U.S. CHEMICAL SAFETY BOARD

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MACONDO WELL/DEEPWATER HORIZON

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PUBLIC MEETING

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THURSDAY,
JUNE 5, 2014

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U.S. CHEMICAL SAFETY BOARD MEMBERS PRESENT:

RAFAEL MOURE-ERASO, Ph.D., Chairperson, U.S. Chemical Safety Board
MARK GRIFFON, Member, U.S. Chemical Safety Board*

STAFF PRESENT:

DONALD HOLMSTROM, Director, Western Regional Office
RICHARD C. LOEB, General Counsel
CHERYL MacKENZIE, Investigator
MARY BETH MULCAHY, Investigator

*present via teleconference

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(time not provided)

CHAIRPERSON MOURE-ERASO: Good afternoon, and welcome to this public meeting of the U.S. Chemical Safety Board, the CSB.

I am Rafael Moure-Eraso, Chairperson of the Board.

Joining me today via teleconference from Australia is Board Member Mr. Mark Griffon, who is over there. Also, sitting with me at my left is Richard C. Loeb, CSB General Counsel. I will be introducing later the investigative panel.

The CSB is an independent, non-regulatory, federal agency that investigates major chemical accidents at fixed facilities. The investigations examine all aspects of chemical aspects, including physical causes related to equipment design, as well as (indiscernible due to accept) and regulations, industry standards, and safety management systems.

Ultimately, we issue safety recommendations which are designed to prevent similar accidents in the future. The purpose of today's meeting is for the CSB investigative team to present to the Board the first two volumes of their investigation report into the Macondo oil well blowout that occurred in April 20, 2010, in the Gulf of Mexico.

As you have seen in the copies of our report, the CSB has dedicated this report to the 11 men that lost their lives as a result of the explosion and fire. I will now remember their names by mentioning them. They are Jason Anderson, Aaron Dale Burkeen, Donald Clark, Stephen Ray Curtis, Gordon Jones, Roy Wyatt Kemp, Karl Klepinger, Jr., Keith Blair Manuel, Dewey A. Revette, Shane M. Roshto, and Adam Weise.

At this time, I would like to have a moment of silence to remember these 11 individuals.

(Moment of silence)

Thank you.

At this time, please allow me to go over this afternoon agenda. Copies of the agenda are in the front table at the entrance.

First, we are going to hear the opening remarks of the Board. Then, we are going to hear the official presentation of the investigative team. And following the team's presentation, the Board will be given an opportunity to ask questions to the investigative team. Thereafter, we will have a public comment period, and then a vote on approving or disapproving the draft report.

Before we begin, I'd like to point out some safety information. Please take a moment to note the location, to note the locations of the exits and emergency exits of this meeting room. There are the exits in the back, and there are two exits on this side that could be emergency exits as well as an exit in this other side of the room.

I also ask that you please mute cell phones, so that these proceedings are not disturbed.

I will follow with my opening remarks. On April 20, 2010, the blowout preventer, the BOP, on the Deepwater Horizon drilling rig that was intended to shut off the flow of high-pressure oil and gas from the Macondo well in the Gulf of Mexico failed to seal the well.

The blowout caused explosions and a fire in the Deepwater Horizon rig, leading to the deaths of 11 persons on board, and serious injuries to 17 others. Nearly 100 persons escaped from the burning rig, which sank two days later, leaving the Macondo well spewing oil and gas into the Gulf waters for a total of 87 days. By that time, the resulting oil spill was the largest in offshore history.

The CSB examined this report, this event, from a process safety perspective, integrating fundamental safety concepts. That is, the concept of the hierarchy of controls and the concept of continuously driving rigs as low as reasonably practicable.

While these approaches are not new in the petrochemical world, or in other offshore riggings around the globe, they are not as commonplace in the U.S. outer continental shelf.

Drilling continues to extend to new depths and will operate in increasingly challenging environments. The CSB report and its key findings and recommendations are intended to put the United States in a leading role for improving well-controlled procedures and practices. To maintain a leadership position, the U.S. should adopt rigorous management methods that go beyond current industry good practices.

Today, the CSB investigators will give an overview of the accident and describe the technical factors that led to this blowout. Following the technical presentation, they will describe the proposed recommendations for ensuring greater safety in the future. I thank them, I thank our investigative team, for their efforts. This is a small team, and this has been one of many large challenging projects they have been juggling.

If anyone in the audience wishes to comment publicly after the investigator's presentation, please sign up on the yellow sheet in the check-in area at the entrance, and I will call your name at the appropriate time.

I will first call those who have signed up, and then open the floor up to anyone who wishes to speak. Please note that we will have to limit public comments to three minutes each.

I will now recognize Mr. Mark Griffon, CSB Board Member, for an opening statement. Mr. Griffon.

MR. GRIFFON: Thank you, Mr. Chairman. I hope my connection is okay.

I, first, would like to express my condolences to the family and friends of those who lost their lives in this tragedy. I am glad to be participating here, or actually in Sydney, Australia, to discuss the CSB's initial report on the Macondo investigation.

I have been discussing this incident with academics, workers, engineers, and regulators around the world for several years, including meetings over the last two weeks in Australia.

Let there be no mistake, this accident is not about workers making mistakes or simply about equipment failing. It is about organizational failures. If the lessons are to be learned, they are not just lessons for those involved in Macondo, but lessons for the entire industry worldwide.

I think it is important to remember why many urged the CSB to conduct this investigation. In June -- in a June 8th letter in 2010, Congressman Waxman asked the CSB to conduct this investigation because "We believe the CSB's past work on BP puts it in a unique position to address questions about BP's safety culture and practices."

The letter goes on to say that as part of our investigation we ask that you consider the following. Due to circumstances and events leading up to the Deepwater Horizon explosion reflect problems in BP's corporate safety culture, what role, if any, did cost-cutting and budgetary concerns play in BP's decisions about well design and testing?

How did BP Transocean and other contractors apply management of changed programs to assess the consequences of modifications to process, technology, and equipment on the Deepwater Horizon oil rig, as well as organizational changes, including changes to personnel, training, and budget? Did BP provide adequate oversight of the contractors working on the well?

I hope these types of issues beyond the blowout preventer are addressed in the final two volumes of our investigation report. I agree with Congressman Waxman that this is the best place we can add value to the learnings from this tragedy. As for the reports being discussed tonight, I must first say that I am disappointed with the internal review process leading up to the release of this report.

I received very interesting expert review comments just days before the meeting, and received a substantially revised final report less than a week ago. After four years of work to receive very thoughtful expert comments only days before voting on our report is unacceptable. This broken process, set up as a norm by the Chairman and senior management, has to stop.

As for the products being discussed tonight, I am glad to see a focus on the effective identification and management of safety critical elements, technical organizational, operational, not just the blowout preventer. I do, however, agree with some of our expert reviewers that the report should have included more extensive discussion of barriers other than the blowout preventer.

Second, the report we are discussing tonight is not meant to be CSB's regulatory analysis, and yet Volume 2 includes many statements comparing the approach under the U.S. regulatory regime currently in place, and other regimes around the world, safety case type regimes.

I note that some expert reviewers also noted a lack of evidence supporting some of these statements. I look forward to a full analysis of the regulatory issues, including how the different regulatory approaches have affected the actual operational activities on offshore facilities in Volume 3 of our report.

Let me close by saying I hope the

lessons of the Deepwater Horizon tragedy will be transformative for offshore safety worldwide. Industry must do everything they can to prevent such a tragedy in the future.

Thank you.

CHAIRPERSON MOURE-ERASO: Thank you very much for your statement, Board Member Griffon.

At this time, we would like to introduce the investigation team. I will start by introducing the Western Office Regional Director of the CSB, Mr. Donald Holmstrom. Mr. Donald Holmstrom is the Director of the WRO office in Denver, Colorado. Mr. Holmstrom joined the CSB in 1999 and led and supervised a number of CSB investigations, including the 2005 BP Texas City refinery explosion and fire.

Prior to coming to the CSB, he worked for 18 years in the oil refining industry. He has extensive experience in other refinery operations, process safety management, occupational health and safety, and incident investigation. I will ask Mr. Holmstrom to introduce the members of the investigative team and to proceed from here. Mr. Holmstrom.

MR. HOLMSTROM: Thank you, Chairman Moure-Eraso. Today I would like to introduce here at the table the investigative team. First of all, I would like to introduce Cheryl MacKenzie. She is the team lead of the Macondo investigation. Cheryl joined the CSB in 2004, and she has been involved in numerous CSB investigations and safety studies, including the 2005 BP Texas City refinery explosion.

Also up here at the podium is Mary Beth Mulcahy. Mary Beth has a Ph.D. in physical chemistry from the University of Colorado in Boulder, and she has overseen many of the technical aspects of our Macondo investigation.

Also joining us is Stan Chrisman,

a CSB consultant. Stan has 38 years of experience in petroleum drilling and production.

With that, I would ask Cheryl MacKenzie to start the presentation.

MS. MacKENZIE: Thank you, Mr. Holmstrom. Thank you, Chairman Moure-Eraso and Board Member Griffon. Good afternoon to all of you. Thank you for coming here to hear our findings and conclusions.

It has been four years since the Macondo incident occurred, and there have been many published reports that have described and analyzed the events of April 20, 2010. So the obvious question is: why another Macondo report? Haven't all the lessons been learned? The CSB has concluded no.

The CSB has carefully chosen issues to address in the volumes of its reports that have not been addressed by others or need further development. This is certainly the case here with the volumes we are presenting today. The blowout preventer was examined in three phases identified here in this visual as preliminary, Phase 1, and Phase 2.

Most of the major reports, except Transocean, were either published before the final phase was completed or did not have access or address the full set of data.

Details that emerge in the third phase of testing -- excuse me, in the second phase of testing -- are imperative, as they reveal latent failures that existed in the Deepwater Horizon BOP before it was ever deployed to the well head.

The CSB also conducted additional testing, which further bolstered our findings and analysis. All of this will be discussed in more detail momentarily.

Ultimately, what our investigative analysis shows is that the numerous technical shortcomings in the hardware of the BOP were manifestations of management system failures that resulted in inadequate treatment of the blowout preventer as a safety critical device.

It is important to note, as this visual depicts, the success of technical elements, the equipment and engineered controls, depends highly upon organizational and operational practices. These human and organizational factors will be briefly mentioned throughout our discussion today, but will be addressed more thoroughly in subsequent volumes of the CSB Macondo investigation report.

So today we are going to give you a quick incident overview and play the CSB's newly developed animation, which details the immediate events leading up to the fire and explosion on the Deepwater Horizon.

This will introduce you to some of the offshore terminology and will provide you with an initial look at the key aspects of our significant technical findings. We will then go over specifics regarding our BOP technical failure analysis, and we will go beyond the events of April 20th and discuss the latent safety management system deficiencies related to the safety critical device.

We will wrap up with a discussion of the role of regulations as they pertain to the management of safety critical elements, and then at that time we will present our proposed recommendations for safety change to the Board.

On April 20, 2010, the Deepwater Horizon drilling rig, owned by TransOcean and under contract by BP, experienced explosions and fire at the Macondo well in the Gulf of Mexico, resulting in 11 deaths, 17 critical injuries, and the release of approximately three to five million barrels of oil into the Gulf.

At this time, I'd like to show you our animation.

(Animation begins)

MALE VOICE: This is a model to demonstrate the effect of pressure on pipe.

What we have is an ordinary piece of garden sprinkler pipe, and we have it connected to an air pump. When we put pressure on the pipe, let's see what happens.

MS. MacKENZIE: Something else we wanted to show you. That's -- it's on a CD. It's on a CD. It wasn't a file that we gave earlier.

All right. Well, we'll skip the animation. Maybe if they find it, we can come back to it. Yes, okay. Thank you.

(Pause)

Technology.

(Pause)

I can continue while -- go ahead? I'll need the slides back, though.

MALE VOICE: April 20th, 2010, 11 workers died and 17 were seriously injured by an explosion on the Deepwater Horizon, an offshore drilling rig located approximately 50 miles off the coast of Louisiana. The rig burned for two days, eventually sinking and triggering the largest oil spill in U.S. history, as oil and gas spewed up from the sea floor.

The Deepwater Horizon had been drilling an oil well in 5,000 feet of water in an area of the Gulf of Mexico known as the Macondo Prospect.

In 2010, the CSB launched an investigation to examine the technical, organizational, and regulatory factors that contributed to the accident. During the investigation, the CSB made new findings about why a key piece of safety equipment, the Deepwater Horizon's blowout preventer, failed to seal the well during the emergency.

These new findings help explain why the accident was so devastating, and the CSB cautioned that other blowout preventers currently in use could fail in similar ways.

Drilling an offshore well involves creating a pathway between the drilling rig and oil and gas reservoirs trapped beneath the sea floor. A deep whole or a well bore is drilled through layers of sub-sea rock and sediment. These rocky layers can contain trapped water, crude oil, and natural gas under pressure.

An unplanned flow of these well fluids into the well bore, known in the industry as a kick, can be dangerous. Without careful management, a kick can lead to a blowout, the uncontrolled release of flammable oil and gas from the well. A blowout can be catastrophic, since oil and gas reaching the drilling rig can quickly find an ignition switch, leading to a fire or explosion, endangering the lives of the drilling crew.

To prevent kicks, drillers pump a dense slurry called drilling mud into the well creating a barrier between the undersea oil and gas and the piping that leads to the rig. If this mud barrier fails, or is somehow removed, the safety of the drilling crew depends on a critical piece of equipment located on the sea floor called the blowout prevent, or BOP.

The BOP is a complex electrically and hydraulically powered device that is essential for controlling the well, and, in an emergency situation, preventing a disaster on the platform high above on the sea surface. The BOP is connected to the rig by a large diameter pipe called a riser. If a kick occurs, the blowout preventer is designed to prevent flammable oil and gas from traveling up the riser to the drilling rig. This is done by sealing the area around the drill pipe known as the annular space.

To do this, the crew can manually close pipe rams and donut-shaped rubber devices known as annular preventers. If those devices should fail to work, the last resort is a pair of sharp metal blades, which form a blind shear ram designed to cut the drill pipe and seal the well. The blind shear ram can be activated manually or by automated emergency systems.

At approximately 8:45 p.m. on April 20th, 2010, a kick occurred in the Macondo well. Oil and gas entered the well bore undetected, eventually passing above the blowout preventer and traveling quickly up the riser toward the Deepwater Horizon and the 126 people onboard.

Just after 9:40 p.m., drilling mud forced upwards by the rising oil and gas suddenly blew out onto the rig. Crew members responded by closing the upper annular preventer in the BOP. However, this did not seal the well as intended and flammable oil and gas continued to flow into the riser toward the rig.

Next, the crew closed a pipe ram. This successfully closed the annular space and sealed the well, but tragically this proved to be only a temporary fix. Oil and gas that were already above the pipe ram continued to flow inexorably toward the Deepwater Horizon.

At approximately 9:49 p.m., the flammable hydrocarbons found an ignition source. The first explosions shook the Deepwater Horizon.

As the oil and gas escaped the riser onto the rig, the pressure dropped in the annular space above the pipe ram, but at the same time the pressure in the drill pipe climbed substantially. The drill pipe was closed at the top, but oil and gas continued to flow in from the reservoir below. After extensive analysis, the CSB concluded that this large difference in pressure likely caused the drill pipe to buckle, essentially bending the pipe off center inside the blowout preventer.

The buckling pushed sections of the drill pipe outside of the reach of the blind shear ram blades. This would eventually prove to be catastrophic. With the drill pipe buckled, the explosion and subsequent loss of electrical and hydraulic power from the rig likely activated an automated system on the blowout preventer known as the AMF/Deadman, which closes the blind shear ram and cuts the drill pipe. This emergency system is designed to activate when electric power, hydraulic pressure, and communications from the rig have been lost.

The AMF/Deadman system was operated by two redundant control systems on the BOP known as the yellow pod and the blow pod. The redundancy is supposed to increase the reliability of the system in an emergency situation. The yellow and blue pods worked independently of each other, and were comprised of identical enclosed computer systems and sets of solenoid valves.

When activated, the solenoid valves controlled important BOP functions, such as closing the blind shear ram. If electrical power from the rig was lost, as happened on April 20th, 2010, both the yellow and blue control pods contained backup 27-volt and nine-volt batteries to power emergency functions. The nine-volt batteries powered computers that would activate the solenoid valves, which were powered by the 27-volt batteries.

However, evidence indicates the blue pod had been miswired at some time before the BOP was lowered onto the sea floor. This caused the pod's 27-volt battery to drain and made it impossible to operate the solenoid valve for the blind shear ram on the night of the accident. And within the redundant yellow pod, the solenoid for the blind shear ram had been miswired.

The solenoid valves were controlled by two coils of electrical wire. These two coils were designed to work in concert, generating a magnetic field strong enough to operate the valve. But within the miswired solenoid valve, the two coils actually opposed each other, leaving the valve paralyzed. Only a third unplanned failure allowed the yellow pod to operate.

On the night of the accident, one of the nine-volt batteries that powered the solenoid valve's computer had failed. As a result, the affected computer system could not initiate the command to energize the miswired coil. Had both coils of the miswired solenoid valve been energized, the two coils would have generated opposing forces on the valve. The solenoid valve would have remained closed, and the blind shear ram would never have been closed.

However, the failed battery rendered one coil inoperable, and most likely allowed the other coil to open the solenoid valve by itself. This, in turn, initiated closure of the blind shear ram. This should have cut the drill pipe and sealed the well, greatly reducing the impact of the accident. But because the drill pipe was buckled and off center inside the blowout preventer, it was trapped and only partially cut. With the failure of this last-ditch measure, there was nothing left to stop the massive oil spill and the destruction of the rig.

During its investigation, the CSB identified a mechanism that likely caused the drill pipe to be buckled around the time of the explosion. This mechanism is called effective compression. Although effective compression had previously been noted as a hazard in other drilling operations, it had never been identified as a problem affecting drill pipe during well operations.

Effective compression occurs because although pipe may appear to be perfectly straight, in fact it has minute bends and irregularities invisible to the naked eye. Along these bends, the side of the pipe that is curved outward is slightly longer and has more surface area than the other side.

When there is a large difference in pressure between the inside and outside of the pipe, as happened on April 20th, 2010, the longer side of the pipe experiences a larger bending force. Eventually, this force can become great enough to buckle even heavy pipe. This is an important finding, CSB investigators said, because the same conditions of differential pressure could occur at other drilling rigs, even if a crew successfully shuts in a well.

The CSB warned this could make existing blowout preventer designs less effective in emergency situations.

In the case of the Deepwater Horizon accident, the buckled drill pipe prevented the blind shear ram from sealing the well. Oil and gas from the well flowed out of the buckled drill pipe and into the Gulf of Mexico for 87 days. A reported five million barrels of oil eventually spilled, causing one of the worst environmental disasters in United States history.

(Video ends)

MS. MacKENZIE: These technical findings reveal several new learnings critical for safe drilling operations offshore and applicable for everyone in the industry.

First -- the slides back. First, as the animation depicts, we conclude that the automatic emergency response system within the blowout preventer, the AMF/Deadman, actuated on the night of April 20th, activating a sharp pair of blades called the blind shear ram to seal the well.

Other reports have concluded the AMF did not fire and that the blind shear ram was activated two days later. Our technical findings also have led us to conclude that the buckling of the drill pipe was actually the result of a mechanism not revealed by other reports on the incident, a phenomenon known as effective compression. This will be discussed in more detail shortly.

What these technical findings and conclusions mean for industry is that the buckling of the drill pipe can actually occur when a well is successfully shut in by the drill crew and can remain undetected. This hazard could impact even the best offshore companies who are properly maintaining their BOPs.

Our investigative analysis of the technical failures also illustrate that industry and regulatory practice for testing of the rarely used AMF/Deadman emergency system can give companies a false positive result. The procedure for testing the AMF actually masks potential failures in the redundant components of the emergency system.

Thus, some of these components meant to safely -- some of these components meant to be safety redundancies to ensure reliable functioning of the AMF may actually fail during the test but remain undetected until it is too late. This means that similar deficiencies identified in the Deepwater Horizon BOP could remain undetected in BOPs today.

Overall, the numerous shortcomings

in the hardware of the BOP were manifestations of the lack of an effective management system to ensure the functioning of this and other safety critical barriers. The CSB found a documented inability to reliably shear the drill pipe was used for an extended period during the drilling process.

Knowing this risk, Transocean planned a two-step workaround that actually would have high likelihood of failure in the event that the two emergency systems, the AMF/Deadman and auto shear, were activated. CSB also found inadequate safety management practices resulting in undocumented and inadequate BOP maintenance and inspection.

Ultimately, although industry guidance and offshore safety regulations have advanced safety after Macondo, more change is needed to ensure that all safety critical elements -- technical, operational, and organizational -- are effectively managed through the life cycle of their use.

I will now turn the presentation over to Dr. Mulcahy, who will discuss the technical failures in more detail.

DR. MULCAHY: Thank you. So although I assume many people in this room are familiar with the Macondo incident, I'm going to step back and just give a couple of other additional details that weren't covered in the video. And then I'm going to step through the technical findings, providing more detail than was originally given in the video.

So the video mentioned two different physical barriers, drilling mud that was placed into the well, and also a blowout preventer that was located at the well head. There are also two other -- or three other potential barriers that are in a well or used in a well. The first is casing and the cement that secures the casing to protect the walls of the well bore, that help seal hydrocarbon-bearing zones as the well bore is being drilled.

Another one is drilling crews can install bottom hole cement at the bottom of a well, again, to seal hydrocarbon-bearing zones so that there is not an ingress into the well. And, finally, there is an option of installing a surface cement plug -- again, another physical barrier that can seal a well.

At Macondo, at the time of the incident, the crews were in the process of temporarily abandoning the well, which means they were removing various equipment and drilling mud with the intent of leaving the well ready for a production facility to come back later and process the hydrocarbons that were found in the well.

As it turned out, the cement barrier that had been placed at the bottom of the well had been tested, but the test results had been misinterpreted, and this erroneously led the drilling crew to believe that they had sealed the well when in fact they had not. And this is -- believing this, they began the process of displacing the drilling mud from the well.

At the time of the incident, the drilling mud was being removed. By removing the drilling mud, the drilling crew was removing one of the physical barriers that could have prevented the ingress of hydrocarbons into the well. The service cement plug that had been planned as part of the temporary abandonment process had not yet been installed. As I mentioned previously, the cement at the bottom of the well had actually not been -- the integrity had not been ensured, and the BOP at the well head was in its open position.

So the timeline of events that day, the CSB calculations and modeling, we predict that at about 8:51 p.m. that evening the well became underbalanced, meaning that hydrocarbons from the well began to flow into the well bore. A kick had begun. Over the next 35 minutes, more hydrocarbons entered the well until they finally surpassed or passed above the BOP.

Once the hydrocarbons got -- pass above the BOP, they have only one place to go and that's the rig. There is no physical means to stop them from making their way to the rig. The best hope the crew can have is to divert them to a safe location.

It wasn't, though, until 9:40 when mud passed -- or exited onto the rig floor that the crew was aware of the problem of the kick that had occurred in the well. At approximately 9:43, they closed the upper annular, but that failed to seal the well. That was followed shortly after at about 9:47 with the closing of the pipe ram, which we do believe sealed the well. But this turned out to only be temporary because at approximately 9:49 the explosions on the rig occurred.

After the efforts had been completed to stop flow from the well, the BOP, the Deepwater Horizon BOP, was recovered and brought to a testing facility, and DNV was contracted to do a forensic analysis of the BOP. There was a lot of interest in people to understanding why the BOP had not sealed the well, particularly since it did have an AMF/Deadman system.

The physical evidence showed one very important aspect that has been well documented and publicized. The BOP, if you look at the image on the left, was designed to seal a drill pipe that had been centered in the well, but the physical evidence indicated that it had not in fact been centered but was off centered, and that is depicted in the image on the right.

So that when the blind shear ram is closed, a portion of the drill pipe was outside of the shearing part of the rams, and so it was actually squeezed and not completely severed. And this eventually caused the blind shear ram not to be able to close fully.

This physical evidence requires us

to consider two very important conditions that we have to match in time. The first is we have to identify what caused or what activated the blind shear rams to close. And, very importantly, we have to correlate that in time with the buckling mechanism that caused the drill pipe to become off center in the well.

We see that there are two most likely situations. The first one is -- that I have represented up here on the left -- is the triggering of the AMF/Deadman system, which is a fully automated system that can trigger the well -- or trigger the closure of the blind shear rams. And the second one is the auto shear system. That normally is not triggered unless a rig drifts offsite, but in this case -- this is an image taken from an ROV or remotely-operated vehicle, where they were able to use a robotic arm to trigger the auto shear mechanism.

So the Deadman system, there are three conditions that must be met in order for it to activate. The first is surface electrical power and communications coming from the rig have to be severed. Second, there has to be a loss of communication between the yellow and blue pods. And, third, there has to be a loss of hydraulic pressure coming from the rig.

We believe that the conditions that were present by the initial explosions on the rig likely established those conditions.

When we look at the auto shear, we know from video evidence on April 22nd, 2010, that the auto shear did likely trigger. That's what it appears to look like when you see the video.

But the triggering of the auto shear on April 22nd does not preclude the triggering of the blind shear rams originally with the AMF/Deadman system. For reasons that I will discuss shortly, we considered the most likely scenario of the buckling led us to examine more carefully the possibility of the

AMF/Deadman being the cause of the closing of the blind shear ram.

So what I'm about to present is highly dependent on data that was collected during this Phase 2 testing of the Deepwater Horizon BOP. The other major reports, BP's report, the Chief Counsel report from the Presidential Oil Spill Commission, DNV's report, all of those reports were published before this Phase 2 testing was completed. And there was critical information, and people have heard now about miswiring of a critical solenoid. It was mentioned in the video. That wasn't discovered until the Phase 2 testing was complete.

When you look at the JAT reports and NAE reports, they also do not address the battery issues and miswiring that were identified during Phase 2 testing.

So I hope -- for everybody sitting in the audience, we have two very detailed technical analyses/appendices that we are publishing with our report, and we have summarized the findings more generally in our main report. But all of those details, we have tried to make that public, so that everybody has access to them to consider.

So let me start with the blue pod. I am -- there was a point-to-point wiring check done of the blue pod SEMS, which are the digital computers inside of the blue pod. And what we found in Phase 2 testing was the point-to-point wiring check did not match the original manufacturer's drawings. So either wires were broken, missing, or had been disconnected at some point in the course of the blue pod's life.

That miswiring would have had an effect of establishing one of the two conditions necessary for the AMF/Deadman to fire, and that is loss of electrical power and communication coming from the rig.

Now, if you look at the image on the right, the cartoon shows a red box around the wiring of the SEM. That miswiring would not have prohibited the blind -- or any of the solenoids from opening, as long as the 27-volt battery was good. But once that condition was set and the AMF/Deadman was turned on at the rig, and that condition was detected by the blue pod SEM, it would have started to try and monitor for the loss of hydraulic fluid pressure.

That process of doing that monitoring would have put a drain on the battery, and we believe by the time the incident occurred that that 27-volt battery would have been drained to a point that it would not have been able to have provided enough energy to allow the solenoid valves to open from the blue pod.

This, then, leads us to believe that the blue pod was not capable of activating the blind shear ram and carrying out the AMF/Deadman sequence on the day of the incident.

So then we have to focus on the yellow pod, and this is -- you saw in the video that -- it animated how a solenoid works, and I'll just repeat that briefly here. The solenoids are designed with two redundant metal coils that when current is run through those coils that they produce a magnetic field that then pulls up a plunger allowing hydraulic fluid to flow through. It's the flowing through this hydraulic fluid that then triggers the closure of the blind shear ram as one of the final steps of the AMF/Deadman sequence.

The picture that you see on the left is a picture that was taken while the solenoid valve, Y103, responsible for closure of the blind shear ram, was being disassembled. And what you may not be able to see clearly in the photo you should be able to see more clearly in the cartoon at the right.

The wiring is supposed to be that -- numbers one and three are supposed to be white, and two and four are supposed to be black. Whereas, if you look in the photo, you can see that the opposite is true. And so this was a miswired solenoid valve.

One of the key factors that I won't go into detail here, but it's important, that there was a lot -- there were published results of testing of the individual solenoid valve that came out as a result of Phase 1. We learned from information gathered in Phase 2 that we had to reinterpret those results, because the miswired solenoid valve could not open.

And so we learned during Phase 2 that equipment that was being used to test the solenoid valve in Phase 1 was not opening or triggering the valve in the way that we thought. So that's a pretty big -- that is a big change from what you would have learned if you had looked at Phase 2 and gone on to Phase 1.

Ultimately, what is important to

remember is that if all of the batteries in the yellow pod were sound at the time of the incident, this miswiring of the solenoid valve would not have allowed the solenoid valve to open. So if that had been the case, then the yellow pod also would have been inoperable on the day of the incident.

But we learned two things. When we learned about the testing equipment and the misunderstanding of how the testing equipment worked in Phase 1, we realized that we had to go back and reinterpret the results from Phase 1. There was also information that came out in Phase 2 through tests on the batteries that we realized that the nine-volt -- one of the nine-volt batteries in the yellow pod had died, was almost completely drained. And it was incapable of sending the command to open up the solenoid valve.

What we also realized when we went back and looked at Phase 1 is that there were three successful AMF/Deadman tests that were completed during Phase 1 testing. And we started to wonder, how could that possibly have occurred? Why would the battery have stopped -- or why would the solenoid have started opening during the AMF/Deadman test?

And we started thinking of analogy of anybody in here who might have started a car on a cold day. If you've ever had the experience where you have gone out to your car on a cold day, and you've tried to start your engine and it turns over but the engine -- your car doesn't actually start, but if you wait until later in the day and try it again, your car will start.

This is because batteries are affected by the temperature of the environment in which they are performing. So we started to consider the fact that the SEM pods that were being tested at the Michoud facility during Phase 1 testing were operating in temperatures that were around 70 degrees Fahrenheit.

The temperatures at the bottom of the ocean are closer to freezing, so closer to 36 degrees Fahrenheit. And so we started to consider that a battery that barely worked in ambient temperatures that were surrounding the pod at 70 degrees Fahrenheit we felt would have an unlikely ability to function at 36 degrees Fahrenheit.

And we did battery calculations and drain calculations to show that we believe that the nine-volt battery on the day of the incident had actually drained, one of them had drained, the one that had died, but it in the cold temperatures had drained sufficiently to not be able to send the command to trigger the blind shear ram to open.

With that in mind, we had to consider -- we still -- we now believed we had two likely scenarios of the AMF being triggered, but now we need to correlate this in time with the pipe actually being buckled. So there are three different theories that we considered. One of them is you could have high flow rate going up through a drill pipe that has at some point broken and lost integrity at the top. Those forces, in addition with forces pushing up on the bottom of the drill pipe, could have caused it to -- could that have caused it to buckle, and that is the image depicted on the left.

Then, we have the image on the right. Another possibility is that -- there was witness testimony that equipment holding the drill pipe up at the top of the rig had actually failed. If that were true, then all of the weight of the drill pipe, plus that equipment, would have been pressing down on the pipe rams that were closed around the drill pipe. That's the second possibility.

And then, the third possibility is this possibility of effective compression that was just introduced in the animation. After looking at all of the evidence that we had, and considering various options, we believe the most likely scenario for pipe buckling happened to be with effective compression, which led us to choose the most likely scenario of the AMF being triggered at the time of the AMF/Deadman.

So pipe buckling is actually -- it's not a new phenomenon that the CSB is putting forth. It is actually one that is well recognized in the oil and gas industry. What you're looking at here is a picture of a buckled choke and kill line that was being pressure tested back in the 90s. It was being pressured up to 15,000 psi, and you can see here that it is bowed or buckled.

If there is anybody in the room who does casing design or pipeline designs, they could probably attest to having to consider this phenomena because it is a concern in both of those areas. What we did notice is no one has mentioned effective compression in the terms of drill pipe during a well control incident.

Part of this may be because this is not a phenomena that is easily recognized if you're on the drilling rig. There is no instrumentation that will tell you directly that you have drill pipe buckled in your BOP.

So this is a simple flowchart of all the information I just presented to you. We know that the annular preventer was manually activated by the crew at 9:43 p.m. approximately. They then followed that by operating the pipe RAM, which we believe sealed the well bore but caused a substantial increase in pressure inside the drill pipe. That also allowed pressure outside in the annular space outside the drill pipe to drop as that oil and gas in that area progressed up towards the rig.

When this happened, when the pipe RAM sealed, we now have the conditions necessary, established, to have the pipe buckled by effective compression. We then had the explosion, which established the conditions necessary for the AMF/Deadman system to trigger. We believe that due to miswiring in the blue plod the 27-volt battery was drained by the time of the incident and incapable of actuating the Deadman system.

We believe the yellow pod had one SEM battery that was already compromised, and that by operating in the colder temperatures had pushed it to a point that it was no longer able to send the commands to trigger one of the coils. This, then, left the other coil unopposed and able to activate and successfully attempt to close the blind shear ram.

Because the blind shear ram was buckled in the drill pipe at the time of actuation, the blind shear ram did not fully close, and in fact punctured the drill pipe and, in reality, reestablished the flow that then continued.

So Ms. MacKenzie noticed at the beginning of the presentation that many of these shortcomings that we identify in the BOP are really manifestations of safety management system issues. So safety management systems, in the words of other process safety experts, one description is safety management systems are recognized and accepted worldwide as the best practice methods for managing risk.

Another expert has noted or described safety management systems are those that provide an organizational framework to help manage critical safety barriers.

PSA has expanded this point and described it a little more generally. They say these barriers -- technical, operational and/or organizational elements -- which individually or collectively reduce opportunities for specific error, hazard, or accidents to occur, or which limits the accidents drawbacks or harm.

So at the beginning when we mentioned that the manifestations come out in the technical equipment, what the PSA quote that I just read really takes into account is that all of these types of barriers, operational barriers, organizational barriers, and technical barriers, play off of one another. And that is actually quite apparent when you think about a piece of hardware equipment like the BOP.

We have an action we want the BOP to take. We may actively, manually activate it on a rig, and we want to make sure that it does not fail when needed, shown over there at the right.

So we have barriers put in place to make sure that that occurs. We try to recognize design limitations that can be identified during a hazard analysis to ensure that the BOP is not put in a situation it cannot handle. There are inspection and maintenance programs that are put in place to make sure BOP is capable of operating when called up. And, finally, we have drilling crew vigilance and response listed as a barrier, because a BOP works best if it's not closing on a flowing well.

All of these, or these three that I have presented here, are examples of organizational and operational barriers that help ensure that the physical barrier, the BOP, can actually function.

There is a quote that we borrowed from BP. "Even the best barrier will not achieve perfect reliability. It will have holes. These holes can be latent or actively opened or enlarged by the action or inaction of people. The robustness of the barriers changes with time and depends on factors related to people, process, and plant." And I skipped a line. "The holes can be latent or actively opened or enlarged by action or inaction of people."

We think this is a very apt quote and why -- highlights why it is so important to have a safety management system for your safety critical elements. So I have shown up here two definitions of a safety critical element. First, it is a piece of equipment or an organizational operational barrier whose failure could cause or contribute to a major accident event.

Or, secondly, it has a specific purpose to limit the effects of a major accident event. In this case, a BOP actually plays both roles. It is intended to stop a kick from progressing into a blowout, but it also has emergency systems that are intended to activate after an emergency situation has occurred.

So we would like to present the idea of looking at how to manage a safety critical element like the BOP with this life cycle approach that you see represented up on the board.

The first step of this life cycle approach is actually a hazard analysis to identify, what are your safety critical elements? We are talking about the BOP today, but there are many other ones. So a hazard analysis should identify all the sequence of events that could lead -- in this case we are talking about a kick that could then potentially lead into a blowout.

Those sequence of events should be clearly documented and include human -- any potential human errors that may occur. If we are going to designate something as a safety critical element, a company might start with a list that it has in a database somewhere. But the important thing is to directly link whatever you say is a safety critical element to the major accidents that it is intended to prevent.

Second we have listed is defining a performance standard. So performance standard is the basis for which a safety critical element will prevent or mitigate a major accident event. What we have listed here is that a performance standard can describe the functionality of a safety critical element, what is it required to do. It can describe its availability, what will its performance duration time be required. It can describe its reliability, how likely is it to perform upon demand, its survivability, what post-event role must have performed or survived in order to be able to perform, and then also its interactions with other systems, so what other systems must be functional in order for it to be able to function itself.

These performance standards can be based on national or internationally recognized industry standards, or companies may also use other various methods or technological solutions to determine and define the performance requirements of their safety critical elements.

So compliance with the performance standard is the basis for assuring that a safety critical element will act as a barrier to a major accident event. These activities are conducted, or these performance assurance activities are conducted to ensure that the safety critical element is functioning appropriately and complying with the performance standards that have previously been set for that element.

And, finally, we list gap closure. Gap closure is meant to encapsulate all the methods employed by the companies to continually monitor their safety critical elements and actually improve upon them. So I'm going to use the BOP as a specific example to walk through this life cycle. And I'm actually going to use an example that was not in play on the day of the incident.

So we talk about that -- we mention that you need to identify what your safety critical elements are, and that should begin with a hazard analysis. The hazard analysis completed on the Deepwater Horizon did not address the BOP's design limitations or capabilities.

With that being said, what you see

here is an image of a daily drilling report from the Deepwater Horizon. Highlighted in that pink box over at the left is the drill pipe size that was used on the Deepwater Horizon. That drill pipe size of 6-5/8-inch was not listed as being reliably shearable or not specified as being reliably shearable by Cameron, the manufacturer of the BOP.

Now, we know that -- that there were transition employees who are aware of this fact. This is an excerpt from an email that was sent from one Transocean employee to another, and it says, "How can I get the chart attachment to change the color on the 4614 psi for shearing the 6-5/8-inch drill pipe to red? Would Cameron have to edit this chart? This is what Rod wants. He says if we can't shear it, then it should be in red."

So Transocean did have -- you could call -- they did have a basic statement that stated that the blind shear rams on the BOP must be capable of shearing the highest grade and heaviest drill pipe used on the rig and sealing the well, and it must seal the well in one operation.

But what we know happened was that Transocean, aware of this problem of shearing this heavier drill pipe that was used throughout the drilling operation, that they actually developed a two-step workaround. The problem with this two-step workaround is it would have worked for a system called the EDS, where they had an option to close something called the casing shear rams first and then the blind shear rams.

The AMF system and the Auto-Shear system, neither one of those had the capability of pre-closing something called the casing shear ram. So that means that they didn't have that two-step process available to them.

When we go back and we think about a performance standard, one of the definitions that we talked about is that you could include, what were the interactions that your safety critical elements had with other systems? So even though the drilling crew found a two-step process that would work for the EDS system, what they didn't consider is that it wouldn't work for the AMF system or the Auto-Shear system.

So that brings us to gap closure, and gap closure is about maintaining -- not only maintaining performance of your safety critical element over time but actually improving upon it. So we talk about active monitoring in the report, and active monitoring is really something completed by all levels of management. It is how they continuously monitor work activities, organizational and operational practices, and systems that impact safety critical elements.

So this is formal and informal inquiries. It's not an audit. It's not checking to see that somebody has done what they were supposed to do, but it is actually increase and trying to check on the health of the system. Was the two-step workaround process -- was that part of Transocean's organizational or operational goals? And, if not, you would hope that management would be engaging in conversations to discover what those processes were, or what other workarounds were being developed on the rig.

We also -- gap closure is about looking at specifically the performance of the BOP. There are mechanical integrity programs that can be set up to ensure that adequate testing, preventative maintenance, and other activities are being conducted on the equipment or the other safety critical elements.

One final possibility is there is a possibility of having an additional layer that actually confirms that safety critical elements are being managed effectively, and that is having an independent, competent person verify the activities that are being completed. This is something Cheryl will talk again about shortly, and we see already happening with BOPs in current post-Macondo regulations.

So I'm not going to walk through all those steps, but I am going to point out a few more other assurance activities that were not conducted on the Deepwater Horizon BOP.

The first one is there was a lack of documentation of testing on the BOP's AMF/Deadman system components. So there was a miswired solenoid, and a natural question to ask is, well, who miswired the solenoid? And we actually can't answer that question. We know from looking at documents from Transocean that they don't know either. Was it rig crew? Was it a contractor? Was it -- where was it rebuilt? Who did the miswiring? We don't know because that was never recorded.

Another testing that was not recorded was testing of the solenoid valves, both in documentation provided by Cameron, the manufacturer, and also that Transocean had its own procedure, instructed users who had rewired or rebuild the solenoid valves to test it, to test one coil, the second coil, and the two coils together. It is impossible that Y103, the solenoid valve responsible for closing the blind shear ram in the yellow pod could have passed that test.

While we were reviewing this, we actually came across some interesting observations about testing in general with AMF/Deadman systems. So before the Macondo incident, AMF/Deadman systems were not even required on deepwater drilling rigs. Post-Macondo, they are. So perhaps accordingly, then, best industry practice guidance didn't address testing of the AMF/Deadman systems.

Since that -- since Macondo, it has, and there is some recommended testing procedures in EPI-53, the fourth edition. So that testing, what it does is it uses an external piece of equipment that -- and they -- to provide power to the SEMS or the AMF or the control pods, and then also hydraulic supply.

And what that test says to do is two -- or, sorry, the API test says cut hydraulics and electrical at the same time, and check to make sure that your AMF/Deadman system triggers. That procedure differs from the procedure, at least for this BOP, provided by Cameron. The manufacturer's procedure recommends that you do it in a two-step process.

In the first step, indicated up here at the top of this diagram, you are to cut power and communications first, and then wait and ensure that the Deadman system does not fire. And then you cut hydraulic pressure, and you wait and you see that it does fire.

Second set of tests, they tell you to do the reverse now. Cut power and communications, and wait and make sure the Deadman system doesn't fire. Then, go back and cut hydraulic pressure and wait and see that the Deadman system fires.

So the testing or the miswiring that we identified from the point-to-point wiring checks found -- or conducted during Phase 2 testing, this test would have caught that miswiring. If the Deadman system believed that it had already lost power and communications from the rig because of the wiring, or, in this case, the test equipment, what would have happened when you turned off the hydraulic pressure first and waited, the Deadman system would have fired.

So had this test been done in this way as opposed to turning off electrical and hydraulic power at the same time, had it been done sequentially, that miswiring would have been detected by this test. And this is, again, the test that is indicated by Cameron, the manufacturer of the BOP.

There is another difficulty or something I think we should -- that everybody in the industry should consider when they conduct tests by just cutting hydraulic and electrical power at the same time. The Deadman system is designed with redundancy. It is designed that either the SEM-A, so the computer A in the blue pod, or computer B in the yellow -- or computer B in the blue pod, or computer A in the yellow pod, or the computer B in the yellow pod, any one of those four systems should be able to trigger the AMF/Deadman system.

So let's think about the Deepwater Horizon system. We know that the yellow -- the two yellow systems could not have triggered, miswired solenoid valve, assuming that it had a good battery at the time. If the 27-volt battery of the blue pod had been good at the time that it was on the rig, it actually would have passed the test and the rig crew would have had no idea that two of the systems were inadequate or unable to perform that function.

There would have been a misplaced confidence on this -- or a redundancy because it actually wasn't verified. It is possible you could have just one SEM pass -- or trigger the AMF/Deadman system successfully, and all of the other SEMS fail for whatever reason, and the rig crew would have no idea. They wouldn't know if one was functioning successfully or all four.

For a system that is one of your last-ditch attempts at preventing or mitigating a major accident event, we feel that this needs to be addressed, this shortcoming needs to be addressed, because, really, ultimately what it means is that the same latent failures found on the Deepwater Horizon BOP could conceivably pass current, new industry-recommended AMF/Deadman system testing today.

So I'm going to now turn the

presentation back over to Ms. MacKenzie.

MS. MacKENZIE: In the aftermath of Macondo, a number of regulatory changes were implemented, and industry standards and good practice guidance was developed and revised. These improvements should be commended for the advancements made in efforts to improve offshore safety.

One of the most significant changes was the establishment of the safety and environmental management systems, or SEMS rule. The SEMS rule requires operators to develop a safety and environmental management system that incorporates several essential elements, including hazard analysis, management of change, mechanical integrity, and many others.

The SEMS rule also generally requires that the operator be responsible for establishing goals and performance measures to carry out an effective SEMS program. Yet the SEMS rule lacks specific language focusing the responsible party to identify and establish a comprehensive safety management system for all safety critical elements. These are the technical, operational, and organizational elements.

The rule also lacks a requirement for the operator and drilling contractor to reduce risk to a targeted level such as as low as reasonably practicable. These gaps allow companies to ineffectively manage their safety critical elements and yet remain in compliance with the regulations.

The components of the safety management system life cycle approach for safety critical elements, as this visual depicts, are not explicitly required for all safety critical elements. For example, within the life cycle safety management system approach is the identification of safety critical elements.

As discussed earlier, this is accomplished, first and foremost, through a process of conducting a hazard analysis, yet there is no requirement to identify and document all safety critical elements as part of that hazard analysis process.

Additionally, the hazard analysis element of SEMS is not focused on targeted risk reduction. Instead, the requirements are activity-based where the hazards identified must be managed, and any resulting recommendations for mitigating or eliminating the hazard must be resolved.

A system can be managed but managed poorly. A recommendation can be resolved, completed, or closed out, but the result may not necessarily make things safer. Companies could conduct a weak or inadequate hazard analysis and not identify the appropriate safety critical elements or operating conditions of the safety critical elements, and yet appear to be in compliance with the regulation. This is something the CSB sees again and again in its onshore investigations as well.

The absence of targeted risk reduction parallels findings in two specific CSB incident investigations that have come out recently on onshore facilities -- the Chevron refinery fire in Richmond, California, and the Tesoro Anacortes Refinery in Anacortes, Washington.

While these onshore sites are regulated by agencies other than BSEE, the California Division of Occupational Safety and Health, and the Washington State Department of Labor and Industries, these are both state -- OSHA states -- the safety regulations parallel the SEMS rule, both in the safety management system framework of each, and that the onshore and offshore regulations both lack targeted risk reduction.

On August 6th, 2012, at the Chevron refinery, a pipe containing flammable hydrocarbon process fluids ruptured, resulting in a large vapor cloud that ignited, sending a large uncharacterized plume across Richmond. Fifteen thousand people sought medical attention from that incident.

On April 2nd, 2010, at the Tesoro refinery, a heat exchanger catastrophically ruptured, releasing highly flammable hydrogen naphtha at more than 500 degrees Fahrenheit into a process unit where seven workers were located and fatally injured.

In both cases, known hazards were not controlled for or mitigated sufficiently to prevent the tragic accidents from occurring. Yet both companies had conducted the requisite hazard analysis activity stipulated in the regulations. Both of these CSB investigations have incident reports for those who wish to have more details.

It is also -- it is significant to note that U.S. offshore voluntary guidance developed post-Macondo support a risk reduction target. API Bulletin 97 provides guidance on the information to be shared between the operator and the drilling contractor regarding well construction and rig-specific operating guidelines.

The bulletin suggests that as part of the well plan interface document, the risks associated with implementation of the planned well construction activities be identified, and that the prevention and mitigation plans be established for those identified risks in order to reduce the possibility as low as reasonably practical.

It goes on to state that these identified risks and prevention mitigation plans are to be communicated to all affected personnel.

Furthermore, in August 2013, BSEE proposed to amend and update an existing regulation -- its oil and gas production safety systems regulation -- that speaks to the need for a life cycle approach to managing safety critical equipment.

With a focus on production, this

rule is not applicable to drilling facilities such as the Deepwater Horizon. However, the proposed changes are significant because they highlight the importance of conducting and documenting a life cycle analysis of specific safety and pollution prevention equipment.

And while this rule excludes the BOP, a 2013 proposal explicitly requested public comment on the possibility of requiring a similar life cycle analysis of the BOP.

This demonstrates an acknowledgement by the regulator of the benefits of a life cycle safety management system approach, albeit for a few specific pieces of equipment.

The CSB concludes that all safety critical elements require this approach for the prevention of major accidents.

I would now like to ask Don Holmstrom to share the proposed recommendations.

MR. HOLMSTROM: Thank you, Cheryl

MacKenzie. The CSB makes recommendations, and I'm going to read the draft recommendations, subject to approval or voted by the Board that came out of this -- the first two volumes of our Macondo investigation. Once the recommendations are voted on, the CSB has a recommendations group that tracks the recommendations until completion, so the CSB doesn't just issue reports and moves on. We have a mechanism similar to the National Transportation Safety Board to issue recommendations and track them to completion. And the status of those recommendations is also a vote of the Board, whether their open, acceptable response; closed, acceptable action; that's an evaluation by the staff and a vote by the Board.

So we -- the recommendations are the mechanism that drives safety change and are very important to the Chemical Safety Board.

The first draft recommendation this

evening is to the Bureau of Safety and Environmental Enforcement, United States Department of Interior. Augment 33 CFR Section 250, Subpart S, to require the responsible parties, including the leasee, operator, and drilling contractor to effectively manage all safety critical elements, technical, operational, and organizational, thereby ensuring their effective operation and reducing major accident risk to as low as reasonably practical.

At a minimum, require the following improvements. A, written identification of all safety critical elements for offshore operation through hazard analysis. This list will be made available for audits and inspections before and by the responsible parties. External entities, e.g. independent competent parties, third party auditors, and the regulator, and it will be shared among the leasee, operator, and drilling contractor.

Identifying all safety critical elements shall ensure the establishment and maintenance of effective safety barriers to prevent major accidents.

B, documented performance standards, as defined in Section 5.2 of the Macondo investigation report, describing the required performance of each safety critical element, including its functionality, availability, reliability, survivability, and interactions with other systems.

C, augmentation of 30 CFR Section 250.1916, to include requirements for all responsible parties, including contractors, to conduct monitoring for continuous active assurance of all identified safety critical elements through each of the safety critical element's life cycles.

Also, part of Recommendation R1 to BSEE, documented independent verification scheme for the identified safety critical elements reported to, and it's subject to review by the regulator where, one, the dependent party meets BSEE criteria that guarantees its competence and independence from the company or facility for which it is providing verification.

Two, the independent verification occurs prior to commencement of the offshore drilling or production activity and periodically as defined by BSEE.

Three, all resulting assessments of the independent verification activities will be tracked in a formal records management system.

And, four, corrective action shall be taken to address negative verification findings and non-compliance. Verified non-compliance shall be tracked by the responsible party as a process safety key performance indicator and be used to drive continuous improvement.

The next recommendation to BSEE, R2, publish safety guidance to assist the responsible parties in the fulfillment of regulatory obligations stipulated in R1 for the identification and effective management of safety critical elements -- technical, operational, and organizational -- with the goal of reducing major accident risk to as low as reasonably practical, including, but not limited to, each of the identified minimum requirements, which we identified in R1.

Recommendation Number 3 to the American Petroleum Institute. Publish an offshore exploration and production safety standard for the identification and effective management of safety critical elements, technical, operational, and organizational, with the goal of reducing major accident risk to as low as reasonably practical, including, but not limited to: A, development and implementation of a safety critical element management system that includes the minimum necessary shall requirements in the standard to establish and maintain effective safety barriers and prevent major accidents.

B, methodologies for the identification of safety critical elements; and, two, the development of performance standards of each safety critical element, including its functionality, availability, reliability, survivability, and interactions with other systems.

C, establishment of assurance schemes for continuous active monitoring of all identified safety critical elements throughout each safety critical element's life cycle.

And, D, fulfillment of independent verification requirements and use of those verification activities to demonstrate robustness of the safety critical element management process.

And, E, development of process safety key performance indicators pertaining to the effective management of safety critical elements to drive continuous improvement.

Recommendation Number R4 to the American Petroleum Institute, revise blowout prevention -- blowout preventer equipment system for drilling wells, API Standard 53, 4th edition, to establish additional testing or monitoring requirements that verify the reliability of those individual redundant blowout prevention systems that are separate from the integrated system test currently recommended.

This concludes our presentation, and we will now welcome questions from the Board.

Thank you.

CHAIRPERSON MOURE-ERASO: Thanks. The next item on the agenda is questions from the Board. I wonder if Mr. Griffon has some questions that you would like to beam here to the investigative team. Mr. Griffon?

MR. GRIFFON: Yes. Thank you, Mr. Chairman. And thanks to the team for the presentation. It is a bit difficult to follow. There is a little delay with the slides and the audio. But, anyway, so some of my questions you may have covered in the presentation, and I apologize, but maybe if you can just expand or reiterate the points.

Just a couple of questions. One, I just was wondering if we have any evidence about what is being done at the operational level and whether these global companies are using completely different approaches to managing safety critical elements in the Gulf compared to around the world? And are there any discrepancies of what is being done in the Gulf versus other -- around the world for, you know, these global companies?

MR. HOLMSTROM: I'll start it out. This is Don Holmstrom. At the Chemical Safety Board, we adopted practice I think similar to the National Transportation Board and -- Safety Board in terms of our evaluation of what practices are. We recognize there is a wide range of practices, and then there is standards and regulatory requirements.

And because of the fact that these practices vary considerably from company to company, we focus on making improvements to what we can identify, which are the generally accepted good practices, usually published by a standard-setting body such as American Petroleum Institute, National Fire Protection Association, et cetera. And, obviously, there is international standards that we have looked at and regulatory systems thoroughly the world.

So we examine those as sort of the floor of practice and examine whether those particular practices and regulations are sufficient to have prevented the incident occurring given what we have identified in our investigation report.

So if one adopts the perspective of minimal compliance, which is often the case in CSB investigations, often when we are investigating an incident it's not the companies that are going above and beyond the standards and regulations; it is often somebody adopting a minimal compliance approach.

And so if there's gaps in those regulations, and people aren't following or are not implementing -- only the regulations and not going beyond those, and the incident could occur given those gaps and weaknesses, then we make recommendations for improvement.

So our typical approach is to identify the practices in the incident that we're investigating, and then look at standards and regulations and see if those need improvement to prevent -- especially when you have a catastrophic incident with I think what everyone would recognize as unacceptable consequences for society, and certainly for those people killed and injured, to prevent that from occurring again.

PARTICIPANT: I would add that API-53 is an international standard for BOP management, and I suspect when the findings of this report come out that people around the world would be considering some of the points that we have made in our report.

CHAIRPERSON MOURE-ERASO: Mr. Griffon?

MR. GRIFFON: Thank you. Thank you. And I guess for me it was just as much a curiosity as a -- you know, I just was trying to imagine whether these very large companies would operate a certain way in one area and then, you know, a more limited, less rigorous approach, you know, just because they're in another -- under another regulatory regime. So it was as much of a curiosity as anything.

But let me ask the second part, which is going into the SEMS a bit, and I think, Cheryl, I -- this is probably something that you may have even covered or touched on, so maybe just to clarify for me.

I think it's in Section 6.1 of the

report that I wondered if you could describe a little further maybe what BSEE is doing with regard to the SEMS regs. It seems that they have some language at least that is very similar to what we are recommending with regard to safety critical element programs.

My sense, and I'm certainly no expert on this regulation, but my sense is that it's probably limited to equipment, not other -- not the broader systems that you talked about. Can you just explain for me further what SEMS -- what is sort of covered in the SEMS approach now and where the deficiencies lie in our view and the justification for our Recommendation R1?

MS. MacKENZIE: Sure. Yes. So a subsequent volume of this investigation will be looking at regulatory issues, and we look at SEMS a lot more in-depth in that one -- not just for safety critical elements but beyond that.

In this case, regarding safety

critical elements, it does speak to safety critical equipment, and specifically we highlighted in our report about the need to look at safety critical tasks, the operational/organizational elements that are safety critical for safe operation and prevention of major accidents.

The language of SEMS, as we tried to quickly point out in this presentation, allows, without a risk reduction target and some of the language that is used within it, it can allow some -- allow a company, a poor performer, a bad actor, those that we typically have to investigate, to fulfill the requirements on paper and yet perform safety management systems activities in a less-than-stellar or inadequate manner.

And when comparing that language in SEMS to regulatory regulations in other offshore regions, we can see distinct differences in the requirements put forward on the -- those creating the risk. And because

of that, we wanted to -- safety management
systems, it's in a safety -- excuse me, safety
critical elements is a safety management
system in and of itself. And it requires a
distinct and explicit requirement in the
regulations.

DR. MULCAHY: I think I would add
to that, too -- and this is Mary Beth speaking
-- we know already that BSEE has implemented
regulations to have third parties look at the
BOPs. But the BOP may not be the cause of the
next major accident event in the offshore
drilling industry.

So we know that there are other
systems, the fire suppression systems,
diverter systems, that are not receiving the
same attention or not given the same attention
by the regulations, whereas the approach that
we recommend would require it for all safety
critical elements.

MR. HOLMSTROM: One additional
point, Board Member Griffon, I would raise is

that in SEMS, I'll use the example of the hazard analysis. When we say it's more activity-based than goal-setting, typically in a goal-setting regime you have a goal to, you know, prevent accidents or the goal to control hazards. And in the SEMS element on hazard analysis criteria, 1911, it talks about managing hazard versus an activity.

This is different than the language used for example in the process safety management standard, which we also believe lacks a specific risk target. But the PSM standard, which applies to onshore process facilities, like refineries and chemical plants, requires the control of hazards.

So SEMS, on the other hand, only talks about manage them, which is an activity and is not a goal-based approach.

The other thing on recommendations relative to hazard analysis that talks about resolving recommendations, it doesn't establish a goal to resolve recommendations to ensure the prevention of incidents, et cetera. It just talks about resolving recommendations.

As we all know, those of us that have participated in hazard analysis, like Haz Ops, often you resolve a recommendation by not addressing it or deciding not to take the action that is recommended by the Haz Op team. That is often -- or can be, you know, an acceptable approach. So using the word "resolve" doesn't -- is not goal-based. It's activity-based. And so we have a specific problem with that, because this is intended to be goal-based, goal-setting-based regulatory activity, but the language used is not goal-setting.

MR. GRIFFON: Thank you. I'll turn it back to the Chair.

CHAIRPERSON MOURE-ERASO: Okay. Thank you, Mr. Griffon.

I only have one question that I direct to anybody on the panel, the investigative panel. The recommendations that were made are basically to Department of Interior, to BSEE, to ask BSEE to require offshore operators to manage all safety critical elements requiring improvements or current practices, I could presume.

After you were able to conduct your investigation and evaluate other regimes in other countries, and look at what has been done in the United States, in your opinion, do you think that the U.S. offshore operations have the capabilities to implement the improvements that are being recommended?

MS. MacKENZIE: Yes. You know, as I had said in the presentation, I think that we can all agree that great change has happened offshore since Macondo. A number of new regulation standards, good practice guidance, have resulted, and that is definitely taking us many strides forward in advances in safety.

After SEMS came out, SEMS II came out, which were amendments that further strengthened SEMS, and that is why in R1 we make the recommendation to BSEE to amend SEMS, because we feel that this is a way that they can add on to the great start with SEMS, and include a safety critical element management system requirement to ensure that these important elements are managed effectively offshore.

CHAIRPERSON MOURE-ERASO: All right. We are doing very well with time. So I think before we enter into the next item of the agenda, the public comments, I am going to take a --

(Brief break)

CHAIRPERSON MOURE-ERASO: We continue with the program.

Before, I would like observe that here on the table in front of the table of the panel we have some examples of solenoids and part of the equipment that we are talking about in the report, if somebody would like to physically examine them.

On the agenda, we have this part reserved for public comments. I would like very much to keep the length of the comments to three minutes. There is a lot of people that are on the list that would like to talk, and any extension over three minutes that you are doing, you are taking away from the time of other people, and that we want to keep the proceedings fair.

I am going to ask Mr. Richard Loeb, the CSB General Counsel, to lead this part of the public comments. So, Mr. Loeb.

MR. LOEB: Thank you, Mr. Chairman. Normally, Daniel Horowitz, our Managing Director, takes this role, so forgive me if I have not been practiced and schooled the way that he has, but I will do my best. But I am learning that the toughest part of this, just reading the list, is some of you, or I guess maybe all of you, should have become physicians, because it's like reading a prescription. I can't quite get it, but I will do my best.

If I mispronounce your name or your affiliation, I would ask that all of you when you come up to the microphone, which is up at the front towards the panelists, that you state your name and spell your last name, and state your affiliation, because this meeting is being transcribed.

So the first speaker is Holly Hopkins from the American Petroleum Institute.

MS. HOPKINS: Hi. Good evening. In the interest of time, I'm just going to read a shortened statement. But if I can submit the whole statement for the record, that would be appreciated.

Good evening. My name is Holly Hopkins, and I'm a Senior Policy Advisor in Upstream and Industry Operations at the American Petroleum Institute. API appreciates the opportunity to provide verbal comments at the U.S. Chemical Safety and Hazard Investigation Board's public meeting on the first two volumes of the CSB report on the April 2010 Macondo incident.

API represents more than 600 companies involved in all aspects of the oil and natural gas industry, including exploration and production, refining, marketing, pipeline, and marine transporters, as well as service and supply companies that support all segments of the industry.

API and our members are significantly affected by the efforts of the CSB and are highly -- and are regularly called upon to respond to and implement the CSB recommendations.

The oil and natural gas industry is committed to operating in a safe and responsible manner while minimizing our impact on the environment. Protecting the health and safety of our workers, our contractors, and our neighbors is a more imperative and a core value for our industry.

No incident is acceptable. Our

industry takes every incident seriously. Continued vigilance is essential in helping to prevent future incidents. We agree with Board Member Griffon's comments on the review process and the inadequate time given to review the report and provide comments. While API has not had the opportunity to fully review Volumes 1 and 2 of this report, or its proposed recommendations, we do have the following general comments.

The CSB analysis in Volume 2 is focused solely on the BOP, but fails to acknowledge the entire system and the systems-based approach that is essential for sale operations. Despite the focus on the BOP and its technical detail, the report draws conclusions and recommendations related to the entire offshore operating system without presenting a legitimate analysis.

The significant safety strides that are directly related to implementation of a systems-based approach must be referenced in the report if the report is going to draw conclusions and make recommendations beyond the BOP failure analysis technical findings.

API requests the opportunity to submit documents that describe the tremendous progress made by the industry on offshore safety and specifically on progress made on systems-based approach to the CSB.

Additionally, there are many comments throughout Volume 2 that compare the U.S. and European regulatory approaches. As API has stated in prior public comments, industry is fully committed to safe operations, both onshore and offshore. This is particularly evident in the standards and programs developed by the industry, specifically Recommended Practice 75 on SEMS and the SEMS resources and initiatives of the Center for Offshore Safety.

The U.S. requires SEMS for offshore operations, and the program includes third-party audits. Nothing has been presented by the CSB to support a sudden shift to the safety case regime. In other words, the CSB has not demonstrated how a safety case regime will result in a higher level of safety and actual operations over a fully functional and properly managed safety environmental management system, such as described in API Recommended Practice 75.

Additionally, all the specific terms and concepts mentioned in the CSB recommendation are included in the SEMS, and were in fact commonly in practice before the SEM regulatory requirement.

In the four years since the Macondo incident, and CSB began its investigation, the oil and natural gas industry has methodically examined every aspect of offshore safety measures and operations to identify potential improvements in spill prevention, intervention, safety management, and response capabilities.

The process started immediately

after the 2010 spill when industry, in cooperation with federal regulators, launched a systematic and comprehensive review. We convened four joint industry task forces to scrutinize all facets of the offshore drilling process, from equipment and operating procedures to subsidy well control and oil spill response.

Working with the U.S. Department of Interior, as well as the Presidential Oil Spill Commission, industry experts developed new recommendations and standards that guide operations in both deep and shallow water exploration.

Drawing on lessons learned from Macondo, we revised existing standards and created several new ones, including standards dealing with well design, cementing, blot prevention, subsidy equipment for capping wells, and protection for oil spill response workers.

One of the first recommendations

implemented was boosting rapid subsidy response capability for well containment. Thanks to the establishment in 2010 of new collaborative containment companies, state-of-the-art containment technology can be deployed quickly in the event of a spill.

The Center for Offshore Safety was created in 2011 to promote the highest level of safety for offshore drilling completions and operations, fully dedicated to safety management and safety culture, as recommended in the Presidential Commission Report.

The Center works with the independent third party auditors and government regulators to reinforce the industry safety culture, support good, safety management audit tools and audit practices, and ensure good operational safety practices are communicated throughout the industry.

The Bureau of Safety and Environmental Enforcement has already adopted three of the Center's guidelines in its own regulations. The Safety Bureau is one of the three new agencies formed from the reorganization of the federal former Minerals Management Service in response to Macondo, and in recent congressional testimony the Safety Bureau's Director, Brian Salerno, stated that 25 of the 33 BP Deepwater Horizon Commission recommendations have been addressed or are being addressed through ongoing initiatives including rulemakings.

Offshore development is an important element in realizing our full potential as an energy superpower. Even one incident is too many, and the oil and gas -- natural gas industry has dedicated the past four years to using the lessons learned from Macondo to enhance safety and operational practices.

To quote the co-chairs of the Presidential Oil Spill Commission, offshore drilling is safer than it was four years ago, because industry and the government are working together to improve spill prevention and response, implementing new rules, and fostering a strong culture of safety within the industry.

In closing, any incident is both one too many and a powerful incident for API and industry to improve training, operating procedures, technology, and industry standards. Our thoughts will always remain with the families of all those who lost their lives in this tragic incident, and we stand ready to continue to work with government regulators to improve safety.

Thank you.

MR. LOEB: Thank you, Ms. Hopkins.

Our next speaker is Charlie Williams, and could you state your affiliation when you're up at the mike.

MR. WILLIAMS: So I'm going to do an abbreviated version as well. So good evening. My name is Charlie Williams. I'm Executive Director for the Center for Offshore

Safety. COS appreciates the opportunity to provide verbal comments to the U.S. Chemical Safety Enhancement and Investigation Board's public meeting on the first two volumes of the CSB report on the April 20, 2010, Macondo incident.

No incident is acceptable. Our industry takes every incident seriously. Continued vigilance is essential to helping prevent future incidents. The COS was established by the industry to ensure that our commitment to improvement continues and that there is a single group singularly focused on SEMS, and that there is a group that is responsive to the Presidential Commission's recommendations on safety and safety culture.

The industry is committed to ensuring that SEMS is a continuous learning and enhancement process. Thus, a key mission of the COS is enabling the sharing of industry knowledge of SEMS and safety. These learnings will be based on SEMS audits, safety performance indicators, and learning from incidence data that includes near misses. The SEMS audits are done by independent third party auditors.

While COS has not had an opportunity to fully review Volumes 1 and 2 of the report, or its proposed recommendations, we do have the following general comments. The CSB analysis in Volume 2 is focused on the BOP and, in particular, the technical aspects of the BOPs. Yet well control in particular, and safe operations in general, or an entire system of technology, people, and processes, and, thus, a systems-based approach is essential for safe operations.

The focus could not be just on the equipment. The report itself notes that many safety systems processes were done at Macondo, like hazard analysis, barrier analysis, and management of change. Thus, the report should do more to analyze these safety management processes and make recommendations on how they could be enhanced and made more effective.

Yet the majority of the report is on the technical details of a single piece of equipment. Significant strides in safety are directly related to implementation of systems-based approaches, SEMS, and operationalizing these systems in the field. There is no discussion or recognition of the significant SEMS enhancements in work by the industry, the regulator, and the industry organization. COS requests the opportunity to submit documents to CSB that describe the COS SEMS progress made by the industry regarding offshore safety.

SEMS II is a regulatory requirement. COS documents in API-RP 75 are referenced in the regulations. And audits and reporting on SEMS is required. The CSB recommends a sudden shift away from SEMS without clear explanation and analysis of why or how another system will be more effective. We believe that all the ideas, concepts, practices, and benefits of other forms of safety management currently exist in SEMS and the regulation.

SEMS and SEMS-A is being implemented and enhanced offshore, has benefits of being an active learning and feedback safety management system with a focus on being fully operationalized and continuously benefiting the work and staff in the field.

Additionally, SEMS has the benefits of focusing on managing barriers, taking a systematic approach to all parts of offshore safety, and active monitoring. SEMS also has both internal auditing and auditing and verification required by regulation and done by third parties. Significantly SEMS focuses on the importance of leadership and the interaction of leadership with staff to deliver the safety culture we want.

We feel that the efforts going forward should be put into continuous learning and enhancement of SEMS. We feel that an important contribution of the CSB report will be the analysis and recommendations on how SEMS and SEMS processes that have been and are in place can be more effective.

In closing, any incident one -- any incident is both one too many and a powerful incentive for COS and the industry to improve SEMS and learning processes, skills and knowledge, operating procedures and standards, and the effectiveness and measures and audits.

Our thoughts will always remain with the families and all of those who lost their lives in this tragic accident, and we stand ready to continue to work with the government regulators to improve safety.

Thank you.

MR. LOEB: Thank you for your comments, Mr. Williams.

Our next speaker is Mr. Kenneth Arnold of the Society of Petroleum Engineers.

MR. ARNOLD: Hello. My name is

Kenneth Arnold. That's A-R-N-O-L-D. I'm representing the Society of Petroleum Engineers, and I was also one of the three reviewers who submitted our peer review of the report last Tuesday, which I suspect didn't make it into the final version, but I just got the final version and I haven't seen how you address the comments.

The CSB asked the Society of Petroleum Engineers to do a peer review on the May 5th draft. As you may know, SPE is not an advocacy organization, but is a professional society of individual engineers and scientists. Our mission is to provide networking and knowledge-sharing opportunities for our global membership, and we represent ourselves and not our individual companies.

We commend the CSB for completing such a comprehensive review of this tragic incident, and share your hope that the learnings can be adopted by operators, drilling companies, and service companies in the future, to prevent recurrence. We were able to send the draft to three SPE members who are recognized experts in the field for their review, but we could not perform a full SPE Board-approved peer review in the one week that was allotted to us.

On May 27th, SPE submitted the comments from the independent reviewers dealing what these three individuals thought were serious problems with these volumes. Some common themes in the feedback emerged.

First, the team believed that the CSB has done a good job at explaining the technical issues of the solenoids and the buckling of the drill pipe that has not been adequately addressed in the past.

Two, there are many comments in the volumes that compare the U.S. and European regulatory frameworks that the team believed warrant more evaluation and examples to prove the contention that a redirection of the U.S. regulatory framework to require identification specifically of SCEs and MAEs and verbiage to prove a LARP will result in a higher level of safety in actual operations.

The individual reviewers did not think this point was valid at all. The full comments include specific examples of where the report has failed to prove this point in Volumes 1 and 2.

The team believed that there are some important items and assumptions that may be technically incorrect, and that the CSB should consider these before publishing the final report. Specifics of these items are included in the full comments which we submitted to you on May 27th.

The team acknowledges that some, but certainly not all, of the comments resulting from this initial review may be addressed in Volumes 3 and 4. For this reason, we feel that the volumes are so interrelated that all four volumes are required to paint the full picture.

It is possible that releasing the Executive Summary and Volumes 1 and 2, before releasing Volumes 3 and 4, would provide an incomplete analysis that could lead to inadequate and misguided actions.

Also, during the completion of Volumes 3 and 4, it will probably be found necessary to make revisions to Volumes 1 and 2 because of the interrelated nature.

In summary, SPE, as a technical organization, believes these volumes of the report should not be approved by the Board until the questions raised by our reviewers and others have been properly vetted and the remaining volumes of the report are written, reviewed, and vetted as well.

Thank you very much.

MR. LOEB: Thank you, Mr. Arnold.

The next speaker -- and thank you so much for spelling your name and restating your organizational affiliation -- is Rudolfo Maya from Dupont.

MR. MAYA: No comment.
MR. LOEB: Oh. No comment? Okay? Well, going down the list, it's Lillian Espinosa, yes, of Deepwater Horizon Study Group. But I may have misstated that, so please when you reach the mike let us all know.
MS. ESPINOSA: Yes. I had the honor and privilege of being a member of the Deepwater Horizon Study Group. And we actually had some of the survivors in the early hours long before the NBI inquiry.
So today I will probably come -- I thought I was coming, you know, just to see about Volume 1 or 2, but I realize now I am here as much for the survivors, some of whom thought about talking to CSB, but not sure that they can trust it.
The manslaughter trial, the hearing is July 9th, so, you know, this thing is not over. One of my questions -- did you all go over any of the evidence from Phase 1 and 2

from the civil trial? Cheryl, did you use any evidence from Phase 1 and 2?

MS. MacKENZIE: Yes. Yes, yes.

MS. ESPINOSA: You know, my heart says that maybe Ken Arnold is right. It would be better to issue all four volumes. Like trust is a really important thing.

And also, you know, I thought you all were going to really focus on the human factor. And I know this is just a technical safety critical equipment, but I think it would be such a greater impact if you issued all four volumes.

MR. LOEB: Thank you very much, Ms. Espinosa.

Our next speaker is Jacqueline Weaver of the University of Houston Law School.

MS. WEAVER: I thought that was just a sign-in sheet.

MR. LOEB: Oh, well, yet another one.

MS. WEAVER: (Inaudible)

MR. LOEB: Well, I don't know if that was picked up, but the next speaker I think is Darryl -- is it Fett of Total?

MR. FETT: Yeah. I started as one that also thought it was a sign-up list, but I greatly appreciate the opportunity to talk to you guys, because -- well, first of all, let me introduce myself. I'm Darryl Fett. I'm with Total E&P USA.

About 25 years in the industry, and I work in drilling and completions as senior drilling and wells advisor. But a lot of my background is fluids and cementing.

And just a disclaimer, I am speaking on behalf of myself and my own personal thoughts and opinions and not those of my company.

I'd like to focus a bit -- there was quite a lot of discussion in the report and today about the last line of defense, but I want to speak briefly on what should have been and was designed to be the first line of defense, and that's the cement job.

In the report, I want to refer to page -- just for your records, to page 23, where it defines the cement at the -- in the annulus and the cement at the bottom of the casing. In the presentation, it was also referred to as sort of independent things -- cemented annulus as being one barrier, cement at the bottom of the casing being another.

You specifically refer to it as the shoe track. And just a bit of education because this isn't the first report that has referred to the shoe track cement as the barrier that failed. It was not. The barrier that failed was the primary cement, and they are not two distinct systems anyway. It is all pumped as one slurry, and it's referred to the primary cement job.

The purpose of the shoe track cement is not necessarily to prevent the flow of anything into the well bore. The purpose of the shoe track is it's a container that captures contaminated cement from wiping the casing with mud. So by design, it is supposed to have contaminated -- be contaminated with mud.

Therefore, it shouldn't be expected to contain flow inside the casing. What it is designed for is so that competent cement can be in the annulus and prevent the flow of hydrocarbons into the annulus in either direction, up or down, depending on where the flow path of the load may be. Hopefully, it doesn't go anywhere, but there has been a lot of reference to the failure of the shoe track cement, and I'd really like to correct that in future references to the failures of the barriers.

One more thing. In your list on page 18 of barriers, as well as the presentation slide, you refer to all of the types of barriers that we use, but there is one -- there is two distinctions that I want to make. You said cement placed at the bottom of the well to seal a hydrocarbon-bearing zone. Again, in context, I take that to mean that you are talking about the shoe track cement.

It is not placed there separately than the primary job. If it's not, if you're talking about a cement plug, which is a separate operation, that is the type of barrier that we place there inside the well bore separately than the primary cement job.

There is also a key omission here. There is a mechanical barrier, either bridge plug, cement retainer, or there are several names for them, but essentially they are steel or composite material that is placed in the well bore to act as another barrier.

And I have to comment the drilling safety rule, there was one of the -- in my opinion, one of the best new regulations is that we have to place a mechanical barrier, another mechanical barrier above what is called our blow collar or our top plug in our final casing string.

Just for the reason that I'm talking about, is that that system that is inside the casing at the end of a cement job is never intended to prevent flow of hydrocarbons. We normally drill it out anyway. So in the final casing string you have to put another mechanical barrier before you put any negative load on it, and that's why we do it, because it's another system.

So I would suggest maybe putting cement plugs as another type of barrier that we use.

Thank you.

MR. LOEB: Thank you. Thank you very much, Mr. Fett.

Our next speaker is Ted Wilkerson.

MR. WILKERSON: No comment.

MR. LOEB: Oh, okay. We are going through the list really quickly.

Dr. Malcolm Sharples of the

Offshore Risk and Technologies.

DR. SHARPLES: I, too, thought it was a sign-up sheet. But given the opportunity, I would like to compliment you on this new piece of technical evidence that you have brought to light. Very, very helpful.

I would also like to say I do agree with some of the other speakers in that I think this is a bigger issue, particularly the issue of safety culture, which doesn't seem to be addressed. And on the -- and in regard to that, particularly the area of sort of social psychology to group-think, and, you know, when one keeps seeing recommendations to doing HAZIDs (phonetic), a lot of the -- whether a HAZID is good or not depends upon the people that are there and their experience.

And quite often you end up with HAZIDs being conducted on the basis that people are in the room, but those people don't necessarily have the depth of knowledge, particularly of the incidence and accidents.

And I think that's an important area to do something about.

I was curious why you just focused on the BOP instead of things like the float equipment, which also may have failed. Perhaps that would have been a good thing to look at, and perhaps no one seems much to have focused on the regulation, which requires that you -- you know, you have to pump something down the well, like the lost circulation pill, before you pump it overboard, which, as I understand it, was one of the things that blocked the kill line.

Nobody has talked much about that, and whether repealing that requirement might be a benefit in the future.

Thank you.

MR. LOEB: Thank you very much, Dr. Sharples.

Our next speaker is John Morawetz of the International Chemical Workers Union. Welcome back, Mr. Morawetz.

MR. MORAWETZ: Always a pleasure. Well, one, it is always a pleasure, and it's always interesting to hear the reports from various investigators or supervisors and the Board. These are very serious incidents, and the ones that you have tackled here has not just an occupational angle, not just an angle for a small town, but nationwide and worldwide significance given the scale of the environmental damage in the release of the oil over such a large area over such a long period of time.

I don't rise to speak to say that I know much about this particular report or the industry technically. I think it would be just inappropriate for me to say that. But, clearly, it was very interesting, I think this is a public meeting for the laypeople to see this report, to see that it's not quite so simple. It's not just one thing that fails, and it was educational to see the questions of the solenoid failure, the battery, the interactions, and I think that regardless of the integral findings, seeing where things can be put in place thoughtfully, that would prevent these type of events from occurring, I think is very important.

For instance, I am quite amazed that -- if I got this right, that there is no procedures for testing the batteries that are placed 5,000 feet under the water, operate at 46 degrees Fahrenheit. I just find it dumbfounding. I mean, you can set up a system to see if it works, but that you don't say -- in that kind of situation that you don't test it beforehand I find very strange.

And just another comment that what we're doing here is trying to prevent a similar thing from happening. I don't think the Board is mandated to, nor should it, try to pass judgment on a whole industry. And I don't take your comments that you are doing that. You are looking at a particular event, trying to examine it, find the root causes, and find recommendations.

I am a little bit troubled and torn as to what to do in a report that I don't think you have ever done before of two reports and two more coming. I would just suggest that there are a couple of ways to deal with that. You could provisionally accept it pending thoughtfulness on the part of the Board and the staff to examine the comments here today, and the written comments you received. Or you could accept it and just make changes later. It is a difficult question given that there could be interrelations between them.

But, anyway, thank you very much for the presentations.

MR. LOEB: Thank you very much, Mr. Morawetz.

We have one more in-person speaker. I apologize. I just can't read your -- your handwriting. From Transocean is all I can read. Someone from Transocean? Okay. Well, that may -- oh, I was about to go on to people who may wish to speak who are not on the speakers list. You are welcome to speak now, subject to the --

MR. DAVIDSON: (Inaudible)

MR. LOEB: Yes, if you could, so we could all hear you -- at the microphone, and if you can spell your name, your last name especially, and your affiliation, if you have one.

MR. DAVIDSON: My name is Michael Davidson. That's got to be the easiest name in the world. And I work for Drill Science, and I'm a petroleum engineer, and I want to applaud you all for hiring Stan, he -- and your report.

I think the determination of the buckling is a very simple root cause. And determining that -- identifying a safety critical element I think is key as well. And with that in mind, the BSEE put in the 30 -- in their final ruling in the 30 CFR 250 a requirement for the very negative pressure test that causes -- which it wasn't actually required -- you can correct me if I'm wrong -- before. Now it is, but the safety critical element that caused all this is not required.

So we are now required to do something without the safety critical element, so you nailed that one on the head. What I'm referring to is the safety critical element that would have prevented the buckling, and also its absence would have prevented killing the well even if the BOP had functioned. And that is that the drill string, the depth between the deepest untested barrier and the drill string that would have killed the well has to be minimized.

It was three miles above the deepest untested barrier at the time of the test. That is your safety critical element, and I think I would encourage you to point that out to the BSEE. And I'm a proponent of the safety case. I think the safety case needs to be tied to hazard levels and the safety critical element that you brought. I never even thought of that, but I think that's the correct way to approach the safety case would be hazard levels at different operational -- on the timeline.

And I think you briefly touched on the fact that some of the operations need to be certified or signed off on, and I think the engineer that designed the negative pressure test on the very next well needs to sign off on it. And that's it.

MR. LOEB: Thank you, Mr. Davidson.

Is there anyone else in the audience who has not made a comment who would like to make a comment? In that case, I would -- oh, we've got at least one more. We've got at least one more. No, no, that's one of our staff.

(Laughter)

Even with these bright lights, I recognize them.

MR. GALLANDER: I'm going to be like Van Morrison. He always starts his concert off with his back to the group. Okay? So my name is Frank Gallander. As of 4:00 this afternoon, I am a private citizen. Okay?

Now, I've got specific questions in regard to the report that I'm going to go down the line and ask these ladies and gentlemen specifically for answers. And this has to do with your report.

So I would like to go with the easies first, and I will start off with Ms. MacKenzie. You mentioned the pod, the temperature outside the pod, was 36 degrees. Do we know for a fact the temperature inside the pod?

DR. MULCAHY: No, we don't, but we can surmise. We have some evidence that has come out of people discussing what they thought the temperatures were, and we --

MR. GALLANDER: Based on?

DR. MULCAHY: Based on readings of

some vessel temperatures that were taken at another time, and also based on somebody's experience.

MR. GALLANDER: Okay. Because sometimes the temperature inside gets warmer because of the electronics and everything that is involved.

DR. MULCAHY: Certainly.

MR. GALLANDER: So the 36 degrees, the barrier life, and all this stuff, comes into question, right?

DR. MULCAHY: Well, and point that we -- I don't actually --

MR. GALLANDER: I think that's a yes or no. Yes? No?

MR. LOEB: Excuse me.

MR. GALLANDER: The question --

MR. LOEB: Excuse me. I want to -- you are -- feel free to ask the staff questions. This is not an interrogation of the staff, however.

MR. GALLANDER: Oh, I'm --

MR. LOEB: Okay.

DR. MULCAHY: Well, it's -- I want to be careful about just saying yes or no, and there's a reason why.

MR. GALLANDER: Okay.

DR. MULCAHY: The pod operated at -- it is going to -- the electronics will give off heat, and the temperature will rise. The environment of the actual battery is not 36 degrees or close -- you know, at freezing. But there is a thermal difference, and the ocean is a large heat sink. So it's also not going to be warm at the surface at a 70-degree Fahrenheit ambient temperature. It will be warmer on the surface than it will be at the -- on the sea floor.

MR. GALLANDER: Right. And that's what I was going for.

DR. MULCAHY: Yeah.

MR. GALLANDER: But, you know, the assumptions in the report was basically it was 36 degrees inside the pod where the batteries were located.

DR. MULCAHY: That's actually not correct. The assumption was not that it was 36 degrees inside the pod. On the outside of the pod, it was 36 degrees. The full technical analysis in the appendix is very clear about that.

MR. GALLANDER: Okay. Well, I haven't seen the appendix.

DR. MULCAHY: It addresses it in a footnote. I can point it out to you before you leave if you're interested.

MR. GALLANDER: Okay. Well, that would be fine. I will go to the next question to Dr. Mulcahy. Is that right?

MS. MacKENZIE: This is --

DR. MULCAHY: I'm Mary Beth Mulcahy.

MR. GALLANDER: Oh, sorry. Okay. Okay. I'll stay with you, then. So I'm going to go through, and you mentioned Auto-Shear/Deadman's, and AMF, and all this. So there are three different systems out there. There's the AMF, there's the Deadman/Auto-Shear, referred to as the DMAS, and there is the EHBU.

Each one of these are supplied by each of the different major manufacturers. So of these, how many of these manufacturers require battery operation similar to the system that you are evaluating? How many of these have a system that is similar in their design that require the use of batteries to operate?

PARTICIPANT: Are we talking about Macondo or just --

DR. MULCAHY: Yeah. Are you talking about worldwide, or are you --

MR. GALLANDER: I'm talking about Macondo.

DR. MULCAHY: -- talking about --

MR. GALLANDER: This knocks on to the -- goes back to the regulations that -- which I'm going to lead to next. And it's not an interrogation. I'm just asking for clarity, because --

CHAIRPERSON MOURE-ERASO: Three minutes.

MR. GALLANDER: -- and the reason I'm asking -- okay. The reason I'm asking the question is because the recommendations out of the group was to go to the regulations about stricter testing and all of this other stuff.

When I looked at that, I assumed that the drive was to get all of them to test it the same way you could test this one, but they're not all the same is what I'm trying to say.

DR. MULCAHY: No. So I think that would -- if that was the impression, I apologize that's what you took it as. So this is -- we have analyzed a Cameron BOP. Other BOP manufacturer don't even use the same solenoid --

MR. CHRISMAN: The Mark II specifically.

DR. MULCAHY: Yeah, the Mark II specifically. Thank you, Stan. Other BOP manufacturers don't use the same redundant solenoid design. For example, part about doing a hazard risk assessment with a targeted risk reduction in the way that we recommended is that we don't believe all BOPs should be treated the same.

I find one of the more interesting conversations in the report is the question of, should you have two blind shear rams, or should you not? So we are saying that sometimes we think it is the safest choice, and sometimes the risk assessment might determine that it's not the safest. No regulation is a one size fits all.

There are prescriptive regulations that everyone should follow, but the goal of a risk-based regulation or performance-based is that people choose what is the safest for their environment. Not all wells have the same characteristics. This is not a one size fits all solution, and that's why we don't recommend a one size fits all solution in our recommendations.

We expect you and want you to do the hazard analysis for your specific well, your BOP, do you have the rechargeable batteries, do you not? Do you contract out your rebuilding of your solenoids, or do you do it in-house? This is not a one size fits all. This is every individual operation needs to be assessed.

MR. GALLANDER: Well, then -- okay. Then the recommendations for the regulators and stuff may have to be revisited because the implied verbiage implies they are all equal is what I read. And that was my point.

DR. MULCAHY: Thank you.

MR. GALLANDER: Okay.

DR. MULCAHY: I can certainly look at that.

MR. GALLANDER: And I noticed -- I noticed the video that you all had there, while we were trying to find the slideshow and everything, and I know we've had discussions about this, but the excessive compression discussion, did we look at the -- when you looked at the excessive compression -- and this is all through the report, and it's a very telling statement, but when you look at the excessive compression, on the 6-5/8, 32-pound, looking at the wall thickness, how much pressure it would have taken to achieve the amount of compression, differential, and you do have pressure because the annular was closed and the ram was closed.

DR. MULCAHY: Yep.

MR. GALLANDER: How much pressure did it take to go inside the pipe to actually get that deflection to go that far?

DR. MULCAHY: It was the pressure that was measured on the drill pipe. So we used real drill pipe data that was transmitted from the Deepwater Horizon and collected onshore. That was the basis of the modeling that we did.

MR. GALLANDER: Okay. So when you did the modeling, then, you could see in that 20-foot section between the annular and the ram, where it was closed, that you would get that much excursion from the center weld bore all the way up against the --

DR. MULCAHY: Yeah. I'll let you answer that one, Stan.

MR. CHRISMAN: Oh. How much excursion, do you get?

MR. GALLANDER: Yeah. From vertical all the way against the well bore side. Was that included?

MR. CHRISMAN: I can -- I think I can answer that.

MR. GALLANDER: What kind of pressure are we looking at seeing?

MR. CHRISMAN: First, what was actually found was that -- at Michoud there was a measurement of the dimples and impressions in the pipe, and that is documented in the DNV report. And that the drill pipe was actually about a half-inch from the BOP wall when it got trapped. That's what actually happened.

In the finite element modeling, we then attempted to see if we could make the calculations match what we saw in the evidence, and that is the report. I'll refer you to get the details in the report. But that's where we discovered that if the upper pipe ram had been closed, as many had originally assumed, including myself, the drill pipe would not have been where we found it.

The finite element modeling predicts the deflection, and it created a match if you assumed that the upper pipe ram was open and the middle one was closed. So the FEFA modeling calculates the deflection, and I refer you to the report to see all of the engineering details.

MR. GALLANDER: So all of the --

what was the pressure of the requirement to get it to move that far? I mean, did we have --

MR. CHRISMAN: The pressure -- oh, I see your question. The pressure requirement --

MR. GALLANDER: Did it ever to get that pressure --

MR. CHRISMAN: -- to start buckling, it's documented in the report, is -- in the Macondo case it was about -- to buckle, it was about 7,000 psi in the drill pipe, and 1,500 psi outside. And that's in the report in one of the tables.

MR. GALLANDER: Okay.

MR. CHRISMAN: If I misquote by 500 off, the report is right.

MR. LOEB: (Inaudible) I think that's more than twice what anyone else got, so I'm not really sure if this -- this is a public comment session.

MR. GALLANDER: Okay.

MR. LOEB: And, you know, we have allowed you to ask questions of the staff, which is a bit unusual.

MR. GALLANDER: That was good. No, no, no. I thought it was good. It was great to be able to have this discussion.

MR. LOEB: Okay. Then, I hope that -- that at least satisfied you for now.

MR. GALLANDER: Thanks.

DR. MULCAHY: But please come talk to us afterwards.

MR. LOEB: Thank you very much.

Our last speaker is one of our staff members, Hillary Cohen, our Director of the Public Affairs Department. And she wishes to put in the record two statements, one from Senator Edward Markey of Massachusetts, and Congressman Henry Waxman of California.

So please go ahead, Ms. Cohen.

MS. COHEN: Okay. I'll be reading Senator Markey's statement first.

"Blowup preventers should be fail-safe, not destined to fail. This report is another data point in a long history of drilling safety failures that were discovered following BP's oil spill. The report further highlights that other blowout preventers currently being used by the oil industry in offshore drilling could have the same types of deficiencies that led to the BP spill.

"If the oil industry ignores or dismisses this report, they will be ignoring these potential ticking time bombs and the safety reforms that could prevent another tragic incident. We need stronger safety standards that build on the improvements already undertaken by the Obama administration, and we need an oil industry that is willing to reform their ways before history repeats itself."

And this is from Representative Waxman.

"I applaud the Chemical Safety Board's exhaustive technical review of how the

Deepwater Horizon blowout preventer failed to stop the tragic chain of events that killed 11 workers and caused untold environmental harm in the Gulf of Mexico.

"The CSB investigation uncovered new evidence showing that buckling of the drill pipe rendered the blowout preventer inoperable just minutes into the accident -- a finding that has safety implications for the proper functioning of blowout preventers still in use around the world. I urge regulators and the oil industry to review the CSB's investigative findings and take appropriate action to ensure the safety of offshore oil and gas development."

MR. LOEB: Thank you, Ms. Cohen. I might add both statements were in under three minutes, so that's much appreciated.

With that, I turn it back to the Chairman.

CHAIRPERSON MOURE-ERASO: Okay. The next issue on the agenda is to take a

Board vote on the report. And I am going to ask -- I am going to make a motion that is as follows. I move that the Chemical Safety Board approve Investigation Report Number 210-I05, Volumes 1 and 2, entitled Explosion and Fire at the Macondo Well at the Deepwater Horizon rig in the Mississippi Canyon of the Gulf of Mexico that occurred on April 2010, including our findings, recommendations, and associated products, like videos contained in the June 5, 2014, report.

Is there a second for this motion?

MR. GRIFFON: I second the motion, Mr. Chairman. I also would like to make a comment before we go to vote.

CHAIRPERSON MOURE-ERASO: Okay. Yeah. We are open for discussion. So, Mr. Griffon.

MR. GRIFFON: Okay. And I just want to say I plan on voting for the report, because I see the primary recommendation to BSEE as enhancing the SEMS system. I do, however, urge the team in finalizing the regulatory analysis in Volume 3 of our report to examine how the differences in regulatory approaches affect performance and practices on offshore facilities around the world.

I urge them to look beyond the regulatory language to actual implementation experience.

I also share some of the concerns expressed by the public in our public comment session about the CSB addressing other non-technical causes of the incident. Obviously, we had to make a decision of how to release the report, but I certainly agree that we need to finalize Volume 4, which is where I think we will address many of these factors as soon as possible.

And that's all I have. Thank you, Mr. Chairman.

CHAIRPERSON MOURE-ERASO: Thank you. So I call the question.

PARTICIPANT: Okay. I will ask --

I will record the vote, then. Mr. Griffon?

MR. GRIFFON: Yes.

PARTICIPANT: Okay. Thank you.

Mr. Chairman?

CHAIRPERSON MOURE-ERASO: Yes.

PARTICIPANT: In that case, the report has -- and the motion has passed unanimously.

Thank you.

CHAIRPERSON MOURE-ERASO: Thank you very much.

In closing, I would like to say that the report that we have just voted to approve is comprehensive and far-reaching. I believe it's a road map to vastly improve safety in the U.S. offshore drilling industry.

The report makes a number of recommendations to the U.S. Department of Interior and to BSEE, and our findings raise several functionality issues related to the blowout preventer. Likewise, the CSB is making a recommendation to the American

Petroleum Institute to create and publish guidance for industry to establish an effective management system for safety critical elements.

Drilling continues to extend to new depths, and we will operate in increasingly challenging environments. The CSB report and its key findings and recommendations are intended to put the United States in a leading role for improving well-controlled procedures and practices.

To maintain a leadership position, the U.S. should adopt rigorous management methods that go beyond current industry good practices.

Thank you for attending this CSB public meeting, and this meeting is adjourned.

(Whereupon, the above-entitled matter went off the record.)

A

C E R T I F I C A T E

MATTER: Macondo Well/Deepwater Horizon
Public Meeting

DATE: 06-05-14

I hereby certify that the attached transcription of pages 1 to 169 inclusive are to the best of my belief and ability a true, accurate, and complete record of the above referenced proceedings as contained on the provided audio recording.
