UNITED STATES OF AMERICA

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CHEMICAL SAFETY AND HAZARD
INVESTIGATION BOARD

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PUBLIC UPDATE

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WENDESDAY

JUNE 18, 2003

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KINSTON, NORTH CAROLINA

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7:00 p.m.

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PRESENT:

CAROLYN MERRITT, CHAIRMAN

ANDREA K. TAYLOR, BOARD MEMBER

CHRIS WARNER, GENERAL COUNSEL

STEVE SELK, LEAD INVESTIGATOR

JOHNNIE BANKS, INVESTIGATOR

ANGELA BLAIR, INVESTIGATOR

LISA LONG, INVESTIGATOR

C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

CHAIRMAN CAROLYN MERRITT: Good evening and welcome. This is a community meeting of the U.S. Chemical Safety and Hazard Investigation Board, the CSB. My name is Carolyn Merritt and I'm chairman and CEO of the U.S. Chemical Safety Board. With me this evening are board member Andrea -- Dr. Andrea Kidd-Taylor; our chief operating officer Charles Jeffress; Chris Warner our general counsel, and lead investigator Steve Selk and others of our staff.

At this time I'd like to give a brief safety message. In the event of an emergency, exits are directly behind you, as well as these two doors, which lead directly outside. Also, if you have a cell phone, I hope you would be considerate to others around you and please turn your cell phone off so that we're not disturbed. Thank you.

Our subject this evening is the tragic explosion that occurred at West Pharmaceutical Services here on January 29. That explosion resulted in six fatalities, dozens of injuries, and much economic hardship to this area. We're holding this meeting tonight to brief the community on our initial findings to date and to hear from members of the public who have been affected by this event.

The CSB investigators arrived here in Kinston the same day of the event, and since that time they have been conducting a far reaching investigation of the facts and circumstances surrounding this devastating event. Today marks their first official report back to this community, as we reach the expected midpoint of our investigation. Our goal at the Chemical Safety Board is to do everything that we can to make sure that an explosion like this doesn't happen again, either here in Kinston or elsewhere around the country. To do that we need to understand all of the causes of the accident. We approach this task with a sincere sense of urgency. On February 20, less than a month after the accident here, a similar explosion occurred at an automotive insulation plant in Corbin, Kentucky. That event led to seven deaths and numerous injuries.

After the investigators' presentation this evening, there will be an opportunity for the public to comment, as I know many of you here have been profoundly affected by this event and we will accommodate as many of you as possible. When the comment period begins, those who wish to comment should line up here near these microphones that are provided in the auditorium.

(Instructions regarding comments were given in Spanish.)

We have a few procedures that I would like to talk to you about before the comment period. In view of the number of people here tonight, we ask that you limit your comments to three minutes. If you'd like clarification on anything that you've heard here tonight, we will try to accommodate brief factual questions for the investigators. Naturally, the team cannot field any questions concerning pending legal or regulatory compliance action. Those are not issues handled by the Chemical Safety Board. Our goal at the CSB is to determine the cause of accidents like this one and recommend actions to prevent recurrence, not to apportion blame or responsibility. I'd emphasize that the main purpose of the comment period is to hear from community members. If you're a journalist and you have specific questions about the investigation, please consult with one of the agency staff around the room after the investigation and we'll be happy to assist you.

Now before we begin, I would also like to introduce several distinguished guests here this evening. And if you would, I would appreciate it if you would stand if that would be all right. Mr. Oscar

Herring, who is a county commissioner here, Mayor John Mosely, who is mayor of Kinston, Representative Wayne Goodwin who is chair of the Safety and Health Committee for the state House of Representatives, and also Staben Gonzales who is legal counsel for the Mexican Consulate in Raleigh. Thank you. Thank you all for being here.

With that I'd like to turn the floor over to Dr. Taylor for brief comments.

ANDREA TAYLOR: Thank you, Chairman Merritt. Good evening. I am from a small town in Alabama that reminds me a lot of Kinston. I arrived here the night of the explosion with our chairman and our investigation team. For several days after the event, I watched and observed how all of you came together to assist your fellow co-workers and friends. I had the opportunity to speak with many of the workers who had been there that day. I promised you the Chemical Safety Board was here for the long haul and that we would be back in Kinston to hear more from the community about your concerns and to update you on our preliminary findings. Well, as promised, this is that meeting.

I understand the impact that such an incident can have on workers and the entire community.

Kinston has suffered a great deal emotionally and economically. It is my sincere hope that from this investigation we can prevent incidents like this from occurring again.

On behalf of the board, I would again like to extend my condolences to the families who have lost loved ones and my regret to those workers who have sustained injuries as a result of this tragic event. As we begin this meeting, let us pause to remember the victims who many of you knew well: Faye Wilkins, William Gray, Alvin Butchgrant, James Byrd, Milton Murrell, and Kevin Cruise. Thank you.

CHAIRMAN CAROLYN MERRITT: Thank you, Dr. Taylor. With that I'd like to introduce Mr. Steve Selk who will begin our presentation this evening.

STEVE SELK: Thank you, Madam Chair, Dr. Taylor, and Mr. Warner. Good evening, ladies and gentlemen, and thanks for attending. We have two objectives for tonight. First, we want to give you an update on the progress of the investigation. And second, we are interested in learning about any comments, concerns, and ideas that you may have. The information we're going to present to you tonight is preliminary. It will remain that way until it is reviewed and voted on by all five members of the

Chemical Safety Board. Nonetheless, we can give you a report of the findings the investigation team has made so far.

It is our conclusion that the blast was, in fact, an explosion of the polyethylene powder that was used as a nonstick coating for rubber sheeting made at the plant. During the production process, the plant ventilation system drew fine dust particles into the space above an unsealed suspended ceiling where it settled and built up. We have not yet been able to determine what ignited this dust. We're continuing to work on that.

We'll present the investigative data to you tonight in stages. It will begin with a brief familiarization that describes the type of manufacturing operation that was ongoing in the area where the explosion occurred. After that we will summarize what first-hand witnesses saw and heard. That will be followed by a description of the physical damage. We'll explain briefly how the pattern of damage leads to a determination of where the largest blast was centered. After we have gone over all these things, then we'll explain how the material that exploded came to accumulate to a hazardous level.

We have some of the material with us here tonight. Our testing has confirmed that this polyethylene powder recovered from the ruins of the plant is explosive when mixed with air. It contains enough energy to account for the level of destruction we observed. We are going to ignite a small amount of it here on the stage.

Finally, we'll close with some remarks about the future course of the investigation and then turn things back to Chairman Merritt and Dr. Taylor so that the second part of the agenda, your comments and concerns, can be heard.

Before we begin the manufacturing familiarization, let me mention that the investigative team departed Washington and arrived at the West plant the day of the incident. Later we entered the accident site together with agents from the Bureau of Alcohol, Tobacco, and Firearms and with investigators from the state Occupational Health and Safety Administration. Within a week or so the accident was declared accidental. The Chemical Safety Board has a long- standing agreement with the Bureau of Alcohol, Tobacco, and Firearms that calls for the Chemical Safety Board to become the lead federal investigative agency in circumstances such as this.

Let me now introduce you to Lisa Long.

Lisa is a key member of the investigative team. She has a degree in chemical engineering from Virginia Tech. Lisa will describe to you the nature of the manufacturing operations that were being conducted in the area where the accident occurred.

LISA LONG: Good evening. I'd like to start the presentation tonight by giving some basic background information on the West plant and the manufacturing process that was involved in the January 29 explosion.

As many of you already know, the facility was divided into two operations. These were commonly referred to as the ACS side and the Kinston side. Both of these operations were housed in the Kinston, North Carolina, facility. On the ACS side, rubber materials were compounded or mixed for use as a raw material in the Kinston side or in other West facilities. On the Kinston side, the compounded rubber from ACS was molded into various final products, such as syringe plungers and intravenous filament used in drug delivery systems. The explosion on January 29 occurred in the ACS side of the plant. There were 255 West employees who worked at the site, and there were also eight full-time contract employees from Mega Force and 27 contract employees from IH Services.

This diagram represents a simplified plant layout. In order to orient you properly, I've shown Rouse Road Extension here in the front of the plant. The main visitor entrance is right here (indicating). The employee break rooms are right here (indicating). This (indicating) is the Kinston side of the plant. The other half is the ACS side. The ACS tower is right here (indicating) and this is the ACS warehouse (indicating).

This is a 3-dimensional diagram of the West facility. Again, Rouse Road Extension runs in front of the plant. This is the Kinston side (indicating). And the ACS is in the back half. The ACS warehouse is right here (indicating) and the ACS tower is right here (indicating). The ACS process that I'm about to describe to you is housed in and around the tower. The mixers are on the upper levels of the tower and the mills and batchoffs are directly below them on the lower level.

West makes several different formulations of compounded rubber in ACS, and ACS has two redundant processing lines. This simplified schematic shows the flow through one of the processing lines. Most of the raw materials for the particular formulations being made are sorted and gathered in what was known as the kitchen area. The materials were mostly rubbers and powders. The kitchen is located on the ground level and the raw materials are moved upstairs to the tower area by conveying systems. The raw materials are then placed into a large mixer. The mixer was automated and would mix the raw materials together for a specified amount of time in order to get a rubber mix with the properties needed for whatever final product it would be used in. There was no chemical reaction in the mixer. It was simply a mixing process.

When the mixing process was complete, a door at the bottom of the mixer would open and the compounded rubber would drop through a chute onto a mill located on the lower level. At the mill the rubber would be pressed into a flat sheet. After being processed on the mill, the flat sheet of rubber would be fed into what was commonly known as the batchoff. On the batchoff, the flat sheet of rubber would be fed through rollers and into a dip tank.

In the dip tank the rubber would be coated by what was called slab dip. Slab dip was a dispersion of polyethylene powder and water, and it looked like this that I have here, a white liquid. After being coated with slab dip, the rubber would travel over a system of rollers that passed in front of a series of fans. The purpose of the fans was to dry the slab dip onto the rubber. The polyethylene in the slab dip insured that the rubber did not stick to itself. After being dried by the fans, the rubber was folded into sheets and placed in boxes to be used in the Kinston side or at other West plants.

Now the powders used in the ACS process produced dust. Both the ACS kitchen and the mixing area had dust collection systems that removed much of the dust from these areas. The batchoff system produced some dust when the fans blew the slab dip coated rubber dry. There was a local filter system at the batchoff but not a dust collection system.

On this diagram you may also notice a drop ceiling. This created a space between the ceiling and the floor above. Later tonight Angela Blair will be talking about the role this drop ceiling played in the incident. I would also like to note that during our investigation we learned that there were full-time cleaning personnel who helped to keep these areas very clean, and dust was not allowed to accumulate on the plant's visible working surfaces. This concludes my description of the process.

STEVE SELK: Thank you, Lisa. From the description that Lisa gave you, ladies and gentlemen, I think it's fair to say that the operation at West was not one that most of us would consider to be particularly dangerous.

During the course of the investigation we conducted many interviews. The team also reviewed information gathered during interviews done by agents of the Bureau of Alcohol, Tobacco, and Firearms and the North Carolina State Bureau of Investigation. We learned that the event at West was a sudden one. There does not seem to have been any advance warning.

Angela Blair graduated with a degree in Chemical Engineering from Auburn University in 1982. She's a registered professional engineer. Angela will summarize for you the information we gathered from first-hand witnesses.

ANGELA BLAIR: Thank you, Steve. As Steve told you, the Bureau of Alcohol, Tobacco, and Firearms conducted screening interviews. They conducted 177 such interviews during the first week after the explosion. The Chemical Safety Board investigation team participated in that interview process and selected key witnesses for in-depth interviews. As of today, the Chemical Safety Board investigation team has interviewed 93 witness. These include hourly, salaried, and contract employees and neighbors of the

Kinston facility.

Our first interviews took place the morning after the accident. We finished most of the employee interviews by the end of March, although some of the salaried employee interviews took place as recently as last month.

It seemed a very daunting task to determine what exactly happened on the morning of January 29, 2003, based on the mound of tapes and notes from nearly 300 interviews. Clearly, we needed a systematic approach. We identified key issues or areas of interest, such as how many explosions the witnesses heard, where they were, what their job was, and what was their knowledge of the ACS conditions on the morning of the accident.

We then summarized each witness's testimony around those key areas. We separated the people who were not on site at the time of the explosion from those who were and compared the information from the Chemical Safety Board interviews with the notes that we had from the ATF interviews.

Finally, we organized the 44 eyewitness accounts into charts to look for patterns and for corroboration. The graphic that I'm going to show you in a few minutes is the result of that analysis.

We learned a great deal from the interviews my colleagues and I conducted. All of us greatly appreciate the cooperation of the employees and other witnesses, and we want to thank them for taking the time to talk with us. It's very important for investigators to hear firsthand accounts by people who were there when the accident happened, people who were at ground zero, so to speak. As I will show you on the diagram on the next slide, what the eyewitnesses saw or heard was very much dependent upon where they were at the time of the accident.

A few witnesses described a bright flash of light just prior to the explosion. While some employees experienced two distinct explosions, some only heard one, and a few heard nothing at all. For this last group of employees, they described a sudden plunge into darkness as the lights failed and then the ceilings and the walls started to collapse.

Through our interviews we began to understand the compounding process and the work flow at West. We heard of the working conditions and life at the facility. The management interviews gave us an understanding of the way decisions are made and how knowledge is shared within the company. These interviews will continue over the next few weeks.

This is the same simplified layout diagram you saw in Lisa's presentation. I've taken the labels off to make it simpler to read, because it's going to get real busy here in a minute. After we analyzed the witness accounts, we started to see some patterns emerge.

Close to the center of the explosion witnesses described the bright flash just before the explosion. It's shown here as a yellow triangle. This larger red area is the location of people who heard two distinct events and also the locations of the most serious casualties for this accident. This even larger orange area shows where employees heard one large explosion. Within that area we match the employees who actually felt the concussion or shock of the explosion. This pink area, there, shows where the people were who actually did not hear anything. Now it's interesting that the people in the break room, up here on the top corner, in some cases heard nothing but they felt the shock wave, while the people in the smoke room actually heard the blast. The folks that were in this area colored in pink may have been standing directly next to or alongside of someone who heard the explosion. The people in -- it works when you don't want it to. The people on the far end of the -- outside edges of the plant were probably hearing noise that was coming from the outside of the building. As many of you know who were off site at the time of the explosion, this blast could be heard as far as five miles away. Finally, we have a blue line that shows the locations of five witnesses who described hearing the sound of rolling thunder just prior to the explosion. This is consistent with a dust explosion. Now it also may be confusing to you that some of these areas overlap. I want you to keep in mind that in some cases two -- the same person is mapped twice. We had some people who heard a blast and felt the shock wave. We had some who felt it but didn't hear it. We have some people who heard it but did not feel it, so this is just a general pattern to help us analyze the witness information.

It's also important to note that we had, as I said earlier, cases of employees standing side by side who heard things differently. It's not unusual at all for witnesses to just a dramatic and sudden event to have completely different recollections of the details.

Now what conclusion do we draw from this diagram? That those closest to the explosion heard the event in greater detail. Lulls and distance muted the effects and noise from the blast for those employees on the far edges of the plant. The pattern of witness accounts supports the physical evidence for the origin of the explosion, as you will see in Johnnie Banks's presentation coming up next.

Out of all the witness statements, several key findings started to emerge. First, there was nothing unusual going on in that plant that morning. A seemingly normal workday suddenly erupted into chaos. Second, no single witness was able to describe seeing or experiencing the actual initiating event, although a few witnesses did hear an initial smaller explosion. Finally, we found that the testimony of the witnesses to be very consistent with the findings from the field observations that Johnnie Banks will be telling you about next.

STEVE SELK: Thank you, Angela. The explosion and resulting fire caused a great deal of damage to the West plant. The site remained dangerous for several weeks. Metal panels, concrete, and other items hung precariously from the building, sometimes fluttering in the wind and threatening to fall. The steel structure in the compounding area required stabilization and access through the debris was difficult. All this slowed the pace of the investigation. However, we were able to determine the location of the large blast with some accuracy.

Johnnie Banks is also a member of the investigation team. Johnnie is a graduate of the University of California- Berkeley and worked for Chevron Corporation for many years where he developed a special interest in safety. Johnnie will go over the results of our damage assessment and identify the center of the explosion.

JOHNNIE BANKS: Thank you, Steve. Good evening, everyone. The next order of presentation I will provide some of our findings relative to the origins of the blast at West Pharmaceuticals and an overview of the most severe damage caused by the explosion and subsequent fire.

Prior to starting, however, I'd like to take a moment to preview some of the areas that I will be discussing. They are the mills and batchoff #1 and 2; the ACS warehouse, which is located in the lower right-hand corner of the diagram; the kitchen which is just to the right of the mill; the upstairs ACS, which also housed mixers #1 and 2 and which would normally be oriented directly over batchoffs 1 and 2. To provide a landmark, Rouse Road Extension is shown here (indicating), just to the west of the plant. And finally, true north is shown here (indicating), cutting a path directly across the plant, from left to right from the southernmost portion of the plant.

With that being said, I'm going to now describe some of the damage from the explosion/fire of January 29, 2003. One of the most stunning observations from this event in the analysis of physical evidence was that the blast caused the movement of the batchoff approximately several feet to the west. This machine weighed several tons. The green figure that just appeared in the diagram is meant to illustrate the movement of this machine. Masonry block walls surrounding the area to the east, to the north, and to the west sustained heavy damage, indicating extreme blast pressure. The force of the blast pushed these walls in an outward direction.

Piecing together these early findings combined with evidence observed at ground level of both mills, investigators conclude that there was a significant event that occurred in the immediate vicinity of mill batchoff #1. Right there (indicating). In examining the damage to structural steel and masonry block walls, the most severe forces were in these areas, indicating that the blast originated in this location with a blast pattern of

360 degrees adjacent to or just southeast of mill #1.

Concrete slab flooring directly over the batchoffs between mixers 1 and 2 was pushed in an outward -- in an upward direction and gave way to an approximate four-foot opening between the concrete floor and the steel supported ceiling above the mill area. This allowed blast pressure to enter the upper reaches of the tower. Additionally, the highest number of employee casualties occurred at or near mill #1.

Three of the six fatalities were from injuries sustained in the area of batchoff mill #1, while a fourth was from injuries incurred near batchoff mill #2. Two more fatalities would result from injuries sustained in the areas east and west of the mill, in the kitchen and just south of the extruders.

A significant number of ceiling tiles were blown in a downward direction, ripping the hangers from their anchoring posts, which is consistent with blast pressure forces from above. Also, these tiles exhibited burn patterns and splattering predominantly on one side, the side facing the concrete floor above. Responses from interviews with employees further away from the mill areas recall the sound of rolling thunder and wind being blown either in their direction or of a vacuum effect.

It is important to note that this type of feedback is consistent with the investigative team's theory of the nature of the explosion that occurred at West and what is known as blast wave movement where dust is involved. This sound and sensation was very likely the blast wave moving through the facility, seeking paths of least resistance.

The explosion affected virtually every corner of the facility. Even in the farthest reaches of the plant, damage was extensive, including broken windows in the break room and buckling of walls and doors on the opposite side of the plant. Additionally, off-site businesses and homes suffered varying degrees of damage. And at a nearby school, six picture windows were broken and several students sustained injuries.

The blast also progressed southward into the ACS warehouse. This activity caused material in the warehouse to catch fire. After the material in the ACS warehouse became involved, there were reports of explosions, as many as fifteen minutes after the initial blast shook the plant. This explosion could be the result of a propane tank on a forklift exploding.

Earliest accounts from witnesses recall that the metal siding from the tower area of the ACS was blown off of the facility almost from the outset. As can be seen in this view, the damage was extensive. Debris from the blast was found as far away as two miles, and as mentioned earlier, virtually every portion of the plant was affected.

In this view of the area directly over the batchoff mill area, it can be seen that the steel frame underwent tremendous forces, causing it to bend in several key support areas. This indicates significant blast forces from within the building.

In summary, an examination of the equipment and evidence recovered at the scene yielded the following observations: A significant number of ceiling tiles were blown in a downward direction. These ceiling tiles and their anchors were ripped from their anchoring posts which suggests explosive forces from above the tiles as opposed to forces from below, which would likely have left the hangers intact.

The masonry block wall south of mixer #1 was pushed in an outward direction and impacted the south side of mixer #1, inflicting heavy damage to the machine and associated piping.

The batchoff from mill #1 was moved

approximately five feet to the west. Two cinderblock walls to the east of the mill that framed a hallway between the mill and the kitchen were knocked down and blown into the kitchen. The masonry block walls to the west of the mill were knocked down and blown into the direction of the finished goods warehouse. Blast forces pushed upward on the concrete floor in the vicinity of the mills, #1 and 2, causing a four-foot opening.

Finally, I'd like to present a demonstration using computational fluid dynamics data to illustrate what our preliminary findings indicate occurred at West.

In plan and elevation views of the plant, it shows the likely path of the blast wave from initiating event through the final explosion. This material was developed using the actual dimensions of the facility and the result of sample testing.

First, we'll view an animation of the blast wave through the facility and then we will see a frame by frame analysis of those paths.

(Animation was shown on screen.)

And this captures the initiating event right there (indicating) and that's the wave you can see moving through the ACS warehouse and through the plant northward. Now we'll view a frame by frame analysis.

In this opening frame, an initiating event is shown in the area of the batchoff #1 area. That thing right there (indicating). The blast pressure expands and quickly reaches the east and west walls of the batchoff #1 area. There (indicating). The blast wave moves north toward batchoff #2. Also, the blast vents out of openings to the south and begins to vent into the ACS warehouse. The blast pressure continues to fill the first level of the batchoff mill area and vent into the ACS warehouse. The second floor at the south end of the batchoff mill area is lifted and the blast begins to enter the second level. The first level walls at the south end of the batchoff mill area begin to fail under the blast pressure and it propagates into surrounding areas.

The blast pressure continues to fill the first level and vents into the ACS warehouse. The south end of the second floor fills with blast pressure and this begins to propagate north through the second level. The first level walls fail and the blast propagates in the surrounding areas. There (indicating) would be the area that would be failing, moving into the kitchen area.

The blast pressure continues to propagate into the ACS warehouse and northward through the second level. There was a significant failure of walls and roof coverings at the south end of the batchoff mill area. The blast begins to vent to the surrounding rooms and to the outside. At some point the masonry walls of first pit #1 and later pit #2 failed under pressure from below and are pushed into the pits.

The blast pressure continues to propagate northward through the second level. Wall and roof coverings are pushed off the building from the inside. The blast continues to vent into surrounding areas of the building and to the outside. The blast pressure reaches the north end of the second level and the wall and roof coverings are pushed off from the inside.

That concludes my portion of the presentation, and I will now turn the proceedings back over to Steve. Thank you.

STEVE SELK: Interpretation of damage patterns indicates that the large blast occurred in the lower level of the compounding area, centered between the south mill and what is referred to as kitchen. Angela Blair will now explain exactly what it was that exploded and how it came to accumulate to hazardous levels in the area where the blast occurred.

ANGELA BLAIR: To repeat what Steve Selk told you earlier, the Chemical Safety Board investigation team believes that the destruction of the West Pharmaceutical Plant in Kinston was caused by a dust explosion.

This pentagon is a simple way of looking at dust explosions and is similar to the fire triangle of fuel, oxygen, and energy that some of you may be familiar with. Five elements must be in place to have a dust explosion and were present at West on January 29, 2003.

First, there must be a fuel, a combustible dust. The smaller the dust particle, the more likely the dust is to explode. Second, if there's no oxygen the dust will not burn. Since oxygen is always around us in the air we breathe, we can assume there was oxygen present. Third, without dispersion or being fluffed into a cloud, the dust will smolder but it will not burn rapidly enough to explode. Next, we need some kind of energy to ignite the dust cloud. Finally, the dust cloud must be confined in a room or a building for a damaging explosion to occur. When the dust cloud is ignited indoors, the pressures and the rapidly burning cloud reach dangerous levels in a split second and Johnnie showed you the step by step analysis of how that blast pressure moved through the building.

By analyzing the pattern of structural damage and beam bending and by comparing this information to eyewitness accounts, the CSB investigation team has concluded that the big explosion at the Kinston facility happened below the concrete floor for mixer #1, near batchoff 1. The evidence suggests that the explosion probably occurred in the space between this floor, the concrete floor, and the suspended or drop ceiling for the first floor. This evidence includes ceiling tile fragments found as far away as two miles from the facility that were scorched on the top side but not burned on the bottom.

You've heard us mention the term "drop ceiling" several times tonight. I want to make sure that everyone understands what we mean by a drop ceiling. This is a false ceiling formed by suspending a framework by wires from the ceiling trusses or beams and then inserting acoustical tiles into that suspended frame.

This is a photo of a typical acoustical -- acoustical tile drop ceiling. This photograph shows the suspension for a typical drop ceiling without the tiles installed. Notice the framework and the wire hangers. We've got the wire hangers here (indicating) that are holding up the framework, and those wire hangers are tied to beams above. Acoustical tiles actually drop down into this framework.

Next slide. Lisa described to you earlier tonight the process that was used for rolling the rubber into strips. Lisa mentioned that the rubber strip was run through a dip tank and coated with a material called slab dip. Remember, that slab dip is a dispersion of ultra fine polyethylene powder in water. Air was blown across the rubber strip to dry it. Once the rubber was dry, what remained on the surface was a baby powder-like dusting which kept the rubber strip from sticking together when it was folded. Since the mid 1990s, the powder part of the slab dip has been polyethylene. Prior to that time, another material, called zinc stearate, was used as the dip. We've learned that both forms of this slab dip dry to combustible powders. When the air was blown across the rubber to dry it, some of the dusty particles were wafted into the air.

We did a careful review of the materials that were present at the site, looking for possible fuels for this explosion. Based on testing results, the investigation team has concluded that the material that exploded was dust formed by dried slab dip. Dust was the fuel. Dispersed in air it formed an explosive mixture.

West went to great effort and had a regular program to continuously clean the dust from the equipment, the walls, and the floors in the milling area. However, this powder also migrated above that drop ceiling through small openings in the ceiling and by being pulled by slight suction from the air conditioning intakes above the ceiling.

You'll see here that I've indicated a grate. This is just an open box type of a tile. They replaced one of the tiles with this grating and this lets the air flow go from the room back up into the area above the ceiling and into the air conditioning intake.

The powder accumulated on ceiling tiles, conduits, duct work, and light fixtures. Although West replaced the ceiling tiles from time to time, dust was continuously deposited and employees recall seeing layers of accumulated dust in just a few weeks prior to the explosion. The other surfaces above the tiles, the lights, pipes, and ducts were not cleaned. This drop ceiling here (indicating) created a space where an explosion could occur and spread. For this reason unsealed ceilings are not recommended where combustible dusts are present.

When fine combustible powder accumulates on a flat surface, we have fuel for an explosion. Some initiating event happened that fluffed up the accumulated powder. The resulting cloud was ignited, either by the initiating event or by static electricity within the cloud. Eyewitnesses heard a sound like rolling thunder, as we've said, as a rapidly expanding chain of explosions moved through the ceiling space and literally tore the building apart.

The evidence for this smaller event, and we still don't know what the initiating event was, but the evidence for this smaller event was hidden in the rubble and the damage left behind by the larger explosion.

STEVE SELK: Ladies and gentlemen, Angela has explained how the heating, ventilation, and air conditioning system drew polyethylene particles of the slab dip up into the area above the ceiling tiles where it settled and accumulated. That was the fuel for the large blast that occurred at the West facility.

Polyethylene is arguably the most basic of plastics. It's been in use for more than fifty years. This plastic milk jug (indicating) is polyethylene. It's hard to imagine a more benign material. How can it be that this chemical substance caused such a massive blast?

There are two parts to the explanation. First, polyethylene is a good fuel. It is made from petroleum hydrocarbons. Essentially, polyethylene is nothing more than a particularly rigid form of wax. Like wax, it burns.

The other part of the explanation is a little more important. At West the polyethylene accumulated as a very fine powder, like baby powder. Perhaps the following example will illustrate why this is important. If I had a wooden log here and a book of matches, I'd be hard pressed to ignite that log. And assume for a moment that it was well seasoned and dry wood. If I took a pocket knife and whittled some shavings and created a pile of wooden shavings here on the podium, it wouldn't be hard to ignite with a match at all, because the surface area is larger. There's lots of air between the shavings. It's very incendiary. Taken to the next limit, if the particles were very fine, like sawdust, and were to become dispersed in air, that can be an explosive mixture. Or that is an explosive mixture.

As we were working in the accident site among the debris, we were able to withdraw a sample of the slab dip liquid that the rubber was actually run through and coated. In the tank was a dispersion of polyethylene powder and water. We've dried some of the material in the lab and we have the portion of the powder, the resultant powder, with us.

To demonstrate its ignitibility, I present to you Mr. Jim Dahn. Jim joined us early in the investigation and accompanied us on some entries we made at the accident site. Jim is a professional engineer and a well-known expert on dust explosions. He is a member of the National Fire Protection Association, Dust Explosion Prevention Committee. And he owns one of the few accredited hazardous materials testing labs in the country. Mr. Dahn will now tell you a little more about dust explosions and demonstrate how powdered polyethylene, when dispersed in air, ignites. Jim will be assisted by Abdollah Kashani, one of his employees.

JIM DAHN: Good evening. We'd like to have a demonstration, a live demonstration, of what a dust explosion looks like. What we have on the table here today is an apparatus that was developed as a standard for American Society of Testing and Materials to evaluate the dust explosibility.

I'd like to regress just for a moment and talk about dust, because we all deal with dust every day of the year, don't we? In the house, you get dust in the house. You get it on the windows. Yesterday I had my car parked next to a driveway that they're going to put new asphalt in it. And, of course, I ended up with a lot of dust on my car. But that dust was not explosive because it was really just the rocks' dust that was being generated. And we know from experience and over the years that grain dust will obviously explode. We've seen many times grain elevators that have exploded, blown apart. We've heard about coal dust explosions in power plants. And the question always is, is the material we're handling a dust explosion hazard?

And what we're going to show here this evening is the Hartman chamber. This is a chamber where we're going to put the dust. And the dust we're going to be putting in tonight is the polyethylene dust from the West Pharmaceutical plant. And we're going to put in about a half a teaspoon of the dust inside of this cup. And we'll put the plastic container over the top of it and we'll put a cover on it, and on the cover we have a thin piece of paper, a very thin piece of paper that acts as a containment. And we're going to set it up.

Now this is the dust that would have been dried out from the slurry that you've seen Steve and Lisa showing you. Very small quantity, about a half a teaspoon that we're going to put in. And when we do this demonstration, I know many of you way in back may not see the full impact of this test. But if you imagine that cylinder is like a room in the building at West Pharmaceutical. And we have an ignition source which could be any one of a number of ignition sources. This one particularly here is an electrostatic spark, a spark discharge. And what we're going to do is cause a spark discharge first and then loft the dust up in the air. We have a small chamber, a very small chamber, on the side of the apparatus that's up to 30 pounds per square inch of air. A solenoid valve opens up and it disperses the air up into the -- into the chamber itself. As Angela was pointing out, in order to have a dust explosion, you need to have an ignition source. You need to have fuel, which is our polyethylene dust. You have to have air. That provides the other element. And confinement.

Within the last year I've been -- we've been working with a company that was making polyethylene pellets and they have dust in their -- in their environment. And they were concerned about the dust because of being collected in the dust collectors. And they went out and they sent some pellets out to one company to do dust explosibility testing. They ground up the pellets into fine powder which is minus 200 mesh, very small, and they ran the tests, and sent the results back to the company saying this polyethylene dust does not explode. We could not get it to explode. I said this is strange, because I've been around this business for thirty-some, thirty-five years and I've always seen polyethylene dust exploding in one form or another depending on the particle size. So we went back to the plant. We got some dust out of the dust collector and came to our facility and ran the test. And obviously, the powder was very explosive. One has to be careful about how you're taking that material and evaluating whether its a dust explosibility hazard or not.

This particular powder is extremely fine, and you'll see what the result is when we kick up the dust right now. And keep an eye -- Look above the electrodes and above up to here (indicating) to see the reaction that's going on.

Oh, yeah, could we dim the lights, please?

ABDOLLAH KASHANI: Three, two, one, fire.

JIM DAHN: You can imagine that small little explosion right here with a half a teaspoon of dust. And looking at thousands and thousands of quantities greater than that in the plant itself, and kind of imagine what kind of result there's going to be. This dust right here is kind of like a primary explosion. When you get a dust kicked up like this right here and if there's a lot of other dust around, it's going to kick the dust up in the air and create, like we have in grain elevators, secondary dust explosions which are devastating.

I just came back from about three or four plants that we did safety audits on. I discovered -- We discovered in the plants that they had dust laying on top of the piping and conduit and in some places in the corners, out of the way, dust was at least three inches thick. So one has to be careful about where that dust is collecting, be sure we know where it is. Thank you very much.

STEVE SELK: Ladies and gentlemen, we have talked tonight about some technical issues. However, we are only mid-way through this investigation. The National Fire Protection Code and the International Fire Code describe measures that industry can take to control the hazards of combustible dusts. Some of these measures were not adhered to in the West facility. This may be partly explained by the fact that no mandatory fire code was in force here in North Carolina when the compounding area of the West plant was built.

We are searching for other explanations as to why the hazard was not recognized. We will be asking why it is that some industrial segments are more aware of the hazards posed by combustible dusts than others. We are looking for what we referred to as root causes. Frequently, root causes involve how systems and activities are managed. What policies and procedures were in place? How were they implemented? What measures were taken towards understanding and controlling the hazards of materials that were in use? What were the qualifications of personnel? What training did they receive? Beyond matters internal to the business where the incident occurred, we will also examine what codes and standards and good practice guidelines exist. How does industry inform itself about these codes and guidelines? To what extent are they followed? We will also consider what laws or regulations are in place. Are these adequate and how are they enforced? Could they be improved? This is the more important part of the work that we do. Attention to these issues is what will prevent further recurrences, not just here in Kinston, not just in North Carolina, but everywhere across the country.

There is much to be learned from an experience such as the one that you've endured. We know that none of you want this to happen again to your friends and loved ones, so ultimately after the board completes this investigation, recommendations will be made to prevent recurrence. We are working on these issues now. And we will report to you in due course.

Thank you for your attention tonight, ladies and gentlemen, and thanks to those who have cooperated with us during difficult moments. Madam Chair.

CHAIRMAN CAROLYN MERRITT: Thank you, Mr. Selk, Ms. Blair, Mr. Banks, Ms. Long, and Mr. Dahn for a very thoughtful and complete analysis and a clear presentation. Thanks also to a number of other CSB investigators. There were more than a dozen people here and involved in this investigation in the last several months, but there are too many to bring and too many to mention here. But we appreciate their assistance as well.

I'd now like to begin the public comment period. The floor is open for you. If you have comments we would really like to hear them. There are microphones being set up in the aisleway and if you would, you're welcome to line up behind the microphone. We're asking that you limit your comments to about three minutes so that we can accommodate as many of you as possible.

(Instructions regarding commenting given in Spanish.)

At this time I'd ask you to speak your name clearly so that our court reporters can get your names and we can know who it is who's speaking and what your affiliation is. And I would also ask that you keep your comments germane to this event and try to refrain from going off on other areas of interest that you might have, and keep it to this event.

So those of you who would like to speak, would you please step up to the microphone. We had three people who registered; Ms. or Miss Bonnie Heath, is she present? Lisa Franks, is she present? Yes, would you like to speak? Go ahead. Come to the microphone. And you're welcome to line up in the aisle. Thank you. Somebody check and see if the microphone is on for her, please. Would you check this one also and see if it's on. There you go. I think it's very on.

LISA FRANKS: Okay, my name is Lisa Franks. And my father Milton Murrell was killed in the accident. And I just have like one question. Were the employees made aware of how flammable the polyethylene was and was there any like warning for them to know how flammable this material was?

CHAIRMAN CAROLYN MERRITT: Mr. Selk, can you answer that or should we carry that for advisement?

STEVE SELK: I -- I think that we do know the answer to that question, Madam Chair.

CHAIRMAN CAROLYN MERRITT: Okay, thank you.

STEVE SELK: The results of the interviews, Madam Chair, were that the employees were not familiar with the properties of this material.

CHAIRMAN CAROLYN MERRITT: Speak a little louder.

STEVE SELK: The interviews indicated that the employees were not familiar with the properties of this material.

CHAIRMAN CAROLYN MERRITT: Okay, thank you.

LISA FRANKS: And I got one more question. Okay. You said there was a cleaning personnel in -- in -- in West company and the tiles were being checked occasionally. Well, when the tiles were being replaced, did they see the accumulation that was above the tiles? I mean, somebody should have known.

CHAIRMAN CAROLYN MERRITT: Thank you for your comment. We'll take that under advisement. Thank you very much. We have a David Willis. Is David Willis here? Then sir, on this side.

ROCKNOR WILLIAMS: How ya doing? My name is Rocknor Williams. And if I'm not mistaken, I think I heard you say that the dust was like the fuel to the ignition. And I'm one of the employees that relocated down to, excuse me, down to Florida. And I'm saying I don't know if it's the same setup or whatever, but being that you said the dust, you know, I mean, what's to stop it -- what's to stop it from not happening down in the Florida plant or the Nebraska plant where most of us are at?

CHAIRMAN CAROLYN MERRITT: I think that's a question really that we can't answer. Is my microphone on? I think that's a question we really can't answer at this time concerning a facility other than this one. I would certainly suggest though that you raise the question with your employer.

ROCKNOR WILLIAMS: I mean, like I said, you said it was dust.

CHAIRMAN CAROLYN MERRITT: Yes.

ROCKNOR WILLIAMS: I mean, and it's a lot of dust down there also so.

CHAIRMAN CAROLYN MERRITT: I would strongly suggest that you raise that with your employer.

ROCKNOR WILLIAMS: All right.

CHAIRMAN CAROLYN MERRITT: Thank you. Is there another question? Are there any other comments from anybody in the audience that you would like -- yes, sir.

OSCAR HERRING: I am Oscar Herring, Chairman of County Commissioners. On behalf of the citizens of Lenoir County, I appreciate the information you have brought to us and give us some insight on what happened. Thank you very much.

CHAIRMAN CAROLYN MERRITT: Thank you. Yes, sir. You'll have to come to the microphone. I'm sorry. We can't hear you. And introduce yourself, please.

TONY CHAMBERS: Yes, my name is Tony Chambers. I'm a process engineer, design engineer. And I certainly appreciate the information you're sharing with us. It's certainly the sort of thing that I like to take back to my clients. I do help manufacturing companies design and build plants so I'm always trying to pay attention to these sorts of things. The question I have, I guess you're still searching for the primary source of ignition. And I was wondering if you had any information about the type of electrical conduit and how the system -- how the plant was wired and if it was suitable for, I'm assuming, a Class II Division I or Division II environment. Or if you have any information on that.

CHAIRMAN CAROLYN MERRITT: Thank you. Mr. Selk, would someone like to answer that or take it under advisement?

STEVE SELK: I think we can answer that.

CHAIRMAN CAROLYN MERRITT: Okay. Thank you.

STEVE SELK: Generally, the electrical equipment in the area where the blast occurred was not classified for use where combustible dusts were expected to be encountered. Keep in mind the company did keep the process area very, very clean and were not aware of any accumulations of hazardous dust in the process area. The only accumulation that we're aware of is above the ceiling tiles.

CHAIRMAN CAROLYN MERRITT: Thank you. Does that help answer your question? Please step up to the microphone if you have a question. Thank you. Can I take this question over here?

MIKE BERRIAN: My name is Mike Berrian. I've got a question for Steven Selk. Steven, you said that no mandatory code was enforced when the plant was built. I'm just trying to figure out what -- what code is it that -- that wasn't enforced and how would that have impacted the -- the explosion?

MADAM CAROLYN MERRITT: Mr. Selk, do you want to answer that or can you answer that?

STEVE SELK: We're continuing to research this matter, but it's our understanding at this time that this county did not have a fire code, a specific fire code like a National Fire Protection Code or the International Fire Code in the late 1980s when the expansion was done. I understand that the state of North Carolina has since that time adopted the International Fire Code which draws on the National Fire Protection Code in the area of dust management.

Does that answer your question, sir?

CHAIRMAN CAROLYN MERRITT: Thank you. Let's take a question over here. Yes, ma'am.

ALISE GALDIERITE: My name is Alise Galdierite. I'm with the North Carolina Occupational Safety and Health Project. I wanted to get a little bit more detail related to Ms. Frank's question earlier about the employees' knowledge of the dangers of this type of dust. Based on the interviews that y'all had with the folks that worked there, was there particular training that employees mentioned they had received, just generally or specifically about this type of dust, or was there no training offered at all to these employees? I ask that because a lot of times in the work that I do I find that there's a number of trainings that are offered to employees but sometimes they're not as complete or adequate as they could be.

MADAM CAROLYN MERRITT: I appreciate your question. Unfortunately, we can't divulge what -- specifically what employees' comments were. And also, we can't comment right now on regulatory issues. So I'm sorry, we wouldn't be able to answer that question. We certainly will take it under advisement in our investigation. Thank you. Yes, ma'am.

MIRANDA VICK: Hi, I'm Miranda Vick. I'm

the daughter of an employee, and the question I have is similar to what she has. As far as the chemicals that produced this polyethylene dust, when these chemicals are made or boxed or however they're sent out, are they labeled that they can produce an explosion or produce this dust which -- like a warning? Is that something that you would know?

MADAM CAROLYN MERRITT: Steve, do you think you can answer that at this time?

STEVE SALK: No, not at this time. We're still researching these details.

MADAM CAROLYN MERRITT: Okay. All right. We're still researching that at this time.

MIRANDA VICK: Okay.

MADAM CAROLYN MERRITT: Thank you.

ROCKNOR WILLIAMS: Excuse me. Can I ask you another question, please. I'm standing because you know, you have people here thanking you for coming and showing up, and you know, I -- I mean, I'm greatly appreciate it too. But it's like every question we ask or people ask, you know, we're not getting an answer, you know. I'm saying you guys are saying you don't know what's going on or at this time you can't answer anything. You know, I mean, I'm coming in and I'm leaving the same way I came in, you know. I don't know anything. And -- And to be in that type environment, you know, like you was telling me, you don't know. I mean, I think it's scary. Honestly. You know, I come here to try to get some type of reassurance, you know, and what -- I mean, it's like every question that is asked it's like you guys are pleading the Fifth. I don't know.

MADAM CAROLYN MERRITT: In the middle of this investigation, we are at a point of things that we feel we can divulge but then there are regulatory issues and issues regarding the company that we cannot answer for them. So we -- we are attempting to answer the factual and scientific questions that we can with what we have as our information now. And also your comments and concerns we'll take under advisement and also make sure that -- We have another several months to go yet with continued investigation before this is complete. So we appreciate your comment.

ROCKNOR WILLIAMS: Well, what do you tell -- What do you tell an employee or worker that's working right now? I mean, how do you -- how do you make them feel like secure or safe? You know, what -- what do you tell them?

ANDREA TAYLOR: Can I -

ROCKNOR WILLIAMS: Please.

ANDREA TAYLOR: Can I try and help?

ROCKNOR WILLIAMS: Yes, please.

ANDREA TAYLOR: What we're saying is we're still in the midst of our investigation. However, you saw what we believe caused the fuel -- or the incident. If you have current problems or you feel that there may be problems at your facility right now, you can go back to your employer with the information that you did gather here so far regarding the dust and try and implement to make sure that there are changes made if there are problems, or at least get clarification on exactly what is happening at the current facility where you are. As far as the other questions that have been raised by the workers, we've taken everything back and we will investigate further. We're really taking all of your comments and questions seriously, and we will have at our final report we will have those answers for you in more detail at that time.

MADAM CAROLYN MERRITT: The Chemical Safety Board is not a regulatory agency. We are an independent agency that is commissioned by Congress to investigate incidents just like this, like the National Transportation Safety Board investigates airplane or transportation accidents, and then to release the information about the cause so that people just like yourself can be informed to try to prevent this from happening anywhere else.

ROCKNOR WILLIAMS: Yeah, like I said, that's what I'm talking about. I'm not trying to give you guys a hard time or anything. I'm just trying to, you know, trying to find out.

MADAM CAROLYN MERRITT: We understand --

ROCKNOR WILLIAMS: I came -- I came here for answers. Like I was talking to the people back at the plant. They sent me here. You know, and like you guys say, well, go back there if you have any issues or whatever. I'm just -- Listen, I'm just -- I'm just a simple worker. I just -- I just want to feel safe at the workplace.

MADAM CAROLYN MERRITT: Well, we appreciate your comment and we understand your concern. Thank you. Are there any other comments, questions? Well, if there's no further comments, then that brings us to the end of this planned agenda. I once again thank all the members of the investigative team and all of you who came and participated here tonight.

The full board will convene here in Kinston when the staff investigation is concluded to issue our final report findings and safety recommendations in this case. The board is deeply concerned by the events and the subsequent plant explosion in Corbin, Kentucky, which claimed seven lives.

This inves -- The investigative staff is reviewing of other serious dust explosions around the country in recent years, including events in Springfield, Massachusetts; Vicksburg, Mississippi; Richmond, California. Sadly, all of these accidents resulted in fatalities. The dangers of explosive dust are not well known, and helping industry to understand this insidious hazard certainly will be a priority for the board in the future. Our investigation at West remains ongoing and if you have any other information pertinent to this case, you may contact the agency at our headquarters in Washington, D.C. As always, your written comments and submissions are welcome. With that the meeting stands adjourned. Thank you all very much.

(Meeting adjourned at 8:17 p.m.)