry, do you think?

MR. FEBO: I can't speak for other insurance companies. Many insurance companies do not provide significant loss prevention services like we do. We feel that, you know, we underwrite on the basis of individual risks rather than statistical risks.

So I would -- what I know of most insurance companies that we co-write insurance with often is they'll use our inspection reports to help them underwrite the location properly and they don't -- they don't have the staff. We have the largest loss prevention engineering staff in an insurance field throughout the world. So they'll do things differently.

CHAIRPERSON MERRITT: I'd like to thank you all. I wish I had time -- I'd like to ask you one more question about the 65 percent who don't accept the recommendations, you know, what the statistics is for, you know, wishing they had. That would be a very interesting piece of information, but I'm sure you don't have that.

We're going to go ahead and break early. I'm going to give you 15 minutes. We'll reconvene here at five minutes after 2:00 -- 10 minutes after 2:00. Ten after 2:00, and we'll convene sharply at 2:10. Thank you.

Thank you, panel.

(Whereupon, the proceedings in the foregoing matter went off the record at 1:53 p.m. and went back on the record at 2:11 p.m.)

CHAIRPERSON MERRITT: I would like to welcome our guest. Dr. Irv Rosenthal, our former Board member, is here.

(Applause.)

CHAIRPERSON MERRITT: And we appreciate very much his coming down to visit us and to be here for this hearing.

PANEL E: TECHNICAL BARRIERS TO DUST EXPLOSION PREVENTION AND PROTECTION

CHAIRPERSON MERRITT: At this time I would like to convene our last panel. This panel will speak about the technical barriers to prevention of this hazard.

Our first speaker has traveled from far away, from Norway, to be here. I think we have good weather here. And we're glad that you are seeing our good weather.

Dr. Rolf Eckhoff is professor of the University of Bergen in Norway and is a well-known -- I should say famous -- consultant on accidental explosion problems.

Following Dr. Eckhoff will be Mr. Erdem Ural of Loss Prevention Science and Technology. Next will be Mr. James Mulligan of Lockheed Martin and Mr. John Going of FIKE Corporation and Mr. Walt Frank of

ABS Consulting. We welcome you and thank you for participating.

And, with that, I'd like to give the floor to Dr. Eckhoff.

DR. ECKHOFF: Madam Chairman, Board members, colleagues, I have been a full-time professor at the University of Bergen for nine years. Before that, I did a lot of other things. I also enjoy having a kind of part-time share in China. Then I have a 20 percent position in a young, dynamic consulting company in Sweden. It's also on safety. So this is my daily life.

So before joining the University of Bergen, I worked for more than 30 years at Kristen Mickleson Institute, also in Bergen. And during the 1970s, I established the research activities there on both accidental dust and gas explosions. There were some other things happening in Norway at that time with the oil coming and all of this.

So my Department of Explosion Safety at that institute was later reorganized into what is now known as GESCOT. You may wish to know that I was, in fact, the secretary in a small group that produced the very first official dust explosion code in Norway 30 years ago. So I have been on that side as well. I think those codes are still going.

So before embarking on the technical issues of this testimony, I should like to thank CSB for being so kind to invite me to take part in this hearing. This is a very new and fantastic experience for me. I want you to know that I consider this a very great honor.

Then to the dust explosion issues, as you know, industry uses both preventive and mitigatory measures for fighting their dust explosion hazards. And there are many important research issues to address also on explosion prevention, the ignition source prevention, all that kind of thing.

In this short presentation, I shall limit myself to the mitigatory problems. And I shall concentrate on research that I think will be necessary that is related to sizing of dust explosion vents for process units, sizing of venting arrangements for rooms if there is a risk of secondary explosions that we have discussed a lot, design of explosion suppression systems for process units, design of systems for preventing primary dust explosions from propagating from one primary enclosure into other enclosures through channels and so on.

The common problem in all of these things is to know how fast the dust cloud is burning. I am going to concentrate on that problem only because we don't know that too well. And I will try to sort of indicate what I think we have to do.

In my view, there is a considerable potential for improving the cost-effectiveness of these kinds of measures in a somewhat longer perspective than just tomorrow or next week. And I wish to use this opportunity, which I consider very unique, to highlight the type of more long-term research and development that I think will be needed to exploit this potential.

I know very well that industry needs solutions that are available more or less immediately. However, this unavoidable short-term pragmatism should not block a parallel strong stride for better long-term solutions. So we have to do both.

As I see it, we are now in the initial phase of a shift in philosophy of dust explosion mitigation. So far we have been relying on more or less simple rules of thumb. In the years ahead, we shall be seeking more sophisticated methods that provide increased flexibility for tailoring and, hence, more cost-effective designs.

The main argument for this shift is that simple rules of thumb must necessarily be conservative to be able to embrace all cases. Then, hence, the resultant design may easily become less cost-effective than designs by methods permitting differentiation and tailoring.

In any design or measures to mitigate dust explosions, the expected combustion rate of the dust cloud is a key parameter, as I said. The core problem is then that the explosive dust clouds of any given dust can have very different burning rates depending on whether they are located inside crushers and mills, dryers, mixers, hoppers, and silos, pithers and cyclos, specter elevators, and other types of conveyors, and inside long ducts.

The reason for the different burning rates is that the distribution of dust concentration and turbulence and of the degree of particle agglomeration in the dust cloud have a decisive influence on the rate with which clouds of one given dust will burn.

These conditions vary substantially depending on the process situation. In other words, the burning rate that a given dust will have in an actual explosion cannot be assessed once and for all in a simple laboratory test.

Those of you who have glanced at my book on dust explosions will know that I strongly believe that in the years to come, advanced mathematical simulation models will play an increasingly important role in solving practical dust explosion mitigation design problems.

In order to develop such models, we have first to deepen our understanding of the physical and chemical processes involved. And a dust cloud presents a complex two-phased problem, which is much more difficult to handle than one-phase gas explosions, for which we have very comprehensive models already.

Then we have to develop mathematical simulation models based on this new understanding, employing the concept of computation and fluid dynamics.

This is, as I see it, the most promising long-term approach for providing us with the desire to cost-effective, differentiated, and tailored solutions that industry will ask for.

However, there is a very important additional point to make Development of this kind of models requires extensive support of carefully planned experiments.

The purpose of these experiments is twofold; first, experiments on needing for solving the basic physical and chemical processes involved. And before doing experiments, we had to screen the literature carefully because there are many good experiments that were conducted in the past which we are not really using and which we would really have to dig out of the forgotten and push back into life because there is a lot of good work done, but we also need more experiments.

And, secondly, we need experiments up to large scales, and they are absolutely essential. They are absolutely essential for validation of the models developed. Also here we can screen, and have to the literature to see whether there are good experiments done in the past, which we can also use for validation. Modeling of dust explosions without extensive experimental support does as far as I see it not make much sense.

As many of you know, a valuable initial project aimed at developing a comprehensive numerical simulation model for dust explosions has, in fact, been running for some years. I'm referring to the Joint European Union research program desk, which I understand will be discussed in more detail later in this session by Dr. Going.

I am proud to tell you that my outstanding senior Ph.D. student, Trig Vishald, is presently playing a very central role in the research part of this program. Unfortunately, the desk program is coming to an end in a few weeks' time. And it's research only constitutes the very first step towards a satisfactory model.

A lot of hard dedicated and focused work and quite a bit of financial support is needed before we have a reasonably well-developed and validated computer code that can be used with confidence in design work.

I sincerely hope that many good people in many countries will join forces to make it possible to continue and fulfill the important tasks that were initiated in the DESC program.

Thank you very much for your attention.

CHAIRPERSON MERRITT: Thank you.

Mr. Ural?

MR. URAL: Madam Chairman, Board members, and CSB staff, thank you for your kind invitation to address this forum.

My name is Erdem Ural. My interest in dust explosions started when I was in graduate school in 1978. I have been working in this area ever since. Over the years, I have worked for a major insurance company and an explosion protection company.

Currently I am an independent consultant active in this area. I'm a member of the NFPA Committee on Explosion Protection Systems and the Chairperson of the ASTM Subcommittee that has jurisdiction on dust layers.

In my free time, I serve as the Advisory Board Chairperson of my local Literacy Volunteers Organization. According to the U.S. government statistics, more than 20 percent of the adults in the U.S. have virtually no literacy skills. About another 25 percent of the U.S. adults have very limited literacy skills that will impede their comprehension and communication in the workplace.

On the other hand, some of the Material Safety Data Sheets are written using technical jargon, convoluted language, and are embellished with legal disclaimers, so much so that you would need to be an expert to understand these.

Dust explosions cause deaths, injuries, property damage, business interruption, loss of market share, and loss of good will. Their actual cost to a company or to the U.S. economy is much larger than the $5 million per anticipated death used in justifying the new U.S. regulations.

As I concur with the previous experts that American people deserve just as good, if not better, regulations than the Europeans and the Canadians.

No company wants to have a dust explosion take place in its plants. Historically large companies took this hazard very seriously, developed, and retained internal expertise and used sophisticated risk assessment, risk management tools to address the dust explosions. They also sponsored research projects to develop basic knowledge as well as customized solutions, but the landscape is changing even as we speak. Even the retiring experts are now being replaced.

Smaller companies had to use public knowledge available in like the NFPA publications or rely on specialty companies, such as explosion protection equipment vendors or our consultants. They would tell them what to do or if the solutions were too expensive, they did everything not to do anything.

We need the government to help the companies of all sizes by increasing the information available in the public domain, facilitating the development of lower-cost solutions, and providing assistance where necessary.

Now I will shift gears and talk about the research issues, protection and prevention opportunities, and the hidden risks. In the U.S., the largest barrier to dust explosion research is dwindling government and private funding.

Most of the published data are coming not from the U.S. but from the rest of the developed world. In the U.S., fewer companies are sponsoring test projects to develop applications where standards do not provide explicit solutions or where the available solutions are too expensive.

Privately sponsored research is usually kept confidential for the sake of competitive advantage. Another issue with the privately funded research is that due to budgetary constraints, their scope is often too limited for a wider range of applicability.

The government needs to create incentives that will encourage companies to make their data available. This is perhaps where the government can use its strategic research dollars most wisely.

Dust explosion tests present special difficulties. Explosions are caused by the dust clouds, but the dust does not naturally stay in the dust clouds. Dust clouds are transient phenomena. The severity and the consequences of a dust explosion depend not only on the dust itself but on the extent and the concentration of the dust clouds, the intensity of the disturbance that lifted the dust particles in the air, and the timing of ignition. That is why explosion test results depend very much on how these tests are run.

As a result, dust explosion test data displays large magnitudes of scatter. For example, in my 2005 loss prevention symposium paper, I compare the medium-scale vented explosion data sets from the same laboratory obtained just a few years apart. The test equipment and the procedures were presumably identical. Yet, some repeat data points were off by about a factor of two.

We must recognize the statistical nature of explosion severity and develop multiple data points for each set of conditions. By the way, this can rarely be afforded in privately sponsored research programs. At the same time, this is essential if we want to remove some of the conservatism built into our standards and guidelines.

The data scattered can be reduced by adhering to good test standards, calibration procedures, and round robin test programs. We have detailed prescriptive or performance-based test standards for bench-scale tests to measure the hazard properties of the tested dust samples. We need to develop test standards for medium and large-scale tests that address the real application issues, such as Professor Eckhoff has mentions.

In the current state of economy, not many people are interested in performing large-scale tests or even participating in small-scale round robin tests for the test methods.

We need to improve the precision and bias characterization of our existing standard test methods. This is where we can use the help of the government.

One of the best approaches to calibration is to have a number of standard reference tests, each with different hazard properties available for use to perform and to check all the test apparatuses.

Unfortunately, today we only have one single reference test that is the standard coal dust provided generously by the Pittsburgh Research Center of NIOSH. This is where we could really use the help of and the leadership of the government organizations, such as NIST.

Now on to current opportunities for dust explosion prevention and protection. The current definitions of explosion prevention and protection standards and guidelines can be non-conservative for some applications and are overly conservative for other applications. And the third type of applications, they are totally silent. The research to develop local solutions will benefit the industry as well as our nation's economy.

For example, some dusts are clearly explosable while others are clearly non-explosable. Therein lies numerous types of dusts that can or cannot be explosable depending on how the explosability test is performed and also depending on the process conditions.

By changing some of the physical and chemical properties of dust or by changing process condition and explosable dust can be rendered non-explosable.

Research projects on how to accomplish this without affecting the product performance would add tremendous value to the companies. Another intuitive example is the sticky materials. From our daily life, we all know that sticky powders are more difficult to get airborne. Technical terms, such as "disbursability" or "dustiness" have been used to refer to this property.

Even with a very strong disturbance, sticky dust layers will lift as trunks, rather than as a dangerous dust cloud. On the other hand, our standards and guidelines treat all dust layers as perfectly disbursable for the sake of conservatism. We do not have a standard test method to measure this property.

As a result, companies have no practical way of measuring or exploiting this property. They could exploit it, for example, by weighting the dust layers, increasing our humidity, or by adding additives in lieu of or in addition to our housekeeping procedures.

Similar opportunities with potentially large payoffs for the American economy exist in the protection side. Among those, I can count examples of protection for localized hazards, hybrid solutions, and generic active protection systems.

It is not unusual to see dust being handled in a small portion of a large open building, but it's not always feasible to build the room around the area where the dust is being handled. We need to reduce the conservatism of existing standards and these applications.

Hybrid protection solutions are those that combine more than one protection and prevention options. Among the examples, I could cite possible inerting with venting, possible inerting with suppression, possible inerting with ignition control. I won't go into this. I understand that my colleague Walt is going to talk about that.

One industry initiative that would benefit the practice and the American economy tremendously is the sharing the available data. We need to create a national or international database, allow anonymous contributions to this database, set up a mechanism to review and grade contributions, and provide incentives for the donors.

Additionally, federal and state governments should not be too bashful to use their secret weapon to guide the protection philosophies, which is the funding of the strategic research.

I will conclude my talk with a few warnings of hidden risks that we tend to ignore. The way I see them, they are consensus standards that are not backed by data, improperly conducted test results, industry-specific standards, and proprietary safety system designs.

Thank you.

CHAIRPERSON MERRITT: Thank you.

Mr. Mulligan?

MR. MULLIGAN: Madam Chairman and members of the Board, thank you for inviting me here today to address the problem of data omission from Material Safety Data Sheets and its deleterious effect on communicating warnings about combustible dust hazards.

I commend you for your leadership in convening this hearing to gather information about combustible dust hazards, hopefully to the end of disseminating knowledge about these hazards and thereby ensuring that workers are better protected from them.

I am a senior system safety engineer with Lockheed Martin Corporation in Morristown, New Jersey and have been a practicing safety and environmental engineer for the last 18 years.

Lockheed Martin Corporation is the world's premier aerospace systems integration and information technology company. As such, we use hazardous chemicals, including combustible dust, such as powder coatings, in manufacturing the finest advance technology products for the nation's defense.

Lockheed Martin obtains information about the hazardous chemicals it uses from Material Safety Data Sheets, or MSDSs, among other sources. These MSDSs are provided by suppliers in accordance with OSHA's hazards communications standard, or HCS. This standard promotes safety in the workplace by providing workers with information about the physical and health hazards posed by the chemicals they handle or to which they may otherwise be exposed.

The HCS requires manufacturers and importers of hazardous chemicals to evaluate the health and physical hazards of the chemicals they produce and import, principally through the review of available scientific evidence. They must then convey this hazard information downstream to their customers through MSDSs and specific container labeling.

Two of the key objectives of the HCS are to ensure that workers are provided with information about the hazards posed by the chemicals they handle and thereby enable them to protect themselves and meaningfully participate in workplace safety programs and to ensure the companies receiving hazardous chemicals are provided with the information they need to design suitable programs for protecting workers.

Despite the fact that the standard addresses both physical and health hazards in the workplace, OSHA and the regulated community have focused on health hazards under the HCS, including the content of MSDSs.

For example, many MSDSs include numerous pages of toxicological data and environmental fate and transport data. In contrast, they often contain relatively little information about fire, explosion, and reactivity hazards.

As a result, MSDSs are often inadequate as references in conducting process hazards analysis as required under OSHA's process safety management standard, or PSM, and the EPA's risk management plan, or RMP program.

While the use of MSDSs to comply with PSM and RMP requirements was not an original purpose of MSDSs under HCS, the omission of fire, explosion, and reactivity data is at odds with the aforementioned objectives of the HCS.

It is not uncommon for fire hazard data to be omitted from MSDSs, even for flammable and combustible liquids. Unfortunately, the omission of data and information from MSDSs simply suggests that the manufacturer, importer, or distributor could not find relevant data from the available scientific evidence.

When fire explosion and reactivity information is included on MSDSs, it is often in the form of general warnings, such as powder may form explosive dust-air mixture and reactivity stabling.

These qualitative segments beg the question, under what conditions is the substance flammable, unstable, or explosive. The lack of adequate data for assessing potential fire, explosion, and reactivity hazards is, firstly, a result of HCS' apparent allowance of manufacturers, importers, and distributors to omit relevant data and information from MSDSs when they cannot find it in the available scientific evidence.

It is questionable that these companies would not have such data for chemicals posing a fire, explosion, or reactivity hazard since these data would undoubtedly be needed to specify safety precautions for transport and protection of their workers, their plant, and the public. Thus, it can be speculated that regulated companies are not providing these data, even when they possess them.

Allowing companies to provide hazard data only when it can be found in the available scientific literature also could be interpreted as a disincentive to develop hazard data at all. That is, if hazard data cannot be found in the available scientific literature and as a company does not develop such data, no hazard data will be available to include on an MSDS.

A company may take the position that it cannot be liable for misuse or misinterpretation of data that it does not provide. Further, the concepts of finding hazards data and available scientific literature are subjective and beg the questions how rigorously do regulated companies have to search for and analyze available scientific literature and what constitutes available scientific literature.

While health hazards data may be available from the scientific evidence for many hazardous chemicals, in part reflecting requirements of EPA's Toxic Substances Control Act, or TSCA, program, relatively little fire, explosion, and reactivity hazards data appear available. This may be because fire, explosion, and reactivity data are often product-specific and even application-specific while toxicological data are typically substance-specific.

For example, the dust explosion hazard data for five grades of the same bulk solid or powder may be completely different from grade to grade as a result of differences in particle size distribution, moisture content, and even particle surface characteristics.

The lack of adequate data for assessing potential fire, explosion, and reactivity hazards is, secondly, a result of the regulated community's strict interpretation of ANSI's guidance document on the preparation of MSDSs, ANSI Z-400.1.

OSHA has cited ANSI Z-400.1 as a useful reference for developing MSDSs for HCS compliance. ANSI Z-400.1 addresses fire and reactivity hazards in four sections, which correspond to four sections of a model MSDS; section 5, "Fire-fighting Measures"; section 7, "Handling and Storage"; section 9, "Physical and Chemical Properties"; section 10, "Stability and Reactivity."

The problem with the ANSI guidance is that members of the regulated community may interpret it too strictly and may not consider the need for data or warnings beyond those specifically stated in the guidance document, despite suggestions in the document to more broadly consider additional data and warnings as appropriate.

For example, ANSI Z-400.1 lists flash point as one of the physical hazard data that should be included on an MSDS. The flash point is the temperature which is sufficient concentration of combustible vapors evolved from a substance to form a flammable atmosphere in air at standard pressure.

Flash points can be determined using any number of ASTM standard methods. Flash point is commonly thought of as applying only to liquids. As a result, MSDSs often state, "Not applicable" for flash point, bulk solids and powders. However, readily sublimable solids may also have a flash point.

Those solids that do not have a flash point may, instead, have a flash ignition temperature or FIT when tested in accordance with ASTM method 1929 because of the different configuration of the test chamber.

It would be helpful for purposes of process hazards analysis for such additional data to be included on MSDSs along with the standard methods and environmental conditions under which the data were determined, including temperature, pressure, volume, et cetera.

Further, the inclusion of such data would be consistent with the aforementioned objectives of the HCS. Simply put, it accomplishes little to provide qualitative warnings that a chemical poses a physical hazard if data are not available describing the conditions under which it poses the hazard.

Companies may refrain from including data beyond those outlined in ANSI Z-400.1 because of legal liability concerns. That is, companies comply with the so-called letter of the law by including in their MSDSs only those categories of data that are explicitly listed in ANSI Z-400.1.

Companies may be concerned that by providing data appearing to go beyond what is explicitly outlined by ANSI, they may expose themselves to unnecessary liability. As it is, companies may already be concerned about potential liability for customer misuse and misinterpretation of data explicitly recommended by ANSI Z-400.1 for inclusion on MSDSs.

For example, the explosability of combustible dust is a factor of their particle size and moisture content, among other factors. A course bulk solid may not be explosable at its nominal particle size if greater than its maximum explosable particle size. However, dust finer than this that evolves during handling of the bulk solid may be explosable.

Accordingly, the manufacturer of this bulk solid may include a warning on the MSDS, "Dust evolved from the bulk solid may form explosive dust-air mixture."

What if the manufacturer reasonably interprets ANSI Z-400.1 and wishes to include data describing conditions under which the dust is explosable for purposes of aiding customer process hazard analysis?

For example, the ignition sensitivity of a dust cloud is described by its minimum ignition energy, or MIE, and minimum ignition temperature, or MIT. The MIE describes the sensitivity of an explosable dust cloud to ignition by electrical arcs and electrostatic discharges and can be determined in accordance with ASTM method E-2019. The MIT describes the sensitivity of an explosable dust cloud to ignition from hot surfaces and can be determined in accordance with ASTM method E-1491.

Considered together, the MIT and MIE describe the sensitivity of a dust cloud to ignition from frictional sparks, such as may occur in rotating and moving metal equipment in the event of mal operation or failure.

These methods recommend that testing be performed for a sample fraction having a gross particle size less than 75 microns since this is the fracture most likely to remain suspended in the form of an explosable dust cloud.

Thus, a manufacturer may be included to include the MIE and MIT for a less than 75 micron dust on the MSDS for a combustible bulk solid.

However, what if the customer grinds or mills the solid? The MIE and MIT of a dust cloud generally decrease as particle size decreases. So the MIE and MIT may be lower during and after grinding or milling.

Consequently, additional precautions may be required to minimize the risk of fire and explosion during the grinding or milling operation beyond those that may be suggested by the MSDS data.

Combustible dust are especially hazardous because there is often little warning provided with bulks solids and powders capable of generating such dust. For example, relatively few bulk solids and powders capable of generating combustible dusts are UN DOT class 4 flammable solids.

The MIT of a dust cloud is analogous to the auto ignition temperature, or AIT, for a gas or vapor. AIT is presently one of the physical hazard data recommended by ANSI Z-400.1 for inclusion on MSDSs.

While the AIT of a gas or vapor evolved from a combustible liquid is sometimes included on an MSDS, the MIT of a combustible dust cloud evolved from a bulk solid or powder rarely is. Perhaps this stems from the fact that it could be confused with the MIT of the dust in layer form, which can be determined in accordance with ASTM E-2021. The MIT dust layer describes the sensitivity of a five-millimeter dust layer to ignition from hot surfaces.

The inclusion of both the MIT dust cloud and MIT dust layer would be useful for process hazards analysis. For example, the maximum safe exposure temperature for a substance in some applications should be based on the lower of the MIT dust cloud and

MIT dust layer less a suitable safety factor.

However, in the same way the MIT dust cloud is a factor of the particle size and moisture content of the dust, the MIT dust layer is a factor of the layer thickness. While ASTM E-2021 recommends testing using a five-millimeter-thick layer, it is known that ignition temperature generally decreases as layer thickness increases. This is because many bulk solids and powders having relatively higher melting points provide increasing thermal insulation as layer thickness increases. As a result, less heat can be dissipated from the particles closest to the heat source.

In this regard, since fire, explosion, and reactivity data is often method-dependent, it should be determined only by approved laboratories in accordance with recognized standard test methods. The specific test methods should be indicated for all fire, explosion, and reactivity data included on MSDSs so that users will better know how to interpret and apply the data.

Further, since the interpretation of fire, explosion, and reactivity data is complex, process hazards analysis and other audits and assessments relating to fire, explosion, and reactivity hazards should be conducted only by certified safety professionals or registered professional engineers having special training and/or experience in chemical process safety.

On the other hand, the complexity of interpreting fire, explosion, and reactivity data should not be used as a basis for omitting them from MSDSs.

While fire, explosion, and reactivity data are complex, they are no more so than the toxicological data already included on many MSDSs. Thus, their inclusion will not make MSDSs any more difficult for workers to understand.

Worker questions about fire, explosion, and hazard data can be adequately addressed through MSDS training, which is already required under HCS and should be improved. This training will enable workers to question whether a hazardous condition exists and request detailed analysis from appropriately qualified

CSPs and PEs.

I have included in my testimony a list of some of the dust explosion hazard data and other hazards data that I would recommend be included on MSDSs. And while these lists are not inclusive, including these and other fire, explosion, and reactivity data on MSDSs would promote a better understanding of the hazards posed by a substance, facilitate process hazards analysis for PSM and RMP compliance, enable companies to design more effective and comprehensive programs for protecting workers from those hazards, enable workers to better understand the hazards posed by the substances and articles they handle, and provide workers with the information they need to protect themselves and meaningfully participate in workplace safety programs.

I would again like to thank the Board for asking me to participate in today's hearing. And I would be glad to answer any questions that you have.

CHAIRPERSON MERRITT: Thank you.

Dr. Going?

DR. GOING: Madam Chairman, members of the

Board, I, too, appreciate the opportunity and the invitation to come and speak to this hearing and applaud your efforts in presenting this at this time.

At FIKE Corporation, I am manager of combustion research. I have been there about 11 years now. FIKE Corporation is a company that is involved in process protection, specifically pressure relief, fire protection, and explosion protection from the perspective of analyzing explosion scenarios and providing the hardware or the systems to protect against an explosion.

My background is in chemistry at the undergraduate and graduate level. And I was asked to address the topic, "The Current State of Computational Models for Dust Deflagration."

First, I might associate this with the overall topic of session technical barriers to dust explosion, prevention, and detection. A cardinal rule of warfare is to know thine enemy. And the dust explosion is our enemy in this case.

An extremely complex phenomenon has been mentioned, has countless variables that affect the course of the explosion. Nevertheless, prevention and protection require some level of knowledge of the course of an explosion in the real process scenario or real process equipment.

One path to this may be the use of computational models for predicting this behavior. I will address this topic by presenting a series of questions or topics and then commenting on those, beginning first with what do we mean by computational model.

The dictionary definition of a model is the use of mathematical equations to simulate and predict real events and processes. A model can simulate an outcome or it can simulate a process. For example, NFPA 68 has equations that are used routinely to calculate the reduced pressure from a specific set of venting parameters. It calculates an outcome. It gives you a single number.

When we model dust deflagrations, however, we want to model the entire process as it occurs over time, time being perhaps a few seconds. Ultimately the model will consist of the physical model, the description of the phenomenon, a mathematical model or equations of those phenomenon, numerical models that are used to solve equations. And then, finally, they implement a model or, actually, the lines of code in a CFD model, for example.

Next question might be, what phenomenon do we want to model. Well, the characteristics of a dust deflagration include pressure, the flame position in a process, flame thickness, flow parameters, temperature. And all of the parameters are changing with time.

Now, at a high level when we look at a phenomenon, this is what we see. As we looking into this a little deeper, we find that we need to model more basic processes. That is the process of disbursing and lifting fine particles in air in order to generate those explosable dust clouds. The transient transport of dust clouds perhaps through duct works and channels.

Flame propagation and pressure build-up in the turbulent dust clouds incite complex geometries. Flame and blast waves generated if the explosion is vented, for example, into the environment.

And then we would like to estimate the effects of mitigating effects, such as venting and suppression or explosion isolation on the flame propagation and pressure build-up.

Next logical question might be why. What can we learn from such modeling? How can modeling results be used in a productive fashion? The ultimate goal of this and all other panel topics is to reduce the risk posed by industrial dust explosions.

Modeling results that indicate the location severity of an explosion could be used in optimizing the design of an industrial process if one is designing from the ground up.

Changes in that design could be made that could reduce the effect of an explosion. Similarly, the effect of a process change could be predicted and influenced. We have heard of management of change. This is one way to perhaps anticipate what is going to happen if you change something in your process.

The same results can be used in optimizing the mitigation measures. Where would vents be most effective in equipment? Is isolation required? What is the proper location for the isolation equipment? What design strength is required in ducting and other attached devices in the event of a deflagration?

Another interesting potential application is in the investigation of accidents that have already taken place. In conducting a forensic investigation, for example, a model may help answer any questions, such as where was the probable point of ignition, how can we explain the observed damages, what made it possible for the deflagration to accelerate or escalate as it did, what could have been done to prevent or mitigate this.

Finally and equally as important is the use of modeling in the effective design of research experiments, as Dr. Eckhoff was suggesting. Research experiments are costly, timely, difficult to conduct. And proper planning can make these more productive and valuable.

The simulation movies that we have seen in the development of some of these software programs have been quite helpful and illustrative in this manner. Unfortunately, we are not in a position to show those to you, but if you get an opportunity to see some of these simulation models, I think you can appreciate some of the potential value.

Now, what models are available to this at this time? As previously mentioned, outcome models such as those in NFPA 68 vent calculation are in common use. Vendors, such as the company I am associated with and others, have engineering models or phenomenological models used to establish mitigation factors, mitigation designs. But these at present are not CFD, computational fluid dynamic, models.

Models of this variety for dust deflagrations are certainly not common or plentiful. Several exist and have existed for gas deflagrations, however. Examples have names such as FLACS, EXCIM, AutoReaGas, and others.

The models for dust explosions are not nearly as well-developed as these gas models that are mentioned. Some fundamental work on explosion modeling has been published. And several approaches on that work have been developed.

What I want to talk about now is the model that goes by the acronym of D-E-S-C, or DESC, as Professor Eckhoff referred to it. This is perhaps a stepchild of the model FLACS, which has been developed since the early 1980s and is a well-established platform for modeling.

Now, the approach in DESC is to take the platform from FLACS and apply to that limner burning velocities from standardized tests in 20-liter explosion vessels at this point in time.

If one is really, truly interested in technical details, I can refer them to some very recent publications on this topic, including authors such as Professor Eckhoff, on that. It does get fairly complicated, but I will be happy to refer you to those articles.

Now, if you wanted to do a scenario, what we call a scenario how do you do this? What's the process? It starts with a thorough and complete description of the industrial process that is under question. What vessels? What are their sizes? What is their configuration? What are the interconnections? What are the ducts associated with it? What materials are present? What are the fuels? What concentrations? What is happening in terms of process flows, heat? What are potential ignition sources?

All of this, then, particularly the geometric issues, are used as input to a model that generates a physical representation on a three-dimensional grid, a Cartesian coordinate grid. And so you actually sort of create a representation of your vessel and your ducts and any other things that are associated with that.

The grids and actually subgrids describe in geometric detail the vessel and the interconnections and account for obstacles, bins, vents, and other parts of the process.

In the next step, a specific scenario is described. In this step, the fuel is introduced at a particular concentration. The ignition point is located. And you select what data that you wish to follow. Is it pressure? Is it flame, flame speed? And where in the scenario do you want to monitor this particular parameter, this consequence parameter?

Limits are set on that in terms of resolution and in time frames. And you activate the program and go home for the night. These can take many, many hours at this point in time to complete a scenario. These can be linked. You can start with your scenario, then move an ignition point and actually generate a series of scenarios to evaluate the effect of a particular parameter.

What do you get out of this? Well, you get tabular data, of course, of these monitoring points, pressure at different locations throughout the process. All of that data is also used to generate essentially movies or MPEGs that over a period of one or two seconds show the generation of pressure, show the movement of flame. If there's a venting process, it shows for the propagation of the flame outside of that vent. And it gives you a visual representation of the overall process.

What do the models not do? The codes in this first, well, two years of development are not fully developed. There are limits, and there are gaps. One thing they do not address is explosion prevention, ignition prevention, for example. They are primarily tools for optimizing the mitigation of explosions.

Several phenomena that are not thoroughly described for which improvements are needed are a multi-phase flow, two-phase flow, the dispersion, the lifting of the dust particles, settling of dust particles, liberation of volatiles and detailed combustion chemistry, smoldering combustion in dust layers, for example. These are areas that are not fully modeled or for which model improvements are required.

What do we need in the future? A number of challenges remain for the computational model, such as DESC and others. A major challenge is the need for a relationship to be established between the combustion model used in the CFD code and the test data routinely developed for dust and powders used in industry.

We have standard tests that are used to characterize dust. And we have talked about those on several occasions. It needs to be thoroughly established how those relate to the CFD models and the modeling process.

As I mentioned, particle-laden flow needs to be properly modeled. This will allow modeling of dust lifting, for example, as we have discussed about secondary explosions. A model of mitigation techniques, isolation, and suppression is just beginning to be developed and needs to be continued and expanded. All of these need to be thoroughly validated by comparison to legitimate large-scale experiments, as Dr. Eckhoff has mentioned.

Finally, at this point in time, the process is complex. It's time-consuming. It's not an intuitive software program. If you're expecting Windows, you're not going to get Windows. It's a process that needs to be simplified quite considerably in the future before it's going to be of a more routine nature.

It is probably something that is going to be used for more complex scenarios. If we have a simple dust collector and that is all we are dealing with, this probably is an overkill. But more often than not, the situations are not simple, they're complex, they contain interconnected vessels. A lot remains to be done, but a very valuable start has begun on this.

The goal, as I understand, was to release the product this year and make it commercially available. I cannot whether or not that is going to happen, but that was the original goal.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

Mr. Frank?

MR. FRANK: Madam Chair, CSB Board members, staff, I am Walt Frank, senior consultant with ABS Consulting. I've got a Bachelor's degree in chemical engineering. I am a registered professional engineer in Delaware. And by profession, I am a chemical process risk consultant.

Prior to joining ABS, I spent 24 years with DuPont, the last 10 years in the process safety and fire protection group in the DuPont Engineering Department, where I specialized in the area of explosion hazard evaluation and control.

The last speaker of the day entertains a very real risk of having heard already everything he wanted to say expressed far more eloquently. And Angela and Giby and their associates ought to be commended for putting together a very strong and very interesting program. I am still going to go through my notes.

I am speaking today in my role as the Chair of the NFPA Technical Committee on handling and conveying of dust, vapors, and gasses. The committee has responsibility for three fire protection and explosion prevention standards, including NFPA-654 that we have heard about several times already today.

As noted in previous presentations, NFPA-654 serves as a primary resource within the NFPA family of codes and standards on the subject of fire and explosion safety and dust hazard operations.

However, as one member of the committee once described it, NFPA-654 is potentially one of the best unknown NFPA standards. Accordingly, I wish to thank the CSB for its efforts in publicizing to industry the existence and the importance of this valuable resource.

As was noted earlier, the NFPA at the request of the Technical Committee has provided no charge access to NFPA-654 on the Web site, on the NFPA Web site. The URL for accessing the standard is too long to read here, but it is included in my prepared statement.

And, Guy, perhaps you can confirm this, but I think when you find the Web site or find the page, there is actually a registration process you have to go through, name, e-mail address, and whatnot, but people should not let that intimidate them. They ultimately get to the point where they can access and read the document free of charge.

Consistent with the panel's theme, I have identified four issues for which continued development of technical solutions could be anticipated to enhance dust explosion prevention and protection efforts. The first of those pertains to the issue of partial volume venting.

We are often required to provide

deflagration venting or, as it is more commonly referred to, explosion venting of equipment or building structures. In many instances, the dust explosion hazard in that enclosure is limited to only a portion of the enclosure. Yet, existing vent sizing technologies require the assumption that the enclosure is uniformly filled with the explosable dust cloud.

This conservative assumption yields calculated vent areas that are often prohibitively large when compared to the external surface area of the enclosure that is available for venting. There are some correlations currently available. So initial efforts have been made to address the issue. However, experts believe that additional test data and further analysis could provide more practicable solutions to this problem.

The second issue is improved correlations for estimating the consequences of successfully vented explosions. Even when successfully vented, dust explosions pose a potential for personnel injury and equipment or structural damage. There are issues such as the length, diameter or length, of the vented fireball or the flame jet that results when the vent opens. Over-pressures are generated external to the enclosure by the combustion of the vented materials. And there are reaction forces imposed on the enclosure and on supporting structural members during the vent discharge.

All of these effects are not comprehensively quantifiable at this time. And more research is required to develop suitable correlations for better modeling these effects.

The third issue is the availability of relevant explosability test data. This issue can actually be divided into several aspects. First, much of the data in the open literature was developed according to now obsolete or outdated test protocols or is insufficiently documented; for example, might be lacking details such as particle size for the sample test data. Also, much available test data was determined at standard temperatures and pressures; whereas, actual process conditions may vary widely from 25 degrees Centigrade and normal atmospheric pressure.

Finally, there exists no mechanism for systematically qualifying and more widely disseminating such explosability data. It should be noted that explosability data, such as the maximum rate of explosion pressure rise or minimum ignition energy, are not intrinsic properties of a material such as the vapor pressure or the liquid.

Several speakers have already pointed out that depending on particle size and moisture content, these sorts of test results are going to vary. One company's polyvinyl alcohol is not going to be the same as another company's polyvinyl alcohol.

Consequently, users will frequently need to test data unique to their particular applications for detailed design purposes. However, an industry database of peer-reviewed test data determined in accordance with current standardized procedures conservatively determined for small particle size, dry samples should prove valuable for research and educational purposes for preliminary hazard evaluations and for comparison and qualification of other application-specific test data.

The fourth point deals with the potential utility of partial inerting, as Dr. Eckhoff mentioned earlier. Inerting of process equipment to below the limiting oxygen concentration required for combustion is a commonly applied approach to explosion prevention.

However, when oxygen concentration inside equipment is reduced to below this limiting oxygen concentration and when a suitable safety margin is added additionally, the resulting residual oxy concentration will not only fail to support combustion. It will also fail to support life. As prior CSB investigations have confirmed, inerting of equipment poses a hazard of personnel asphyxiation.

Work in Europe points to the potential application of partial inerting. By this, I mean reducing the oxygen concentration inside the equipment but not to a value below its LOC. So the use of partial inerting is a means of mitigating or possibly preventing the explosion while reducing the asphyxiation hazard.

Further work is required to determine

whether partial inerting is sufficiently widely applicable to warrant its inclusion in the explosion prevention toolbox.

While it is important that we continue to develop and refine the technologies required to address combustible dust hazards, technical solutions are of value only when understood and successfully applied.

Furthermore, as recent events have illustrated, it is often the low-tech aspects, such as failure to maintain high standards of housekeeping, which most significantly exacerbate the dust, fire, and explosion problem.

It is axiomatic. And several speakers have already mentioned this today, but it is axiomatic that one must first be aware of and understand a hazard before seeking to analyze and control it.

Investigations often reveal that the damage potential posed by a combustible dust suspended in air is an under-appreciated hazard, under-appreciated by those in responsible charge of facility operations.

Earlier Guy Colonna of NFPA noted that a revision to NFPA-654 had been recently approved. By the way, Guy, I guess that is going to go up on the Web site as soon as it's official. August 18th. Okay. Thank you.

I would like to briefly review some of the changes that have been made to the standard over actually the last two revision cycles, changes which the committee hopes will address some of the low-tech problems and some of the awareness issues.

Six fifty-four now requires formal documentation of the design and design basis for facilities containing combustible dust hazards. Such systems are required to be designed by and installed under the supervision of qualified engineers who are knowledgeable of the systems and their associated hazards.

Furthermore, the design of fire and explosion safety provisions must be based upon a process hazard analysis of the facility, the process, and the associated fire or explosion hazards. And this PHA must be updated at least every five years.

To ensure careful review of proposed modifications and to ensure that personnel are notified of such changes, a management change procedure is required for all changes to process materials, technology, equipment, procedures, and facilities.

Housekeeping requirements have been strengthened. They now include warnings about concealed surfaces, including areas above suspended ceilings.

In addition, more detailed guidance has been provided relating housekeeping performance and the assignment of aerial electrical classifications.

Written operating procedures are required. Employees must receive initial and refresher training on topics that include the hazards of the workplace, plant safety rules, and the necessity for proper functioning of fire and explosion protection systems, emergency response plans. And we added housekeeping requirements.

Written maintenance procedures and inspection testing and maintenance program are required to ensure that the fire protection and explosion protection systems and related process controls and equipment perform as designed.

It should be noted that the requirements for the management change controls, housekeeping performance, procedures training, and maintenance programs are all applied retroactively. In other words, these requirements are applicable to facilities that were built even before the effective date of the standard revision that established those requirements.

Those familiar with industry process safety management programs will recognize the elements I have just described. It has been the Technical Committee's intention during the last two revision cycles to incorporate into NFPA-654 key management system elements dealing with the recognition, evaluation, and control of combustible dust hazards analogous to those controls applied elsewhere to other highly hazardous chemicals.

It is gratifying to note that some of these controls have subsequently been added to certain of the other NFPA dust explosion prevention standards.

Many familiar with the combustible dust, fire, and explosion hazards would likely agree with the CSB's preliminary conclusions that there is insufficient awareness or perhaps insufficient appreciation of combustible dust hazards within industry in general.

Experience suggests the need for a cooperative effort on the part of all stakeholders -- by that I mean industry, labor, insurers, academia, regulators -- to raise the awareness of combustible dust hazards and to provide the necessary training and risk management tools to those responsible for operating and maintaining facilities producing or handling combustible dusts.

I appreciate the CSB's interest in helping raise this awareness. I thank you for the opportunity to speak here today.

CHAIRPERSON MERRITT: Thank you. Thank you, all of you.

At this time we'll take questions. I would like to open with one. Mr. Frank, do you think that if OSHA adopted the NFPA consensus standard for combustible dust, such as 654 or 484, as a regulation, that this would improve the current situation regarding combustible dust hazards prevention?

MR. FRANK: Let me start. I think I should point out one thing. Taking NFPA-654, in particular, if that were to happen, you know, having 654 regulatorily required, that's not going to provide some deterministic path to some predetermined set of protective systems and procedures for a given situation. There's a lot of flexibility. There's a lot of subjectivity in NFPA-654, even though it's written in the mandatory "shall" language.

For example, if the standard says, "All dust collectors will be located outside" and then the next statement says, "Well, you can locate dust collectors inside provided that certain conditions exist," a little bit further on it says, "Dust collectors located outside shall be provided with explosion protection according to one of five options" and then it says, "We don't use the word 'but,' but it's implicit." But you can do a documented risk assessment acceptable to the authority having jurisdiction to determine if you really need those protective requirements.

And then, finally, you have got an over-arching NFPA standard equivalency clause that says, "Regardless of what this standard says you must do, if you can solve the problem in another way and satisfy the AHJ that you have provided equivalent protection, then go for it."

CHAIRPERSON MERRITT: That works, too.

MR. FRANK: So my point is it's -- I don't want to leave the impression, let people be predisposed to believe that having 654 regulatorily required is going to be a very prescriptive path to a certain approach to explosion prevention.

And having gone through that long introduction to get back to your original question, I think a lot of it, the effectiveness is going to depend -- and we have heard other speakers talk about this today -- on the quality of the enforcement personnel.

You know, when we get down to the subjective decisions and AHJs evaluating the suitability of the documented risk assessment, it's going to depend on how well-educated and informed the enforcers that are out in the plant if they're in the plant are in knowing the technology and being able to apply the standard.

CHAIRPERSON MERRITT: Okay. Thank you.

Questions from the Board?

MEMBER VISSCHER: I want to thank you all for testimony. I've been thoroughly disabused of any notion that this is a simple issue. So thank you for that.

This is a question both to Mr. Frank and Mr. Mulligan; well, specifically Mr. Frank. I was interested in the changes that are being made in 654 that you described, which have kind of given it a PSM look. Were you concerned, was the committee concerned, that given the amount of kind of complex detailed analysis that is required in a PSM-type analysis that a lot of particularly small businesses and perhaps less sophisticated operations would have a hard time figuring out what that all meant as compared to more of a housekeeping emphasis?

MR. FRANK: No, I didn't sense any anxiety on the part of the committee in that respect. You know, we require a PHA. Well, okay. That requires certain expertise to conduct, but even small organizations -- and I don't mean that disparagingly, but low resource-available organizations have demonstrated that they can effectively do PHAs.

We looked at the dust explosion issue and compared that hazard to other hazards where PSM-type approaches were demonstrably successful in improving safety. And we said, "Why shouldn't a similar approach be applied to the dust hazard?"

And so, again, over the last couple of revision cycles, we have slowly moved some of these management system elements into the requirements of the standard. And I feel much more comfortable about it with them there.

MEMBER VISSCHER: Mr. Mulligan, with your statement on the MSDSs, basically the common statement that is made now is something along the lines of if it's in dust form, it may be combustible or it may be explosable. And you found that to be insufficient.

Yet, I gather from all of your testimony, that to be really specific to what is going on at that workplace requires understanding of a variety of factors that may be specific to that process or that workplace even.

So I was a little unclear what exactly information you would end up with on an MSDS. It obviously couldn't be that process-specific, but somewhere in between I guess is what information I would like to see on there.

MR. MULLIGAN: I was thinking that the data I was recommending for inclusion on MSDS kind of provides a baseline level of information for the company receiving the MSDS and the substance. And then they need to have the kind of expertise and knowledge that has been testified to by a number of the panelists that beyond that, they need to be able to conduct process hazard analysis using that data, but I think that providing them with a baseline level of data that had been determined in accordance with existing standards is better than the current state, which is just kind of cursory warnings or nothing.

MEMBER VISSCHER: Thank you.

DR. GOING: Can I add a comment?

CHAIRPERSON MERRITT: Sure. Thank you.

DR. GOING: I was going to do this later, but I sort of accidentally ran across an MSDS off the internet. And I won't identify the source, but almost the very first statement under "Emergency Overview," "Nuisance dust with a possibility of dust explosion." And it just strikes me as something that simple can be helpful to getting the reader's attention. And then perhaps they are more sensitive to other information.

This does actually go on to provide lower explosion limit or a minimally explosable concentration, minimum ignition energy, Kst value, all of which is provided in an MSDS. So it can be done.

MEMBER BRESLAND: Following up on that, Mr. Mulligan, in your presentation, you list 10 or 12 parameters that should be included on an MSDS. I don't disagree with any of them.

The problem I see on the other side is, how do you educate the recipient of the MSDS as to what, let's see, the minimum ignition energy would be or what the meaning of that would be? I think when we go in that direction, it is going to require a fair amount of education to explain to people just exactly what those terms mean.

Any thoughts on that?

MR. MULLIGAN: Well, there is presently a training requirement under the hazard communication standard that requires companies to ensure that their workers understand the hazard information that they have available to them or that has been provided.

And, you know, I think it would be incumbent on them, you know, as a part of that to provide training sufficient that they can understand that, hey, the hot equipment surfaces that are in the plant, you know, some of those may be capable of igniting this dust based on the MIT data that are provided.

Now, as I testified, you know, it can be complex, but, you know, there are many vendors of dust explosion hazard training courses available. And training can be tailored to front-line workers on up to executives and what have you.

As I mentioned in my testimony, I don't think that those data are any more complex than the toxicological data that are presently included on the forms.

MEMBER BRESLAND: A question for Dr. Eckhoff. Leaving aside the technical issues that we have been talking about, what is the regulatory process in Europe for combustible dust?

DR. ECKHOFF: It is a complex situation now with ATEX, you know. I have up until recently been believing that ATEX was about safety, you know, trying to get the industry as safe as possible, kind of ideal conception. But it turns out that that is not only partly true in a way. I can try to explain.

You know, we have two directives. There is one for apparatus and one for users, as we say, for the plant protecting people and so on. And the apparatus directive is followed up by a lot of standards.

I have to admit that I have written papers about this and discussed it at conferences. I am extremely frustrated about what is going on when it comes to design of apparatus; in particular, electrical apparatus for dusts in Europe because it seems to me that now I am a little bit sort of open-minded perhaps, but I think it's true -- I've been to the committees -- that many of these committees making it the standards consist of people from the instrument producers. And they have a special agenda. They have now seen that ATEX does market in the dust industry for their gas instruments.

So we have a massive process going on. And ironically that process started inside IEC, the International Electrotechnical Commission. That was a strategic move by many European countries taking their people out of the European committees, putting them into the IEC committees and getting everything sorted out there, and then implement the whole lot in the European regulations.

So we have got now some extremely, I should say close to ridiculous, meaningless standards, for dust apparatus, for dust atmospheres that are essentially the gas standards with a new name.

So that is one part of this. And then we have the user side, the workplace, to make that safe. And that directive dealing with that is really not followed up by any standards.

And I met a very sort of knowledgeable man from Netherlands who knows all of this. And I said to him after our conference that why don't we get more standards in that area. And then he said, "Oh, no. We shall never have that because we have to accept that when it comes to the workplace, that there will be different levels of standards in different countries." So that is a very confusing situation.

The apparatus thing is something that has got to do with free trade. One has to make sure that nobody is going to have an advantage, they're going to just stick to the same rules, all of them. So if the rules lead to very expensive equipment, it doesn't matter as long as all have to play to the same rule.

I am not saying that the apparatus are not same. They are for the dust extremely sort of super conservative, very expensive solutions. This is how I see it.

So I am very frustrated with the European situation.

MEMBER BRESLAND: Thank you.

CHAIRPERSON MERRITT: One of the questions I guess I have is I guess I'm pretty much a practicalist. You know, if you look at it from a 10,000-foot level, whether it's Norway, Sweden, France, Germany, England, or America, a certain amount of dust in the workplace is going to be a hazard ignited by 100 different potential sources.

If you were to look across all of the regulations, all of the standards, all of the different ways that countries are managing dust hazards, who do you think is doing the best job? Where do you think the best control or management or information is that is the most practical for the use of the workforce or the workplace? Do you have an idea about that? Anybody on the panel might answer that.

DR. ECKHOFF: Well, I really can't answer in any comprehensive way, you know, but with the present situation for dust in the European sphere with

ATEX, I really hope that the United States can get us out of this mess.

(Laughter.)

CHAIRPERSON MERRITT: Put no pressure on us. I've heard, you know, several people have comments about things that Canada is doing. Does anybody have any recollection or any idea of what Canada is doing with regard to dust standards or dust hazards or --

MR. URAL: I think they refer to the NFPA standard, part of the law.

CHAIRPERSON MERRITT: NFPA standards?

MR. URAL: Yes.

CHAIRPERSON MERRITT: Okay. That's very interesting.

I applaud what you had to say, Mr. Mulligan, about Material Safety Data Sheets, certainly one of those things that is a very important first step in understanding what the hazards are. And we recognize that they are in many instances quite inadequate. As a matter of fact, some of them in investigations that we have done have been a contributing cause or root cause for some of these events because they have been so poor.

You know, we're looking. You have given us some interesting ideas about things that should be on there. And I applaud the statement that was made in the one that you read, Mr. Going, a low-tech statement.

How much information do you think can be put on there and kept in a -- I mean, there are some that need to be used for engineering. That's some of the reason that you would have some of the information there.

But keeping it simple enough for people to understand how to manage the hazard, what would be some of the things that you would recommend or are there some that you have seen you think are particularly good that could be emulated?

MR. MULLIGAN: Well, you know, the ANSI guidance presently recommends that certain gas and vapor flammability data are data that would ordinarily be thought of as applying to combustible gases and vapor should be included, things like flash point and flammable limits and such.

You know, there are analogous properties or analogous measures for dust explosion hazards, not necessary for flash point, but there are flammable limits for combustible dusts. And the lower flammable limit would be analogous to the minimum explosable concentration.

So, I mean, I think it just suggests that companies need to or maybe the ANSI guidance needs to be improved to indicate that the analogous properties for combustible dust need to be included.

But what we're talking about here is about the risk posed by dust explosion hazards. And everybody probably is aware that risk can be thought of as the product of the probability of something happening and the consequences of something happening. And I think that the probability of having a dust explosion would be described by its ignition sensitivity, minimum ignition energy, minimum ignition temperature, whether it's in the form of a cloud or layer, and be the minimum explosable concentration. On the other side, the consequences side of the risk equation would be described by the explosion severity data, the maximum explosion pressure, the maximum rate of pressure rate, and the Kst value.

So, you know, that would give you both sides of the risk equation so that you would be able to proceed with some type of informed risk assessment. Again, it would be based on baseline data based on the form in which the bulk solid or powder is received from or for the 75 micron or less, as recommended by the ASTM standards.

CHAIRPERSON MERRITT: One of the things that we I think keep saying is you've got -- basically with regard to dust potential, you've got one fuel. And, you know, the practical side of that is making sure that you don't have an accumulation of what could be a fuel in a potential explosive situation. And so, you know, that seems like to be a pretty low-tech solution to some of this.

DR. GOING: What comes to mind a bit is what is the intent or what are we trying to accomplish with this information on the MSDS. Is it an awareness, an alert, a warning, or is it a hard number that they are going to go to work with? And I hesitate to suggest that it is a hard number that they are going to take all the way down the road, 137. It's not 136. It's 137.

Perhaps there's information of the variety that tests with this material less than 75 microns has indicated an MIE of 12. At least that draws attention to the issue, but they need to get specific information for the material they're using. That's all.

CHAIRPERSON MERRITT: Yes, sir? Anybody else?

DR. ECKHOFF: Would you like me just to give you one example of this mess with the apparatus?

CHAIRPERSON MERRITT: Sure.

DR. ECKHOFF: Yes. You know, in the gas vapor sphere, we have something called pressurization, which means that we are making a box. And we put a little bit of over-pressure inside it to make sure that if there is a gas leakage, explosive gas, outside, it will not enter the box.

And now they have made a dust standard

toward EXP dust, which I find completely ridiculous. And I remember I gave a paper on this in France to powder technologies, dust explosion experts. And I said to them that I am going to ask you a question. And if the answer is yes, then I terminate my lecture and walk out.

You see, the point is that if you make an enclosure with a timely logging, it must be very small so that you can keep an over-pressure inside by a limited amount of air into it.

And you then take away this, and you put this box inside a permanent explosive dust cloud. You have to keep it going by fans and so on.

And then the question arises, will there ever be an explosive dust cloud inside this thing? And, of course, the answer is no. It is physically impossible. That standard rests on the assumption that it is physically possible. This is why it is ridiculous.

And I am ashamed of the whole standardization process coming out with this kind of thing. This is because the apparatus produces making the thing for gas once you sell -- they will go to the grain elevator saying, "This is what you need. I've got a standard."

CHAIRPERSON MERRITT: I see. Are there any other questions?

(No response.)

CHAIRPERSON MERRITT: At this time, thank you, panel, very, very much. I appreciate all of your effort and your coming and being here, answering our questions.

At this time, we would like to open the floor to any public comment. And I have a number of names. And there is a microphone in the middle of the floor. I would ask that you come and please in case I mispronounce your name, state your name and who you represent, if anyone other than yourself, and spell your name, please. And the first one is Raymond Momgrin. And I've butchered that, no doubt.

PUBLIC COMMENT

MR. MOMGRIN: My name is Raymond Momgrin. That's Mom with a grin. I think the doctor knows the origin of that name, I'm sure, Scandinavian.

I am with Toyel America. I am the Safety, Health, and Environmental Manager with Toyel. We manufacture aluminum powders, pastes, and flake products. So we're more than aware of the capabilities of poor housekeeping in our organization.

I just wanted to make a comment regarding additional regulations. Please don't give us any more regulations. There are plenty out there. I think that if we take the time to maybe fine-tune the existing regulations a little bit, I do agree that perhaps the MSDSs need a little fine-tuning.

But speaking from a need to deal with compliance on a regular basis as well as the safety of the people who work at the plant, we have an awful lot to do in making our people safe and adhering to the existing regulations. So please when you're thinking about additional regulations, let's take a hard look at what is already out there and do a little fine-tuning.

One other point that I would like to make, too, the Fourth of July is coming up. We all like the Fourth of July. It's Independence Day for the United

States.

A couple of years ago there was a box that had written on it, "Caution: This device will cause high heat and severe burns," but the parents decided that they were going to go ahead and give the little girl her sparkler anyway.

So they lit the sparkler. And the little girl proceeded to drop it on her foot. Well, her shoe caught fire. And she got severe burns. And now, the next couple of days, the City of Chicago is going to ban sparklers being used.

We regret the little girl having burned her foot, but why take away the joy of sparklers when I was a little kid because there are other ways of controlling that situation? It's just my point of let's not have any more regulations, please. There are ways of controlling these things.

Thank you very much.

CHAIRPERSON MERRITT: Thank you.

C. W. Kauffman?

MR. KAUFFMAN: Good afternoon. I am Bill Kauffman. I am a professor of aerospace engineering at the University of Michigan. And I was a member of the National Academy of Sciences panel on grain elevator explosions. And I led the go team, and we went to 14 disasters involving grain facilities. We issued reports. And in all of them, we found the dust, the ignition source, and the damage. So the recommendations that were later issued were based upon solid evidence.

I might title my comments, "Return to the Future" because in the past, there has been a lot of work done on dust explosions. We have a long record of coal mine explosions involving coal dust and methane. And the Bureau of Mines, Pittsburgh, did a lot of extensive research on all kinds of dust explosions.

Strong regulations were issued in the late '60s, which basically ended the coal mine explosion in the United States. Coal mine explosions continue in the People's Republic of China, the Russian Federation, and the Ukraine because there are no regulations or they are not enforced.

The grain elevator investigation came

about because in Christmas week of '77, there were 5 explosions in 8 days with 59 dead and 48 injured, and it got the attention of the American public.

The National Academy of Sciences issued four reports. The Department of Labor issued another report concerning this. And OSHA standards were issued concerning grain dust, grain elevators. It had a significant effect on the injuries, fatalities, and property damage. And this was first reported on in 1996 in two papers showing the favorable effect of this action.

We saw this morning the explosion pentagon. It's very simple: the fire triangle plus confinement and mixing. And the most effective method of controlling these explosions is control of the fuel.

We had developed a little internal expression that "God will provide an ignition source. So don't worry about controlling the dust." It's much more effective because it takes time for dust to accumulate. Ignition sources can appear in a fraction of a second.

The explosive event results in blasts, missiles, and fire, all of which can be lethal to the human body. And some of the details of the dust explosion are not going to affect whether you get third degree burns or not. We can take a low-reactivity dust and a high-reactivity dust, and both will cause fatal burns on the human body. It may be preventing other things, but as far as killing people, all dusts are equally effective.

In the 1980s, after our panel existed, and into the 1990s, there were numerous reports, books, meetings, conferences, et cetera, on the hazards of combustible dust. I think I have about three meters on my book shelf of publications and two file cabinets of data. So it's pretty much known that if you have an organic or a metallic dust, it's like propane or it's like methane, which most people know are dangerous.

Some of the dust is hidden, and some of it is open. And after the Corpus Christi grain elevator explosion, I thought the world knew about the dangers of hidden dust. The Corpus Christi grain elevator exploded because of the dust accumulations within the pneumatic dust control system. That is on the floor. On the wall it's more obvious. And if you can see your footprints, you can write your name on the wall, you have a problem.

I would argue that individuals who are unaware of the hazards of combustible dust must have been living on the dark side of the moon. And perhaps the easy way to deal with this problem is an educational campaign first. Then people can go look at what has been done.

I put down some interesting, obscure perhaps dust explosions here, Fortage Wisconsin, lignite coal in the baghouse. Lignite coal is almost pyroflouric. And they had an accident here, and we tried to deal with it.

Peachtree City, Georgia in 1984, there was an explosion involving phenolic resins. We've heard about phenolic resins several times today. Well, gee, we knew way back then. And the Bureau of Mines had run phenolic resins in their Hartman bombs and other things.

Las Vegas, New Mexico, and Gaylord, Michigan, 1991 and 2001, particle board. I mean, wood burns. I mean, people heat their homes with it. And so this should not have been a surprise.

And then we really have only had one major grain elevator explosion like the ones we had in '77. And that was Wichita, Kansas in 1998.

The reason it occurred was the management of the elevator had allowed an enormous amount of dust to collect. And the interesting thing here, which was something that wasn't mentioned today, we can have transition to detonation in dust explosions. Deflagrations kill. Detonations kill. Detonations make smaller size concrete for the bucket loaders to pick up.

And also I found in dealing with workers that if you tell them that you have a detonation problem, most people understand detonations as being something evil. And they don't want to deal with it. So if you say, "This stuff can detonate," most of them, "Yeah? Maybe I'd better pay attention to that."

Now, one incident, the explosion which

wasn't, and with recognition to Sherlock Holmes' the dog that didn't bark, Danville, Illinois, 1990, myself and several OSHA inspectors went to the plant that manufacturers Chuckles candy. They're big gumdrops. They use cornstarch and sugar in this manufacturing process.

We found enormous accumulations of dust above the suspended ceiling and within the candy-making machinery, shades of Corpus Christi, where the dust was hidden.

We made suggestions. They took them to heart. And this explosion did not occur. It sounds like the pharmaceutical plant in North Carolina.

Why does the problem linger? Well, George Santaya observed that those who do not remember the past are condemned to relive it. I think to some extent, there has been a defanging of MSHA, OSHA. There's also been a loss of corporate memory in that we have the outsourcing of corporate safety department to insurance and risk management companies and, shame upon me, the failure of educational process at institutions of higher learning, where now safety means hygiene and engineering means analysis.

And the outlay for the future, the Russians, Soviets are very pragmatic people. And they have an expression, "What is to be done, and who is to be blamed?"

When we were in the grain elevator business, we had a very effective regulation, although I heard a plea here for no regulations. And that is you put the plant manager's office on the roof of the factory.

(Laughter.)

MR. KAUFFMAN: That I assure you will end all of these problems. Okay? And I would tell you that the prevention investigation of these explosions is not rocket science. And in kind of looking at is the glass half empty or half full, it's not easy to have a good explosion. A lot of things have to go right.

So thank you for listening.

CHAIRPERSON MERRITT: Thank you.

(Applause.)

CHAIRPERSON MERRITT: Mr. Dan Sliva?

MR. SLIVA: Thank you very much. Very few people get that name right.

CHAIRPERSON MERRITT: Oh, I did?

MR. SLIVA: Yes, you sure did.

CHAIRPERSON MERRITT: Well, thank you. Go ahead and say it again.

MR. SLIVA: Dan Sliva. And I am here representing the American Institute of Chemical Engineers Center for Chemical Process Safety.

The Center for Chemical Process Safety, which is abbreviated CCPS, exists to address technical and management systems issues related to process safety through the development of guideline books.

Now, these guideline books are not standards but are intended to represent good thought processes to be used in addressing issues throughout the industry.

CCPS recognized several years ago a gap in guidance related to handling dust and particulate solids and decided to commission the writing of a new book entitled Safe Handling of Powders and Bulk Solids.

This book addresses issues such as tools for process design and plant engineers who are responsible for the designing and running of processes handling particulate solids in the chemical, pharmaceutical, and related manufacturing industries.

The primary focus of this book is the instability, reactivity, and combustibility hazards of particulate solids manufactured or handled in the chemical and pharmaceutical industries.

Now, in the development of this book, the committee responsible for putting together the outline decided not to cover the hazard of explosives because these hazards and corresponding protection measures are quite different from the mainstream combustible powders and bulk solids handled in the processing industry. However, the committee did include some guidance on classifying combustible solids versus explosives to cover those few materials that might fall in either category.

Just to finish, the first staff consultant to do this job in another lifetime was John Bresland. And then I took over for John.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

Next we have David Stumbo.

MR. STUMBO: Thanks. I am with the Kentucky Department of Labor. The CTA Acoustics explosion has been on the top of my desk for some months now. And I am glad to be here today.

Just a couple of thoughts I would like to share. Kentucky has made some important steps at what we consider to be the biggest problem, which is the awareness of this hazard. We have issued a hazard alert bulletin. We have also arranged for cost-free training across the state.

Otherwise, some things I would like to point out as a former compliance officer. It was mentioned that the general duty clause can be used to address the hazard of combustible dust, but, really, that is a tough tool for a compliance officer to use. I would like to see the Board make some strong recommendations to OSHA to provide a national standard, a vertical standard, either included in the PSM standard, something along those lines, or perhaps along the lines of the grain standard.

Some other things that came across my mind during this hearing were the fact that it's so difficult for employees, safety managers, plant managers a lot of times don't have the technical expertise or understanding necessary to deal with this issue.

One idea that I got was that if we could just rank some of these dusts, just in an arbitrary scale perhaps that would catch the attention, we could base it on explosivity. You know, I know there are a number of technical concerns, moisture and all of those sort of things but just a relative scale so that when somebody looks at that Material Safety Data Sheet, something will catch their eye. This is a moderate explosion hazard. This is no explosion hazard. That way they could at least eliminate some of the materials that so many companies have hundreds of materials in a plan.

So I would like to see something along those lines be recommended. Even if it is imperfect, it would be a big step beyond what we have got now.

A couple of publications. The HSC and the New Zealand Department of Labor have lists, not all-inclusive lists but just generalized lists of various materials, dog food, plastics, and give them a relative moderate explosion ranking, you know, just rules of thumb, that sort of thing. We need some practical applications, something that the average health and safety professional or HR manager who wears three hats can recognize.

Thanks.

CHAIRPERSON MERRITT: Thank you very much.

We have Mr. Joseph Senecal.

MR. SENECAL: Thank you, Madam Chairman.

I am Joseph Senecal of Kidde-Fenwal, Incorporated, a colleague of Mr. Randy Davis, who spoke earlier. I have a Ph.D. in chemical engineering. And I have been involved in combustion science as I was a graduate student of some decades going. I won't tell how many. And I have been involved directly in fire and industrial explosion issues for 18-plus years.

And I manage the Kidde-Fenwal Combustion

Research Center, which is one of several laboratories in the country that conduct the various types of combustion characterizations of dusts and gases and so on.

I have three points I would like to address. Early in the day, one of the questions you put forward was whether or not the community felt the CSB should take a comprehensive view or inclusive view on how it addresses the combustible dust question.

Given my number of years of experience in this industry, I would strongly urge that the CSB take a very inclusive and comprehensive view, which does not necessarily have to in any way conflict with the very good work that has been done by other agencies. And certainly this work can complement one another. I mean, after all, a dust explosion once it's initiated doesn't really care what jurisdiction it falls in. It's going to happen.

Secondly, I'd like to address the subject of the near miss. I, too, like Bill Kauffman, have an explosion that didn't happen story. And it was a consult that I did a few years ago at a paper mill processing wood pellets to make wood dust for fuel. And the explosion was wood dust, I think, actually, if I'm correct, wood dust, one of the sort of dust that you sort of didn't really include in your data set.

Here was a case of a room, actually, about this size with two mills on it. One of the mills blew up because God sent an ignition source. And I think that is a perfectly satisfactory explanation.

But the room must have had about a ton of wood dust accumulated all around it. And, for reasons unknown, it didn't undergo a secondary explosion. And had it, -- this was an occupied building -- this could have been another one of your events, but it wasn't.

And so my question or point is that this event was just an industrial dust explosion, probably never reported outside of the plant. They did a very thorough job indoor. It was in the plant. But this was a case that could have been a real disaster.

And I don't know how you build that into the process that you're building, but I think you should encourage industry that has incidents like this to volunteer information because I think much can be learned from incidents like this that don't take lives but could have.

Finally, the incidents that were really sort of the driving force I think for much of the meeting were the 3 incidents in 2003. They were all massive secondary explosion events that took multiple lives and injuries and very significant community impact.

When we look at the explosion pentagon, there are two clear things. One is, let's get the fuel out of there. Whether you call that housekeeping or not, I'm not sure. I don't think, actually, housekeeping is quite the right word because in an environment that releases process dust to its surroundings, the surroundings become part of the process. And it's no longer housekeeping. You have to view the process on a wider scope. And I would urge considering that perspective.

Secondly, the ignition corner of the explosion pentagon in this case is not one of the many God-sent ignition sources. It was really a primary percussive event, a primary process dust explosion or gas explosion, for which we worked very hard to prevent, certainly Kidde-Fenwal and our colleagues in industry, to try to provide systems to control or prevent those kinds of explosions.

So efforts focused on eliminating or preventing process explosions will certainly deal I think in many cases with one corner of the secondary explosion pentagon that we need to address.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

Next is Karen Synca. No Karen Synca? Jim Tidwell?

MR. TIDWELL: I see my handwriting hasn't gotten any better.

CHAIRPERSON MERRITT: Tidwell?

MR. TIDWELL: Tidwell, yes.

(Laughter.)

MR. TIDWELL: Thank you.

My name is Jim Tidwell. I represent the international Code Council. Just a couple of seconds of background. I retired from the Metro Fire Department in Texas a couple of years ago. I work in fire prevention as well as several other arenas in my department, including assistant chief and chief.

In a 30-year career there, I responded to a number of explosions, none of which were dust explosions. What I have heard today indicates to me that the old adage that experience is the best teacher is still true. It's the best teacher of bad practice.

You've got folks out there that are running these operations that are not taking care of the dust. And on rare occasions, one blows up and gets everybody's attention.

But then I heard from one of the panels earlier that even after a facility experienced an explosion, they did their risk analysis and decided it was worth the risk not to solve the problem.

And then I hear about voluntary compliance. I'm sorry. From my personal perspective and my history, that may not be the best course of action to take.

The reason I wanted to comment today -- that's all a sideline -- is when you made your publication in the Federal Register, we took your questions and distributed them to our fire service members, which, oddly enough, today I find the responders haven't really been involved in this. But it may be something you want to consider because those folks also have a stake in the outcome of what you are doing.

So what I want to do is just recap the responses we got from your questions in the Federal Register from our fire service members. First of all, the Material Safety Data Sheet question, there was universal agreement from our respondents that the MSD sheets are virtually useless when it comes to trying to assess this kind of hazard. Now, there may be an exception here and there, but the folks that responded to your questions tell us that they can't use them.

Another universal observation was that a major problem in this arena is recognition of the potential. Dust explosions or deflagration hazards exist in facilities and operations that many of us don't normally consider hazardous.

Many people continue to labor under the misconception that dust explosions occur primarily in grain elevators and wood-working establishments. There simply isn't a lot of knowledge and experience in the fire service overall concerning this issue.

One of the other themes that ran through the responses was that we couldn't find a clear standard for the determination of whether a dust explosion hazard exists in a facility or not. I think this goes back to the MSD sheets and trying to recognize all of the factors that go into that assessment. The current state of codes and standards is severely lacking in this regard.

It was perceived by some that there may be a lot of dust explosions that are going unreported. You have to remember that only about half of the fire departments in the United States report under the INFIR system. And while that gives us a good strong database and NFPA does an outstanding job of analyzing that data, a lot of these things are going unreported.

The other reasons are probably intuitive to you. There are industries out there that won't call the fire department because they don't want to call their insurance provider because they don't want to be punished in some way. And I suspect some of that is going on. I think it is safe to assume that these dust explosions are severely under-reported.

In response to the question of whether the CSB should examine only the industries covered by the NFPA standard, the general consensus was that you should be looking at everything. It doesn't make a lot of sense to look at dust explosions and then start excluding things that haven't been otherwise addressed.

You had a question about additional resources. And one of the groups mentioned was Society of Fire Protection Engineers. They have a pretty strong interest in this arena, I think. Databases that the state fire marshals keep and NIOSH were the other ones mentioned.

Some of the recommendations that I see we would make as a result of the feedback from the fire community is: A) much more research needs to be conducted to determine where the hazards are present, how to recognize, define, and mitigate those hazards.

A significant void of knowledge exists

among the regulatory community, including building officials, fire officials, and other inspectors.

A training program that will contribute to filling this void would be welcome and effect. Such a program should include issues relevant to response personnel. That's recognition reporting primarily as well as regulatory personnel.

The code organizations, we need to facilitate the production of a regulatory document that would provide for recognition and mitigation criteria that is easily understood by the regulatory community.

There aren't a lot of chemical engineers or physicists that are out there inspecting buildings. I hate to use the term, but we're going to have to dumb it down so people like me can understand it.

Consolidation of the standards on dust explosions would be beneficial so that we have one source to go to for those regulations. To fill the need for first responders' right to know information, either revamp the MSDS system to include this information or create an additional requirement for manufacturers, users, and so on, to provide a hazard analysis of dust explosion potential for any facility or material that might generate such a hazard. And that would be done on request of the code official.

We're talking about what to put on an MSDS sheet. It crossed my mind we may want to create a mushroom cloud to set down beside some of those materials.

Anyway, the single most common comment that ran throughout all of the responses was a need for more information and more training on the issue. It was suggested that a federal project similar to the DOT project on pipeline safety, where the National Association of State Fire Marshals collaborated with the Department of Transportation -- and they're still in that process of educating the fire community throughout the United States -- might be a good model to use.

When I get back to the office, I will forward the actual responses that we got from the fire service and where they came from. And you will be able to contact them or contact us as needed.

Thank you.

CHAIRPERSON MERRITT: Thank you. That would be much appreciated.

And last but not least is Deepay Mukerje. If you could pronounce that correctly and spell it for us, I would appreciate it.

MR. MUKERJE: Yes, I will. You did a wonderful job, actually. I used to be a moderator. And the toughest job of a moderator is to be able to pronounce all of the names correctly.

Deepay Mukerje. I'm from the National Institute for Chemical Studies. And thanks, John, for the invitation. It was a wonderful day.

We do a lot of different studies. Unfortunately, we probably haven't done enough of the dust explosion studies. But some things that came to my mind today are to make it solution-oriented.

We talked about the difficulties with MSDS. I don't know if Tom Hobbe is still here, but he probably doesn't remember. When you don't have the data -- I called Ciba specialties, and I got the data. But it was not published in any MSDS that I had seen from Ciba-Geigy.

The point is the data is available in many, many cases. And Jim Mulligan had made some good comments about equivalent data. If you ask for MIT, you might get MIT. You may get an equivalent data, which is just as useful, I think.

The other part that I was surprised we didn't address today and I would have liked to have seen it, primary explosion from dust is not the reason for the damage and the destruction and the like, death or injuries. It's the secondary explosion that causes most of the problems.

I have a feeling that the secondary explosion is under our control, rather than changing MSDS. You know what Dr. Eckhoff said. He is the only one that made the comment these explosions are two-phase explosions. It is not that easy to do the study on two phases. One-phase gas explosions are very easy to get data on.

So I want to leave you with the comment that the solution of the secondary explosion may be the better solution than trying to change the MSDS and get additional data on MSDS or anything like that.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

At this time -- yes, sir?

MR. URAL: I have signed up for our public comments.

CHAIRPERSON MERRITT: Oh, you did. I didn't know if you meant to.

MR. URAL: I would like to read a comment on behalf of the ASTM committee.

CHAIRPERSON MERRITT: Sure. Thank you.

MR. URAL: This was developed by the Executive Committee of the ASTM E-27, which is the, for those of you who don't know, hazard potential of chemicals.

The committee focuses on quantifying fire and explosion hazard properties of vapors, liquids, bulk solids, and dust. And the standards that have been talked today, like the Kst, MIE, MIT, and dust recognition temperatures, are developed by this committee.

So the committee's statement is very

brief. We need two things. And we need the support and the help of the Chemical Safety Board to promote those needs.

One, there is a need for better round robin data to determine the precision and bias for ASTM international test methods for measuring the explosion characteristics of dust. These data are used to inform the user about the repeatability of the explosability data.

And, two, there is a need for more standard reference calibration dust to compare the results from the various laboratory equipment used to measure dust explosion characteristics. These dusts are also used to periodically check the calibration of the laboratory test equipment.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

And I also had Dr. Going. Did you mean to sign that or did you --

DR. GOING: Yes, I did. As well-said by now, two of three of my subjects have already been thoroughly discussed. And one has been commented on three previous times, but I did want to add another little tidbit to that. And that is the issue of perhaps unaccounted for or unreported explosions, sometimes called puffs if you talk to people in the field, "Oh, we had a puff the other day, and it blew out the vents. But it was no big deal."

From the side of industry that is involved in replacing vents or rebuilding suppression systems, we see a large number of these. I believe Mr. Davis referred to these as success stories. And we're happy that they are, but as such, there's no damage and there's no injury and there's no reporting.

We don't really have a number on it, but perhaps that 197 number we heard this morning should be 2, 3, 4, 5 times larger, which, unfortunately, says a lot of times things do go right and you do have deflagrations.

So the magnitude of the problem -- and this is largely the contained explosion problems, not the secondary explosions -- is perhaps larger than that 197 number.

Thank you.

CHAIRPERSON MERRITT: Thank you very much.

Is there anyone else that we missed?

(No response.)

CHAIRPERSON MERRITT: Okay. Well, thank you very much, panelists, all of the panelists, and for all of you who have hung in there with us all day today. I want to thank the team who put this together. I think they did a wonderful job. And we should give them a hand. Thank you.

(Applause.)

CHAIRPERSON MERRITT: I hope you agree this has been a very insightful and stimulating day and certainly of tremendous value to us at the CSB as we proceed with this study.

I think each of the speakers has provided us with some new information. And we look forward to further discussions with all of you.

We will continue to welcome and take written comments for the record. If you would like to submit a written comment, please send it to our e-mail address, which is dust, d-u-s-t, @csb.gov. And that will be open until August 1st, 2005.

We would also ask you to check our Web site at www.csb.gov for any updates that we might be providing with regard to the study and the work that we're doing.

And so, with that, I would like to thank all of you who have been here today. Thank you, fellow Board members. And with that, the hearing is adjourned about 13 minutes ahead of schedule.

(Whereupon, at 4:18 p.m., the foregoing matter was adjourned.)