

U.S. DEPARTMENT OF TRANSPORTATION

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OFFICE OF HAZARDOUS MATERIALS SAFETY

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RESEARCH & DEVELOPMENT FORUM

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WEDNESDAY,
MARCH 23, 2016

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The forum occurred in the Conference Center, 1200 New Jersey Avenue, S.E., Washington, D.C., at 9:00 a.m., Rick Boyle, Acting Chief of Engineering and Research, presiding.

PRESENT:

RICK BOYLE, Chief of Research and Development,
OHMS
BILL SCHOONOVER, Deputy Associate Administrator
of Field Operations, PHH-3
LAD FALAT, Director of Engineering and Research,
OHMS
VEDA BHARATH, R&D Branch
MARK RANEY, Volpe
SAM ELKIND, UPS
DAPHNE FUENTEVILLA, PhD, Naval Surface Warfare
Center, Carderock
COREY LOVE, PhD, Naval Research Laboratory
GEORGE KERCHNER, PRBA
DAWN JOHNSON, Volpe
FRANCISCO GONZALEZ, FRA
LEONARD MAJORS, Engineering Branch
BRIAN MOORE, Engineering Branch
REFAAT SHAFKEY, Engineering Branch
JACK WERT, CGA
DAVID LORD, Sandia National Laboratory
MICHAEL KLEM, Sciences Branch
RICHARD TARR, Sciences Branch
ANDREA DUNHAM, Sciences Branch
DAVE BROWN, Argonne National Laboratory
CYNTHIA HILTON, IME

SHANNON FOX, Sciences Branch

BRITAIN BRUNER, Sciences Branch

ALSO PRESENT:

JOANNA LU

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

2 9:07 a.m.

3 MR. FALAT: Good morning everyone.

4 Can everyone hear me just fine? All right. On
5 behalf of Pipeline and Hazmat Safety
6 Administration Administrator Dominguez and
7 Associate Administrator for Hazmat Safety Dr.
8 Magdy El-Sibaie, I'd like to welcome you to
9 Office of Hazmat Material Safety Third Annual R&D
10 Forum.

11 My name is Lad Falat and I'm the
12 Director of Engineering, Sciences and R&D for the
13 Office of Hazmat Safety. Rick Boyle, our Chief
14 of R&D and Radioactive Materials, will host you
15 for the next day and a half, and he will soon
16 walk you through the mandatory safety and
17 security briefings for this location. Also
18 joining us up here is Bill Schoonover, our
19 associate administrator on the Hazmat side.

20 I want to thank you for taking the
21 time from your schedules to allow us to inform
22 you about our R&D program. The meeting is

1 intended to give you an opportunity for feedback
2 on PHMSA's existing projects and on the program
3 in general, but also to serve as an outreach for
4 proposals on new initiatives.

5 I will also thank in advance our
6 presenters and their supporting organizations,
7 for taking the time to enrich the forum. Believe
8 me, I know how much work it is to get
9 presentations together, and of course I want to
10 acknowledge and thank Rick and his R&D staff whom
11 he will introduce for pulling all this together.

12 The core mission of Pipeline and
13 Hazmat Safety Administration is of course safety
14 in the transportation of hazardous materials. As
15 such, we analyze our causes of past incidents and
16 close calls, and address them through risk-based
17 research, which may inform future regulatory
18 policy.

19 Another critical aspect of the R&D
20 program, however, is forward-looking, to
21 anticipate emerging hazmat transportation risks.
22 This effort takes varied subject matter expertise

1 from the technical folks such as our chemists and
2 engineers you see in the room, but also
3 economists and the like to analyze market
4 conditions and developing trends.

5 As crude oil was an emerging risk of
6 hazmat transportation by rail several years ago,
7 and by the way it remains in the center of our
8 radar screen today, we must identify and address
9 tomorrow's risk starting -- well, starting
10 yesterday actually.

11 Will the next focus be LNG, liquefied
12 natural gas as a transportation fuel for highway,
13 rail and marine, and a growing export
14 opportunity, or will the next emerging risk be
15 the increasing transportation of ethane and
16 ethylene as a valuable chemical raw material
17 extracted from natural gas or separated from
18 natural gas.

19 So engagement of the regulated
20 industry, you folks, and other interested
21 parties, academia, other federal agencies and as
22 well as old partners within DOT, engagement of

1 all of those is vital to our ability to identify
2 these emerging risks.

3 I see a number of familiar faces in
4 the room. For those who have attended our
5 previous R&D forum, I hope that after the next
6 day and a half you will agree with me that our
7 R&D program has substantially evolved from two
8 years ago and maybe even from last year.

9 We now have resources on board, and as
10 you will see we're implementing a structured
11 framework. We still have a long way to go, but
12 we are keenly aware of the urgency of developing,
13 prioritizing and executing research projects. So
14 without eating up more of the clock, I'll hand it
15 off to Rick Boyle, Office of Hazmat Safety, Chief
16 of R&D, to host this year's meeting and to walk
17 you through our program. Enjoy.

18 MR. BOYLE: Thank you, Lad. But the
19 first thing I'm going to do is introduce Bill
20 Schoonover, our associate administrator for
21 Hazmat Safety and let him give a few welcoming
22 comments. Then you'll be stuck with me for a

1 straight hour, so get your coffee in now. Thank
2 you.

3 MR. SCHOONOVER: So without warning,
4 I think I'm supposed to give you enough time to
5 regroup and prepare for an hour's discussion.
6 Good morning. It's exciting to be here. I'm
7 looking forward to this forum.

8 I do want to thank the group that's
9 put this together. They've spent a lot of time
10 trying to put this together and develop a forum
11 that we could have a lot of dialogue on how we
12 develop and conduct our research program within
13 PHMSA.

14 Our Administrator, Marie Therese
15 Dominguez has -- puts forth three values that we
16 try to espouse, and that is safety, trust and
17 innovation. And you know, I think with this,
18 with this forum is a means of carrying that
19 forward so that we are looking at safety, safety
20 of the industry.

21 We are developing trust that we have,
22 the public trust that has been put into us by

1 yourselves, by our other stakeholders, by
2 Congress who has given us quite a good bit of
3 research dollars to invest, and we're also
4 looking at innovation.

5 You know, our mission and our vision
6 is really to be the most innovative
7 transportation safety organization in the world,
8 and we can only get there by using research and
9 finding solutions, and finding solutions that are
10 not only applicable, but easily put into place
11 everyday and help us move the industry forward.

12 So I'm sure over the next two days
13 you're going to have a chance to have some really
14 good discussion. I've seen the agenda and I
15 think there's a lot of intriguing topics, topic
16 areas that we're looking at, and we look forward
17 to your help in guiding our process. So with
18 that, I'm going to turn it back over to Rick.
19 Thank you.

20 MR. BOYLE: Thank you, Bill. Again,
21 I'm Rick Boyle and I'm in charge of the Research
22 and Development program which is under Lad. So

1 if you start, you start at PHMSA, then you go to
2 Hazmat and then you come down to Engineering and
3 Research and I'm in that group. I'll give thanks
4 to them later, as we go through the
5 presentations, but I think right off the bat we
6 have to talk to our pipeline people.

7 I think Jim Merritt and Bob Smith are
8 probably both online or streaming in, and they've
9 given us a lot of help with their program. They
10 said you know you're about 10 or 15 years behind
11 where we were, that they got hired in and their
12 budgets have been starting to creep up, and they
13 said this is how we got started.

14 So they've really been giving us a lot
15 of help. So it truly is one PHMSA, as they've
16 been helping us walk through. The other thing, I
17 think if you attended last year or the year
18 before, you pretty much, at least last year, you
19 saw me standing up here for almost the whole day
20 just talking, because I was pretty much the
21 program. They really hadn't staffed it up.

22 Tiffany Fossett is outside. She did

1 the admin for me last year, but it was just the
2 two of us running around. Well, this year you're
3 seeing we have more people here. We've arranged
4 video. We have a better agenda, and I think you
5 can thank Joanna Lu came in around Thanksgiving.
6 She came in and my next briefing's going to be on
7 how we're enhancing the program.

8 She was brought in to kind of put that
9 program together, put the strategy in, document
10 the whole process and as we like to say get us
11 ready for an audit, because they seem to be
12 auditing programs all the time. So get our
13 program in line for the audit.

14 I was looking over at Bill because
15 Veda was right over there. Veda also came in --
16 here he is. Veda came in around Christmas and
17 he's the technical side. He'll introduce himself
18 later as he gives a presentation.

19 But he's doing the technical side, so
20 when you come in and when you want to talk about
21 lithium batteries or you want to talk about crude
22 oil or whatever you want to talk about, Veda's

1 going to understand it. If you want to talk
2 about radioactive material, I'll understand it.
3 But you know the other -- the other eight hazard
4 classes are really going to Veda, so that's where
5 he's come in to put that together.

6 So at this point you're seeing us be
7 a little bit more of the whole team. As I go
8 through the program, you'll see we're doing the
9 evaluation. Now I get to -- we say this goes
10 into the stewardess mode. I have to do the
11 administrative details.

12 For emergency and evacuation, if it
13 comes to that, we'll have speakers that will tell
14 you it's time to evacuate. Basically, all I need
15 to tell you is go out either door when you go out
16 right through here through the main. You can go
17 left or right. Both of those will take you
18 outside and just go toward the river.

19 The rally point is to the river. If
20 you go towards the street, you get in trouble
21 with the fire trucks and everything. They can't
22 bring the fire trucks in if thousands of people

1 go that way. So us old timers, our initial rally
2 point was to go the other way, and the fire
3 trucks couldn't get in. So now we go to the
4 river.

5 So if we do have to evacuate, just go
6 out, go to the river. It will be a nightmare to
7 scan everybody back in. I haven't seen how that
8 works, but we're going to hope for the best and I
9 don't think we'll have an evacuation. But it
10 would be go to the river and we'll all rally out
11 there. You'll see people and you'll probably be
12 with people.

13 But just remember to go to the river.
14 Restrooms are come out here, basically right
15 behind me. If you go over here, that's where the
16 restrooms are. You can also go back to the main
17 hallway, turn left and they're down to the
18 hallway. Don't walk so far that you go out
19 through screening, so then you'll have to screen
20 yourself back in.

21 They're out towards -- you'll probably
22 see signs for the credit union or anything if you

1 want to go that way, or they're right back here.
2 Coffee, snacks, lunch, typical government YOYO
3 program. You're on your own for those. You
4 probably saw the small coffee bar as you came in.

5 If you go down the stairs through the
6 elevator bay as you take a right and go down
7 there, there's a snack bar down there. If you
8 come back up the stairs that's where our
9 cafeteria is and you can get more coffee. So
10 you'll be -- I don't know some. If you have
11 government badges, you're completely clear to
12 walk around. The rest of them, you probably want
13 to stay by this coffee bar and then we'll have
14 people over there, over in the cafeteria at
15 lunch.

16 But I think checking in you realize
17 you're pretty much here for the day. So when we
18 have our lunch break, unless you have a badge to
19 get in and out easily, you'll probably want to
20 just eat in the cafeteria and we'll have escorts
21 over there.

22 Cell phones, it's the standard. Just

1 put it on mute, put it on silence, whatever.

2 It's a small room, so it's going to be a little
3 bit warm. Let's not try to bug each other. I'll
4 try not to drink too much coffee and get jittery,
5 and I won't have my cell phone going off.

6 The last thing, anybody -- this is a
7 little bit more for the people that are listening
8 in. If you're having connectivity problems, I
9 know we put out a Skype link, and then we came
10 and had a pre-production meeting here. We said
11 wow, the streaming is so much better and the
12 Skype you have to be flipping through the -- you
13 have to be looking at your screen to see the
14 slides and be holding the phone.

15 So we kind of shut down the Skype. So
16 we want you to go to our streaming side. We
17 figured if you have a Skype access you'd have
18 Internet so you can look at the streaming site.
19 So if you'd go to the streaming site and kind of
20 we shut down Skype.

21 WiFi, as you can probably guess, is
22 pretty limited here. So it's not going to work

1 too well. So you're probably not going to stream
2 yourself. If you have an important question and
3 you want to say what do I look like on the
4 camera, it's probably not going to work. You're
5 going to have to wait.

6 I do want to tell everybody that's
7 here and everybody on the phone, we do have a
8 transcriber here. It's a court reporter, so it's
9 all being typed in. So if all goes well, in
10 about a month you'll see the videos come up. We
11 hope the videos will be cut by topic, by
12 presentation topic so you won't have to watch
13 eight hours of video or try to find out where you
14 are.

15 We'll also have a written transcript
16 so you'll be able to go each way. If you want to
17 combine the two, the video will have closed
18 captioning on the bottom so you can read instead
19 of listen, whatever you'd like to do. It will
20 all be there.

21 All said, administration we've been
22 pretty much warned and everything that our video

1 people have told us have come true. Pick a
2 technology and stick with it. I know when we
3 were looking at Skype, if you left it and tried
4 to come back, you had to make a comment or it was
5 kicking you off.

6 If the phone kicks out, the phone is
7 routed through the meeting room. If you're
8 having any problems, really the streaming side is
9 best, stick with that. If you want to, if you
10 want to make a comment you'll send your comment.

11 There should be a bar. If you're
12 watching in video there should be a comment bar
13 at the bottom that says if you have a question or
14 if you have a comment, send it to the Hazmat
15 Research mailbox, the email system.

16 Joanna is sitting there. She's
17 monitoring that. So anybody that's participating
18 not in this room will send emails in and their
19 questions will come up and we'll monitor.
20 Everybody else here, you can just stand up and
21 ask your question at the microphone. We do have
22 a second camera so that they can -- you can show

1 up on video. We didn't want to just have strange
2 voices in the middle of the video, so we put in a
3 second camera.

4 Again, if you have connectivity
5 problems, if anything's going wrong, we can't
6 tell from here. Send an email and that's
7 hazmatresearch@dot.gov.

8 Quickly to go through the outline or
9 the agenda, I'll be quick. We kept changing it
10 as we wanted to confirm speakers and confirm
11 topics and who was coming in. So we're going to
12 start out -- what I'm going to do is give you an
13 update.

14 Last year I told you it was a big wish
15 list, how we're going to fix our program, what
16 direction we're going to go in. So I'm going to
17 give you an update on what our enhanced program
18 is, what it looks like now, what are our plans as
19 we go forward.

20 Then we'll go to electronic
21 communication. For us it's HM Access is the
22 program. That's the acronym we've been using.

1 But it's really electronic shipping papers and
2 electronic communication. We have Mark Raney
3 from Volpe and we also have Sam Elkind from UPS
4 here to speak on that.

5 We'll go into lithium batteries next,
6 and we have Daphne Fuentesvilla from Carderock,
7 Naval Surface Weapons Center. We shouldn't just
8 say Carderock. It's easier for us to type, and
9 then we have Corey Love from the Naval Research
10 Laboratory to discuss two new programs that we're
11 thinking about or we've gotten started, we've
12 invested in.

13 So we're going to talk about those and
14 how we're moving forward, and if he feels better
15 -- I know I saw the email from George this
16 morning, bad head cold, seeing the doctor at
17 eight.

18 If the doctor lets him come here and
19 he won't infect us all, he'll be here to give a
20 lithium battery presentation. If not, we'll have
21 a longer question and answer period and we can
22 grill Carderock and Veda and Naval Research Lab.

1 You can ask them very tough questions.

2 We'll move in LNG next, and we have
3 Dawn Johnson from Volpe here to speak on some of
4 the work we've been doing up at Volpe. Then we
5 have our partner, Francisco, from the Federal
6 Railroad Administration who will talk, as well as
7 Leonard Majors from the Engineering side of our
8 office will speak on what we're doing, and then
9 Veda will get up and he'll give you the summary
10 on what direction our program is going.

11 We'll have compressed gas research,
12 and, again, our Engineering Group will take over
13 with that, with Brian Moore and Refaat Shafkey
14 giving presentations on the work we're doing, and
15 we'll bring Jack Wert from the CGA, the
16 Compressed Gas Association.

17 Crude oil. We have David Lord here to
18 tell you. That's our biggest project. I think
19 everybody has heard a lot about it. It's a lot
20 of money. Joe Nicholas from our Sciences Group
21 has been heading it up as our subject matter
22 expert. But David's here from Sandia, who's

1 actually doing the work and doing the research,
2 so he'll give us an overview of that.

3 Then another program that we're
4 working through -- Francisco at FRA but through
5 Harvard, Michael Klem will talk to us about the W
6 Inc. Oil Classification Program.

7 We'll go through energetic materials.
8 Dr. Richard Tarr will be giving a presentation on
9 our chained and unchained work, as well as our
10 black powder equivalency, and then Andrea Dunham
11 will come up and they're all with the Sciences
12 Group. So that's an internal section, internal
13 meaning that whole section will be speakers from
14 PHMSA. They'll give us an overview on enhancing
15 the classification and testing of energetic
16 material.

17 Emergency Response will be next. I'll
18 ruin the own surprise of my own presentation,
19 we're printing the 2016 book right now. That's
20 why I'm giving that presentation instead of Tom
21 Kiddy who does the ERG. It's being printed right
22 now. It will start delivering next month.

1 So I'll basically be telling you what
2 enhancement we've made, and then we also have --
3 we're happy to have Dave Brown here from Argonne
4 who I always call him the guru of the green
5 section. If you have any questions on how that
6 green section is put together, what protective
7 action distance is, what happens when it's Table
8 1 and Table 2, ask your questions when Dave comes
9 up.

10 And then Emerging Risks. We kind of
11 put that in as a placeholder. We knew people
12 wanted to speak. I know Cynthia Hilton from the
13 IME wanted to give a presentation or short
14 presentation, so we're looking at smaller, more
15 informal presentations to close out the day as a
16 lead into Thursday morning is discussion groups
17 the whole day and what we're trying to do is
18 we'll give research needs statements.

19 We stole the idea from the TRB, that
20 they have research needs statements. We're
21 trying to put as many topics together so we can
22 gather them together. And that would close out

1 what the agenda's going to look like.

2 Finally, success depends on you. If
3 you're here or in the audience, please step up
4 the microphone, ask questions, tell us what you
5 want. Again, the more topics we have, the more
6 research we can do, the more directions we want
7 to go in. A lot of us have more time sitting
8 upstairs at our desk than out experiencing the
9 regulations and experiencing the hazards and
10 seeing where the gaps are and the risks are,
11 seeing what the capabilities of researchers are.

12 So please, just comment if you're
13 here. If you're streaming, please comment
14 through the email system, and as I said before,
15 the Skype participants, you're probably getting
16 either a blank screen or a screen that says we
17 cancelled the Skype presentation. Go to the
18 streaming side, and that's the link if you go to
19 our Engineering and Research home page is where
20 you'll get.

21 Teleconference participation --
22 whenever we ask for questions, we'll ask our

1 audiovisual people. They'll open up the mics so
2 we'll be able to hear the phone people right
3 through here. So they'll be coming in.

4 And again, if you go home and you're
5 watching the video later or you just think of
6 something or it's something in your everyday
7 work, you can always email the Hazmat Research
8 group.

9 That's our email address. You can
10 send us your research needs statements, your
11 ideas, your thoughts, your comments, anything
12 you'd like to. No spam or junk mail. We get
13 enough of that. But I threw that in at the end
14 so you can give us that at any time, and I will
15 see how it works.

16 We're switching to the next
17 presentation or the first presentation. That
18 concludes the administrative side. Is it on me
19 to go forward or -- get to take a breath. My
20 Marco Rubio moment, have a little coffee. Well
21 he had water, sorry. Cheating.

22 MR. FALAT: What Rick didn't mention

1 is that there's also coffee in the back of the
2 room. But a word of warning. It's only for the
3 break, because I made it. I typically don't make
4 percolator coffee, so I used a half a can, and
5 I'm not sure if that was the right thing to do.

6 (Laughter.)

7 MR. FALAT: On Monday I made a test
8 batch, and it was so strong that when I diluted
9 it 50-50 with water, it was still almost
10 undrinkably strong. So it's only for the brave,
11 it's in the back.

12 MR. BOYLE: Lad's first batch of
13 coffee was the second worst coffee I ever had,
14 because the worst coffee I ever had, the woman
15 that was making it she had never made coffee
16 before. I couldn't imagine that. So she looked
17 -- if you look at the little box, the filters
18 come in, they show that the coffee's all the way
19 to the top. So she took ten cups of coffee all
20 the way to the top. I wonder.

21 It takes a long time for the water get
22 there, so we're like what's taking so long? That

1 was the worst cup of coffee I ever had. But
2 Lad's is about half strength of that and good
3 luck if you can get that down. Oh, it certainly
4 will Bobby, no question of that. Full strength.

5 I don't have to reintroduce myself.
6 I'm still Rick Boyle and I still head up the R&D
7 Program. What I'd like to do now is just give
8 you an overview of our program.

9 At first, we wanted to just give you
10 the strategic side of the program, and then it
11 was requested why don't you put in some of the
12 money at the end, because people come here saying
13 where can I be part of the program, and we always
14 said that's a nice way of saying how much money
15 do you have? So you know, I know how to gear my
16 programs.

17 So we do want to include that. I will
18 tell you, I put in total numbers, our yearly
19 budget, but I didn't give you every number for
20 every project, because what happened is last year
21 all the slides go up and they're searchable on
22 the Internet, and somebody said, where's my

1 money? Right there in your slide last year it
2 said I was getting X amount of money, and I don't
3 have my money yet.

4 So we said we don't want to be putting
5 them up online and have anybody think that
6 they're promised any amount of money. So I took
7 the specific money columns out, but you'll see
8 the programs we're looking at. So I'll give you
9 the overall framework of the program, the
10 strategic system we're working on and then go
11 through a little bit of the programming, all in
12 45 minutes or less and a giant slide deck.

13 So what we wanted to do is again, I've
14 been on the program for about 14 months and
15 everyone else less than six months. So we said
16 where do we even start with the defining of the
17 program? So we went back to the strategic plan
18 that our predecessors put together, and it's
19 about three years old now so we'll be refining
20 it.

21 We said well what did we say was our
22 mission, and basically it was to provide the

1 research and analysis to support the program,
2 which would support safety because we were
3 looking at incidents that had occurred, but we'd
4 also be supporting the regulatory program.

5 So that was where we were looking at,
6 and then as the new administrator came in within
7 the last six months or so, they took a new look,
8 they being all the executives put together a new
9 -- I want to say I don't think it was a strategic
10 plan because they're not here that long. It's
11 not a three to five year plan.

12 So they took a look at strategy and
13 that's the small house or Parthenon-looking
14 structure, that they put it together and put
15 their mission and their goals, and then I knew,
16 boy, those columns are so small there's no way
17 we're going to be able to read those.

18 So I said let's look, and what we
19 wanted to do was compare what our mission was
20 with what the PHMSA goals were and what PHMSA
21 wanted us to do. PHMSA's goals were to promote
22 continuous improvement and I'm going to read

1 through them fast, and when you see the next
2 slide, you'll see why.

3 Promote the continuous improvement and
4 safety performance of the regulated community,
5 invest in safety innovation in the pipeline and
6 hazardous materials sectors, build greater public
7 and stakeholder trust, cultivate organizational
8 excellence and safety culture for our people,
9 pursue operational excellence in our data
10 processes and systems.

11 We said wow, that was a mouthful. So
12 the first day we sat down and said how does any
13 of that apply to us, because the first one when
14 we look at their objectives and what they wanted,
15 it looked like it was an enforcement program. So
16 what we did was sit down and said where does this
17 apply to us.

18 So we took the goals and lined them up
19 in the next column and said what are we doing to
20 achieve PHMSA's goals? How are we going to line
21 ourselves up with the entire organization? What
22 we said is rather than promoting it and going out

1 in the regulated community, how are we promoting
2 safety improvements?

3 What we're looking at is the risk
4 reduction program, doing more root cause analysis
5 and then the prevention side. I think the first
6 thing when the Administrator sat down with me,
7 she said I want to stop studying the old
8 incident; I want to start preventing the one that
9 hasn't happened yet.

10 I want you to start looking forward
11 more, because she felt our research was too based
12 -- too much based on what had already happened,
13 and then stopping that from happening again. She
14 goes I don't want these things to happen anymore.

15 So that was exactly what we wanted to
16 do, and I want to say this. When we go through
17 the rest of the program, we've somewhat split our
18 program in half. We're not going completely away
19 from investigating incidents and accidents and
20 projects that we want to run, but we have added
21 risk reduction and we're calling it, as you see
22 them, either as risk reduction, RR.

1 What we're looking at is picking up
2 ideas from here, looking for gaps and saying how
3 are we going to prevent the next accident by
4 putting broader-based research proposals out
5 there, where we say we're looking for help in
6 this particular risk category and put a few
7 themes out there and let people respond to those.

8 So you're seeing two types of programs
9 being run, but I'm not going to give you two
10 parallel slide paths to say this is how we're
11 doing the prevention, and this is how we're
12 looking back at the incidents. We're generally
13 doing them in the same way.

14 Investing in safety innovations.
15 Again, risk reduction, preventing accidents and
16 looking at emerging risks. That's why we put the
17 second day on this conference. We want to
18 discuss.

19 We want to see where the gaps are. We
20 want to prevent the next incident. Not to say
21 we're not going to look backwards at what's
22 already happened, but want to prevent the next

1 incident.

2 Building greater public and
3 stakeholder trust was probably the easiest one.
4 We sat down right away and said we need a system
5 like Pipeline has, that somebody can go online.
6 They can see what proposals we've put in the
7 system. They can see where their proposal was
8 put in the system. They can see oh, it was
9 evaluated by this panel, these were the results.
10 You either got comments back to say this is how
11 you need to modify your proposal, or you track
12 your program all the way through.

13 If you were funded, you'd see all the
14 way at the end with a report or a piece of
15 equipment or whatever came of that. You'd track
16 it all the way through the system.

17 We're using the pipeline. If you're
18 familiar or you want to go back, the Pipeline
19 Management Information System is our model.
20 They're putting everything together.

21 I do want to tell you, right now,
22 we're working the system or the piece we've put

1 together is the behind the closed doors side,
2 where we're doing all our budget and all the
3 money shows up and we're tracking our statements
4 of work and we're tracking everything.

5 We're doing that internally. We
6 really wouldn't be sharing that with you at all.
7 That would be ours. What we want to do is start
8 putting together where you'll see your proposals,
9 you'll see anything that our contracts office has
10 issued, statements of work. You'll see the
11 public documents, but our budget system will stay
12 behind closed doors.

13 So that's what we're looking on. This
14 is our third forum. We've also started talking
15 about we need, we're calling them mini forums
16 right now. Once a year is probably not going to
17 be enough. We're going to need your help doing
18 more of the evaluation prioritization. So we
19 want to pick up on that as well.

20 And then cultivating organizational
21 excellence and safety. What we're looking for is
22 a broader participation in the program.

1 Previously, you saw the R&D Group, two or three
2 people and then you'd have half a dozen or so
3 engineers and scientists that were interested in
4 R&D in the Engineering Group.

5 Since Lad came in, he kind of rewrote
6 a lot of personnel descriptions and said
7 everyone's going to participate in R&D. So we've
8 been able to expand our subject matter expertise
9 to everyone in the Engineering and Research
10 Division. The best part, too, is Todd Steiner's
11 group and our Analysis Group, which is PHH-60 has
12 also come on board and said we'd like to do some
13 work, some R&D.

14 So they're coming in. So as the word
15 is spreading, we're getting more subject matter
16 experts within PHMSA. The next aspect is we said
17 we want to go outside and through our LNG
18 congressional demand, they said work more with
19 FRA. So you'll see Phani and Francisco are here,
20 and they'll give presentations. We're partnering
21 with our fellow agencies more.

22 Motor Carriers, we met with them

1 yesterday to look at human factor work. So we're
2 reaching out to our modal organizations. Rick
3 Bornhorst is here from FAA. I wouldn't want them
4 to be left out, and the Coast Guard is also here
5 because I love to talk to them about the fracking
6 water and if you barge it all down and when does
7 it become radioactive. That's one of my
8 interests, side interests.

9 So we're trying to get all our modal
10 partners together. You'll see, soon, Joanna
11 said, we're going to have a more public process.
12 So we're going to need experts from the field to
13 participate in our evaluation and prioritization
14 efforts. So we're looking to broaden the entire
15 base of the program, and again to summarize it
16 all, pursue excellence in all of it.

17 Let's not do research for research
18 sake and we'll have the money. We might as well
19 spend it. We want to do things that actually
20 help the program, prevent incidents and keep
21 people safer.

22 So that's the first thing we're

1 looking at is when we do an evaluation of the
2 statement of work is does this matter? Does
3 anybody really care about this or what could
4 possibly go with this?

5 Program enhancement. We got a big
6 promise last year from me that said oh, we're
7 going to do things better. We're going to think
8 strategically and, well, I was thinking a lot of
9 these things but they never got to paper. So
10 you'll probably see this better when you get your
11 slides at home.

12 What we did, Joanna came in and in --
13 I think you spent probably the first 30 days she
14 was here explaining to me what a maturity model
15 is and how we would evaluate our program, and how
16 we could take a current assessment and grow it to
17 a longer-term ever-improving session.

18 So what we did is we said for me
19 primarily, but it also worked in with the model
20 selection, is let's take bite-sized chunks.
21 Let's not write up the biggest plan in the world,
22 where we have thousands of things we have to do.

1 So we wanted to look at three domains, and that
2 would be listed on the far left-hand column.

3 We wanted to look at our organization,
4 how were we put together, how were we running the
5 program. The second domain we wanted to look at
6 is our methods and processes. How are we doing
7 things? How are we collecting ideas? How are we
8 evaluating them? How are we processing them
9 through.

10 The last is the program operations.
11 I always dump that into the program
12 documentation. That's what I have in my mind.
13 How are we putting a management information
14 system together? How are we reporting it back
15 through our budget? How is it supporting? What
16 is what we're doing now supporting the budget
17 request we're making for two years from now? How
18 is what we're doing documenting what we spent and
19 said we were going to spend from two years ago?

20 So we want that whole program
21 operations. So what we did is we have the model
22 and from there you'd want to say well what are

1 you talking about? It's fine if you're with
2 organization, methods and operations. What do
3 you really want to do?

4 So what we developed, and I'm sorry
5 it's so small. We thought we were going to have
6 extra screens. What we did was broke down and we
7 said we made three statements for each domain,
8 and each statement is what are we really talking
9 about? When we say organization, what are you
10 talking about, and I'll read them to you.

11 Organizational -- for the
12 organization. We want the framework of the
13 organization. We wanted to define who we are and
14 what we're doing, what's our culture, basically
15 our safety culture, and then finally, the people
16 and resources. We said how many people do we
17 need, what should they be doing, how should they
18 be operating.

19 A little look into their position
20 descriptions and things like that. What do we
21 want them doing? With the second domain, the
22 methods and process is our business process, is

1 how we are doing things, our collaboration. We
2 said we really thought that the first thing we
3 needed to do was collaborate internally, that we
4 needed to reach out within all of hazmat, and
5 Pipeline was so helpful right off the bat.

6 We said we need to make better use of
7 everybody in PHMSA. Then that started growing to
8 interested parties and industry, and then it just
9 kept growing to FRA and our modal partners. So
10 that's the collaboration we're looking at, and
11 then our actual programming activities, how are
12 we running the program.

13 For program operations, again I look
14 at that as management information system. It
15 doesn't cover all, but it's a good start. We're
16 looking at our business architecture, we're
17 looking at our information systems and
18 architecture, and we're looking at the technology
19 that we're using.

20 Basically, we want to know what we're
21 doing, tracking it internally and then making it
22 transparent and communicate it all to you, so

1 when we come here you'll know exactly what
2 projects we're running. You'll know exactly
3 where your proposals went from last year, and it
4 moves on.

5 This is a little bit of a misnomer.
6 I wanted to show you what we're doing. So if we
7 had a -- if you think these are hard to read, you
8 should see the next one that I wanted to put up
9 and they said you can't put that up. We were
10 growing it like a tree.

11 We started with three domains; then we
12 had three statements or three subject areas in
13 each one of those domains, and then we have five
14 rating factors for each one of those. So you can
15 see as that tree grows out, you're never going to
16 see it on this screen. So they said just talk
17 people through that.

18 So what we've done is we've created,
19 we evaluated ourselves, where are we right now
20 and we said organizationally, these are our three
21 important areas. We have five criteria for each
22 one of those areas. Where do we stand right now?

1 What we came up with, this is an overview of it.

2 You come up -- I don't think it's any
3 secret. We're not proud of it, we're not ashamed
4 of it. We really came up with a Level 1. We're
5 in a developing program status. But what we felt
6 was the good part about doing it so far tiered
7 out is we could really sit down with Lad and with
8 Bill and with Magdy and our supervisors and say
9 this is where we want to take the program. This
10 is where we think we're weakest, and we had 15 or
11 20 choices, rather than saying we think it's
12 going to be organizational and they'd go, well
13 what are you talking about?

14 So we could lay it all out and then
15 this, our Thanksgiving/Christmas effort will be
16 we'll do a new current status. We'll evaluate
17 ourselves every year and hopefully next year I'll
18 be coming in and saying we're a Level 2 or in
19 organization we're a Level 3 that will do these
20 things continually.

21 We're hoping, or our plan is in about
22 three or four years we'll be telling you we're a

1 Level 4 developed, mature program that's
2 operating efficiently, and then Joanna will have
3 to give us new organizational, new domains and
4 new statements as to how can we get even better.

5 So that's the strategic side. I think
6 a little more, probably a little more interesting
7 for you guys to say where do I really fit in the
8 process and what am I doing. This is how our
9 workflow is coming and how are we getting
10 projects, how are we getting ideas and how are we
11 taking them through, if you want to say, a
12 contract award or an actual research contract?

13 Probably not too much different than
14 you think, but I do want to say some of it is
15 still evolving, that we're trying to get more
16 people involved. But we're also under a time
17 crunch that money needs to be spent within the
18 fiscal year constraint.

19 So it's -- you know, that's why I said
20 in three or four years, we'll be the fully
21 perfect program. It doesn't happen in six
22 months. What you're looking at, as we come into

1 the top you'll see we label them the TRB. IP
2 could be international programs. It could be
3 interested parties.

4 The acronym's don't really matter that
5 much, because what we're doing is over time
6 collecting ideas and the ideas are represented as
7 this evolves, the ideas, the research needs
8 statements. If we go to TRB and we see they have
9 a needs statement or something we want to do, if
10 somebody's identified a gap, we're kind of
11 putting those in the hopper.

12 It goes through. We present many of
13 them here at the Research Forum. We collect even
14 more at the Research Forum, and what they do is
15 come across as the first box on your left, it's
16 reviewing the information and risk. What we want
17 to do is take all these ideas and that's a dark
18 blue box, and dark blue means we wanted outsider
19 participation and outsider meaning outside the
20 Office of Hazardous Material Safety.

21 When I say outside, we want more than
22 just our subject matter experts looking at these.

1 So we want to review everything we've had and do
2 a really rough screen, you know, maybe 50 percent
3 are good, 60 percent are good. Just screen out
4 the ones that really just don't make sense, are
5 really not hazmat oriented.

6 If they're too multi-modal in nature,
7 we'll send them over to TRB and say this is too
8 big for us. If they are more for Coast Guard or
9 FRA, we'll send them out to them. So we'll
10 screen through with them and establish our own
11 priorities, and that's the next box as we're
12 coming across.

13 It will be establish priorities. Then
14 what we want to do, the next two are lighter-
15 color boxes. They'll be internal. We'll take
16 our subject matter experts and that will be in
17 our Sciences and Engineering Group, and what we
18 want to do is make sure we haven't done that
19 research before.

20 I don't want to call it a literature
21 search, but it's a little bit of a literature
22 search or your expertise search. Reach out to

1 your experts. Let's make sure we're not
2 reinventing the wheel. Let's make sure, you
3 know. It's always -- I always kid around with
4 contractors that say the best contractor sells
5 the same thing two or three times.

6 We want to make sure we're not going
7 down that road, that we're like I think we saw
8 that before. So just do a little screening from
9 our own expertise, a little literature search and
10 make sure it's clean.

11 I think the next two boxes, Joanna and
12 I have a constant battle, which one comes first.
13 Right now we have a lighter box, which means we
14 take it to our management and say these are our
15 priorities and this is what we want to do, and we
16 present it and say that's what we want to do, and
17 that would be the Magdy El-Sibaie level at the
18 associate administrator or maybe even the
19 administrator.

20 We'd have a briefing and say this is
21 what we want to do over the coming year. Then it
22 would go, as it stays now, then we'd take that

1 out and somewhat publish it, maybe have another
2 meeting here and get the public input to it and
3 say what do you want to do.

4 For me, I say I think that's reversed.
5 We should get the public buy-in and then we can
6 go to our management and say we've briefed this.
7 Everybody's in line with it, it's all good. You
8 can make a decision and we're struggling over
9 which group we should do first.

10 So at this point, we're going to take
11 it to our management first. We're going to get a
12 list and that lines up with our communications
13 goals that say before you release a large plan to
14 the public, get management buy-in on it.

15 So I think this reflects our
16 communication standards now, and then what you'll
17 see, what we put in in project development, which
18 is somewhat new for us.

19 It's not only new concepts, but there
20 will be acquisition planning, how we'd source an
21 award, how we're going to evaluate those, how
22 we're managing the contract, how we're evaluating

1 the results. And then how are we promoting the
2 results because for us, the worse research
3 program in the world is to have a book shelf full
4 of reports, and say here's the FY '16 bookshelf
5 because we've got all these reports.

6 It might be good, but we're looking
7 for more than that and that we'd have more output
8 and we'd have devices or equipment we're putting
9 out. We'd have suggestions. We'd commercialize
10 some of our work.

11 Now this, Joanna said you know, you're
12 pitching the same slide twice. I just took that
13 column and made it a circle. So you're telling
14 the same story twice, and I said oh, not so fast.
15 I see it completely different. What the circle
16 reminds me of is we're going to do this year
17 after year after year.

18 So if you say every year we're going
19 to come across the top and generate new research
20 ideas, they're going to go down in that circle of
21 evaluation. Now what's in that circle already is
22 last year's projects. If you're given a three

1 year funding, well you're going to be
2 reevaluated, that if I haven't seen anything from
3 you or I said that was kind of a dry hole. That
4 didn't turn out to be the problem we thought it
5 was going to be, what we'd be able to do is
6 evaluate and I'll be blunt.

7 We'll cut your funding off. We'll say
8 that one's just not achieving the results we
9 want. It's not where we want to go. So what
10 this means to me is it's not individual years
11 where you get your money and we say you're good
12 to go for three years. Let us know when you're
13 done. We're going to reevaluate you year by year
14 and if you're not producing or we're not seeing
15 the results we want, we're going to shut that
16 program down in favor of a new idea.

17 And again, I don't know. We haven't
18 had in our mind how many will be multi-year
19 projects, how many will be single year projects.
20 But that's what we're looking to do, is it will
21 be a continuing process we're evaluating.

22 Now for the interesting part for some

1 of us is to where do we spend our money, what do
2 we have, and since I have I think about ten
3 minutes left, we don't want to -- we don't want
4 to drill down too deep in all these and luckily
5 it's hard for you guys to see. So I'll read some
6 of this off.

7 With our FY '14 to '16 money, just to
8 be clear, we get three year money. Our goal,
9 long term, is to spend about 60 to 75 percent of
10 the money in the first year, and then the extra,
11 if you want to say the remaining money would be
12 for the contracts that we say are multi-year or
13 follow-on.

14 But our goal is to spend it 75 percent
15 in the first year. That's quite a change from
16 what we normally have. We've normally been
17 spending in the second and third year, so it's a
18 big shift. So what you're seeing, I've color-
19 coded it. Some of the PRs, purchase requests
20 that we've submitted that we've just submitted
21 this winter, you'll see we're supporting the ERG.
22 Dave Brown will brief on the green section. He

1 has a whole model to do the toxic by inhalation
2 modeling, and we pay Argonne annually to maintain
3 that.

4 He's also doing reactivity studies,
5 which I could tell you loads about but he's going
6 to tell you later this afternoon. So he's much
7 smarter than I am. We're doing some black powder
8 equivalency work. We have two lithium battery
9 projects and then currently through the FAST Act
10 we were required to do an insurance and liability
11 study for rail transport. So we're funding that
12 as well.

13 So that's what -- those are the, if
14 you want to say new projects that we've really
15 got going. I've put submission by March using,
16 you know, we were going to say we're going to
17 submit them before the Forum starts.

18 If you look at the blue section, those
19 are projects that we've submitted a long time
20 ago. IDIQ, I'm going to have a slide on that.
21 It's Indefinite Delivery, Indefinite Quantity,
22 and what we did was split that in half. We

1 wanted to set up a commercial entity where we
2 could send task orders and it would be --

3 I don't want to say it's all for
4 enforcement; it's more of a rapid response where
5 if we see a problem, we can say please analyze
6 this right away and send a task order. If it was
7 a deterministic, if it was testing we'd say,
8 here, test this material and we could send task
9 orders out and we'd have a contractor already set
10 up.

11 So we put those two out there, and
12 what I want to do is I promised our budget people
13 those announcements are on the street now, I
14 said, so I'm not supposed to talk about them.
15 They said no, you can talk about them. It's
16 fine. The solicitations are out. I've provided
17 the solicitation numbers, and then you just have
18 to go to the website below and you'll be able to
19 pick up and you'll be able to bid.

20 If my memory serves me, I think we're
21 still in the question and answer period. If you
22 have questions, comments, don't understand

1 anything, I believe you have about another week
2 to make sure you're clear on what we're doing,
3 and then you probably have two or three weeks
4 from today before bids close.

5 So what we did was divided that.
6 Initially when we put our first request out, we
7 want a company to do it all. The comments we got
8 back is, you know, you really don't have a
9 company that can do all the analytical work and
10 all the testing. Break it in two.

11 So that's what we've done, and I do
12 think some of the comments were down in testing
13 is you don't have testing companies that can test
14 all nine hazard classes, anything you want. So
15 we're seeing what kind of bids come in. But we
16 do want to tell you that indefinite delivery,
17 indefinite quantity, what we're looking for is
18 setting up a contract for testing and then
19 setting up a different contract to be analytical.

20 At this point we're looking at one
21 company at a time. If it's successful, we may
22 put it out again and look for multiple companies.

1 So we'd have multiple test labs or multiple test
2 facilities, multiple analytical. Right now we're
3 going to bite, take a small bite off the apple
4 and set it up once and see how that works.

5 So we also have money. We got money
6 in FY '15 to '17, and that was \$7 million. So
7 the easy pie steps were the safe transport of
8 energy products. It looks broad like we could
9 spend it on any energy product, but as we read
10 the language and our projects came in, it was
11 really crude oil.

12 Step was almost synonymous with crude
13 oil and David Lord will come in and talk to you
14 about the project we're working with, we being
15 the Department of Transportation. Department of
16 Energy have funded Sandia National Lab to do
17 crude oil classification work.

18 Rather than me butcher the topic,
19 David gave the best presentation I've seen on it.
20 I've seen about a half a dozen presentations.
21 This really made sense with me and brought it all
22 to light with me. So if you love David, you

1 think like I do. If you said David didn't make
2 any sense, you're thinking like other people,
3 other scientists in the room that liked other
4 presentations.

5 But that money was generally spent.
6 That money has been put on contract and is out.
7 Our LNG money, liquefied natural gas, we're
8 partnering most of that money with Federal Rail.
9 We're looking at doing tests on intermodal
10 containers and we're going to have Leonard Majors
11 and Francisco get up and talk about those
12 programs and tell you what's going on in a later
13 section.

14 So again, I won't butcher that. But
15 what I want to talk, because when we met with
16 some of the interested parties, they say, tell
17 us, you know, what they consider as a gap is
18 where you have money left. What could we propose
19 and there would be money left.

20 I'll tell you in that LNG section
21 you're looking, we could have half a million
22 dollars left and say to do LNG work. Right now

1 we're working. We're doing some thermal work.
2 We don't know how far that's comes along right
3 now. But if you want to say what has a statement
4 of work or what has a problem statement attached
5 to it, you'd be saying about a generous half a
6 million dollars is left there.

7 From the discretionary side, what
8 we're looking to do, it's open but it's not open.
9 What we're looking at is we have about a million
10 and a half left, but we want we want to do is use
11 the topics that we generate, that we've already
12 generated.

13 Remember all the balls going into the
14 funnel to feed into the research forum. What we
15 want to do is take those out and say those are
16 the research contracts we're going to issue for
17 the risk areas that were identified by
18 management, by our interested parties, by our
19 modal authorities, by our research forum.

20 These are the hazards and gaps that
21 are coming through, and then what we do is put
22 out a request for proposals or request for bids,

1 if you will, to say who can help us do this
2 research. So right now, the discretionary pot
3 would show about a million and a half open, but
4 that's what we want to do with it.

5 We want to put it out to say who can
6 help us with emerging risks such as who can help
7 us with safety improvements such as. So we'd be
8 looking to put those out. I think our initial
9 goals is to get those to our contract office by
10 the 4th of July, and then so you'd see those go
11 out on the street late summer or early fall to
12 say who can help us with this research.

13 So if you're talking at the microphone
14 or asking questions or bringing up gaps and
15 issues, what you'll see is those be put into
16 these general research proposals and announced in
17 the summer, if all goes well. That's the plan
18 with that. So there is money there. If you
19 recognize and say here's a specific problem,
20 here's a specific project, we could pull the
21 money out of there.

22 '16 to '18 funding, seven and a half

1 million. I think what I'd want to say is, again,
2 we see the risk assessment or the risk reduction
3 being an annual effort to the million and a half,
4 million and three quarter level. So you'd see
5 that be pulling it up. That's the green section
6 down at the bottom.

7 What you're looking at, where you're
8 most interested is new starts. Two and a half
9 million dollars is we have projects. In a sense
10 we have a list of projects. We're always looking
11 to have that project grow. If you remember the
12 chart as you're coming across the board, we're
13 going to evaluate and prioritize. We're going to
14 start evaluating and prioritizing everything we
15 have in the loop and start funding those.

16 So if you propose new starts, if you
17 propose new ideas, you'll either be put in a
18 general research topic with a Broad Agency
19 Announcement, or we'll look specifically to your
20 project and we have about two million dollars for
21 you in the purple section that's showing up on
22 this chart.

1 And again, all these will come to you
2 online. I don't know how fast they'll be
3 available, but I'm pretty certain you'll have all
4 the slides by the end of the week, because we
5 have them now. Veda has them and it's a simple
6 case. We go to our IT team and they post them on
7 the website within 48 hours.

8 So you should see all these slides by
9 the end of the week. So these -- you'll see the
10 dollar figures and you'll see what I'm talking
11 about. Looking forward and just to close out
12 before Veda cuts me off, he's getting ready.
13 He's the meanest guy we've hired next to me.

14 Challenges on future actions. I hope
15 it's big enough. You can see what day I was
16 putting the challenges slide together. Metro, it
17 was the day last Wednesday when they closed
18 everything down. So we said project improvement
19 and program management is something we really
20 need. That's the biggest challenge.

21 We're really starting from scratch.
22 Again, I've done radioactive material for 20

1 years. So when Lad said guess what, you're going
2 to do R&D. You're doing real well at it. I said
3 well okay. So there's the challenge of program
4 definition, improvement, documentation,
5 management information systems. You can put all
6 of that in there.

7 I think the next is -- I used a few
8 traffic signs. You say no U-turn. Well we're
9 saying there's no going back. When they said
10 you're hired in to do this job, we want it done,
11 they didn't say -- unless it turns out later on
12 you don't really want to do it.

13 So there's no going back. We're
14 committed to this process. We think we've got
15 the right pieces in place. We've got the right
16 model in place. We've got the right
17 documentation in place. We have the pipeline
18 people that have helped us and moved us forward.

19 So we don't think there's any going
20 back and we don't think we're going around in
21 circles and never going to accomplish anything.
22 Lastly, our long term challenge is we want this

1 to feed into our budget request. We want to say
2 here's all our thoughts, here's all our efforts,
3 here are all our programs, here are our
4 priorities and we want to be feeding those into
5 the budget process for a year or two from now,
6 rather than having more the budget process
7 feeding back to us saying you've got a pot of
8 money, now spend it. So we're looking at
9 rotating the program around.

10 What are our future actions? I like
11 the electric car. That's a little Duracell
12 battery if you can't see it. Our problem is to
13 get the whole program defined, that I started
14 writing it a year ago when it was just me. I
15 started writing, I said this is a hopeless cause
16 and I just stopped.

17 I said I couldn't write the whole
18 standard operating procedure and define the whole
19 program. So I said get me some help. Get me
20 somebody that knows what they're talking about.
21 So Lad said Joanna can come in. So we hired
22 Joanna. So her whole job next year if you're

1 lucky, she'll stand up here and she'll have a
2 giant document and say here's our standard
3 operating procedure. Here's the whole plan. I'm
4 going to give you a briefing of this book that
5 defines our program.

6 That's where we're looking to, and
7 then maybe next year or the year after, you'll
8 say I really don't need Joanna's brief anymore
9 because your management system is all online, and
10 I can see everything online. I can see where my
11 projects are, I can see everything in the hopper.
12 I can see everything you're doing.

13 Training. Who knew? Our budget
14 office came down and said you need contractual
15 training. You need to be a contracting officer's
16 representatives, and Veda and I said we don't
17 even know how to spell that. So there are
18 training requirements. We need to bring
19 ourselves up in line.

20 The other thing we looked at is we
21 said if we're looking to, you know, award a
22 million or two million dollar projects to Sandia

1 to look at oil, shouldn't those subject matter
2 experts have some sort of contractual awareness?
3 If we want to start co-funding with TRB,
4 shouldn't we have a higher level of training than
5 we have now?

6 So we put together training plans, and
7 then the last challenge is to keep our partnering
8 going, that it's easy to sit in our own office
9 and never go upstairs to FRA. It's easy to say
10 Coast Guard isn't part of DOT anymore, so we
11 don't have to talk to them, and FAA has their own
12 buildings over there at L'Enfant Plaza. We never
13 have to go over there.

14 It's real easy to ignore them. We
15 don't want to do that. We want to rely on their
16 expertise as well as industry. We want to keep
17 you involved. You know what's going on out
18 there. You know what we're not doing well. You
19 know what we are doing well, so we want to have
20 you guys involved.

21 And with Veda's permission, I get to
22 say thank you and ask if there are any questions.

1 If you have any -- through the whole day and
2 tomorrow you can ask Veda anything. You can give
3 him your card. We're going to have comment cards
4 out front if you just want to submit a question
5 because you don't want to stand up at the mic.

6 Joanna's available, Veda's available,
7 I'm available. Even Lad's available. Lad might
8 tell you to go see one of the three of us, but
9 he's available to take questions and comments.
10 We deem him quasi-core, quasi-subject matter
11 expert. He gets to wear two hats.

12 So -- and if you have any questions I
13 can take them now, or we'll just move into the
14 next piece. Frank, how are you? In the back of
15 the room please. Please come to the microphone
16 and introduce yourself, the microphone in the
17 center of the room. That would be true not just
18 with Frank but everybody, because you'll be on
19 the camera. So you need to tell us who you are
20 so the court reporter can comment on that.

21 MR. LISAK: I'm Frank Lisak. I'm
22 with PHH-60, and I wanted to ask Rick, will you

1 be putting these slides online for us to review
2 later on?

3 MR. BOYLE: Yes. What we were doing
4 is we were in panic mode earlier this week just
5 to get them ready, because we had to put them on
6 a thumb drive so they'd be on the IT section. So
7 what we're doing is we said just as we kind of
8 locked down the agenda on Monday and posted that
9 online, all the slides and presentations are
10 locked down as they're given today, and Veda will
11 take the same thumb drive that he gave to the IT
12 people today or roughly the same, maybe not the
13 exact same one.

14 But then they'll be posted. We'll put
15 them online. I would expect they'll be there by
16 Friday.

17 MR. LISAK: Thank you very much, Rick.

18 MR. MILLER: Thank you. David Miller,
19 American Petroleum Institute. Great overview. A
20 question early on in the presentation. You
21 talked a bit about mini-forums. Can you describe
22 those a bit more? Are they going to be thematic

1 or on a specific project?

2 MR. BOYLE: Yes. Yes I can talk
3 about them and they're in the planning phase. I
4 think what we're looking at is here we're looking
5 at a big meeting wherever -- I'll say all nine
6 hazard classes are open. As we get proposals in,
7 let's say for the sake of argument only people
8 want to talk about crude oil.

9 We have crude oil and LNG are the only
10 products or the only ones that are high priority.
11 What we'd do is call subject experts on those two
12 topics and maybe have two meetings and do it
13 topic by topic. There will be at some point
14 we're planning an overview.

15 I don't think we're at the point yet,
16 so I'd say maybe we're a year away from almost
17 saying there's an executive panel, if you will,
18 that meets, that will have some of the more
19 senior people and will have an overview, and
20 they'll be cross-cutting, I'll say against all
21 nine hazard classes.

22 But I think at this point we'd be

1 looking at thematic or topic areas, small
2 meetings. Thank you, David.

3 MR. WILLAUER: David Willauer,
4 Cambridge Systematics. I was just curious. The
5 TRB is doing a study on flammable liquids, crude
6 oil, ethanol and natural gas.

7 I was curious why ethanol was left out
8 of the mix today as a high volume flammable
9 liquid, whether that was already being covered in
10 another topic and if you guys have given that
11 some thought. Thank you.

12 MR. BOYLE: We have given it thought.
13 I think what we were -- why it's not on today is
14 we were trying to give projects we had defined
15 and we had statements of work, so if people had
16 questions we could say this is what we're working
17 on.

18 We are looking -- we did expand in our
19 own mind to energy products, of staying STEP
20 would be more than just crude oil and we'd start
21 taking some of the money that we said was
22 discretionary and start feeding that back into

1 the energy product line.

2 I think we're going to have a
3 presentation or Brian Moore may touch on
4 compressed natural gas and then in the Emerging
5 Technologies Britain Bruner's going to present
6 some of the new natural gas and that would be the
7 time that comes forward.

8 The other aspect we'd look for, we
9 hope you're going to stay on Thursday, or at
10 least submit a comment to say you should be
11 looking into this area, because that's the type
12 of topic if it's growing. And I know Chris
13 Biggers (phonetic) was here.

14 PHH-60 hired or assigned an emerging
15 energy subject matter expert, and we asked him if
16 he'd look at ethane and looking at the emerging
17 market and should we be doing anything about it.
18 So if Chris shows up again, Rob Benedict is
19 standing right there by the door. He works or
20 he's Chris' boss or I'm going to claim he's
21 Chris' boss.

22 So the ethane work would be talk to

1 Rob and see what Chris is doing, because that's
2 the problem definition leading to the statement
3 of work that's going to come from Chris. You've
4 handled the worse part of the day, me for an
5 hour. Now you get the quality presentations.

6 We have about five minutes to stretch.
7 Just a little bit more administration. For
8 presentations, we're going to ask that people
9 giving presentations, we've saved the front three
10 chairs if you'd come up and sit here. It looks
11 -- it's a little annoying if you sit at the table
12 all the time, probably annoying for you because
13 you can't see the screen as well as with the
14 video. It may pick you up.

15 So we're going to ask the presenters
16 to sit in these chairs and then I'll come back.
17 I'm going to host the morning, Veda's going to
18 host the afternoon. We'll introduce you, and
19 then at the end of the session if we have
20 question and answers, we'll bring you up and
21 we'll sit at the table at that time and they'll
22 turn the camera to the table.

1 So if you're giving a presentation in
2 that section, please come up and sit in the
3 front, and then I'll kind of introduce you.
4 You'll speak and then you'll sit back down and
5 come to the table.

6 We've got a couple of minutes. If you
7 want to stand up and stretch as we reshift, and
8 then the next thing we'll is Mark Raney with
9 Volpe on the HM Access program, past, present and
10 future. Sam from UPS will also be here.

11 (Whereupon, the above-entitled matter
12 went off the record at 10:00 a.m. and resumed at
13 10:15 a.m.)

14 MR. BOYLE: If I can get you to take
15 your seats. I think I'm going to have to owe Lad
16 some lunch, because I said nobody will want your
17 coffee. That's awful. So I think we had a lunch
18 riding on it or anything. So I think I'm buying
19 the next lunch, Lad. Can you take your seats
20 please, so we can stay on schedule?

21 (Pause.)

22 MR. BOYLE: Thank you. The first

1 section or the first topic we're going to cover
2 is the electronic communication and there will
3 also be, in addition to questions and comments at
4 this presentation this morning, there will be a
5 whole session, they'll be a half an hour session
6 that's talking on electronic communication.

7 So if you don't get your question in
8 today or we run out of time, come in tomorrow or
9 send your question in tomorrow, because we're
10 going to have a whole session on electronic
11 communication and the globalized harmonized
12 system. So without wasting any more of Mark's
13 time, I'd like to introduce Mark Raney from
14 Volpe, who's been working on the HM Access
15 program for longer than I've been here. So much
16 longer than the year and a half that I've been
17 here.

18 What he'll do is touch on where are we
19 -- what we've finished and he'll also give you
20 where we're headed in the future. So Mark,
21 please --

22 MR. RANEY: Thank you, Rick. So as

1 Rick mentioned, this has actually been going on
2 for a while. It's a large program, so it's an
3 awful lot to cover in a short period of time. So
4 what I'm going to be doing is hitting some of the
5 high points, discussing the activities that have
6 been conducted, what the findings were,
7 recommendations and what our next steps will be.

8 But it is going to be at the high
9 level and if you have additional questions, I'll
10 be happy to answer those during the Q and A
11 period or during one of our scheduled breaks as
12 we move forward.

13 So for those unfamiliar with HM
14 Access, it's actually a pilot program under Map
15 21. The purpose of the program is to look at the
16 -- evaluating the feasibility and effectiveness
17 of paperless hazardous communications systems,
18 really e-Systems, and their ability to provide an
19 equivalent level of safety as compared to the
20 current paper-based requirements.

21 The intent of the program is to look
22 for all transportation modes, to evaluate the

1 performance and impacts associated with using e-
2 Systems. I just want to clarify. HM Access
3 itself is not the system. It's a study of the
4 performance of systems. Sometimes that's how
5 people get that confused.

6 So I'm sure everyone in this room in
7 this room is aware that current regulations
8 require the use of a paper copy to accompany
9 every hazardous materials during transport. The
10 rationale behind the paper system is that it's a
11 consistent manner to -- that is widely understood
12 amongst all stakeholder groups that need to have
13 access to the information.

14 But for a while now, a number of
15 stakeholders have been asking to be able to use
16 electronic systems to communicate the
17 information, and that is really the next step in
18 the evolution of hazardous communication, and it
19 does -- and E-Systems do offer the potential not
20 only to industry but offer potential benefits to
21 inspectors and responders.

22 So in terms of the activities that

1 have been conducted, so in accordance with Map
2 21, because it is a Map 21 program, we consulted
3 with various hazardous material stakeholders,
4 both within state and federal inspectors and
5 responders as well as industry, primarily with
6 shippers and carriers.

7 We conducted pilot tests that test the
8 performance of these systems, and we collected
9 additional data to support an impact analysis or
10 qualitative impact analysis. All of these
11 activities, the pilot test, data collection,
12 required development of a data collection plan
13 and development questions to collect the
14 information and that all had to be conducted in
15 accordance with the Paper Reduction Act.

16 At the end of the pilot test, we
17 prepared a feasibility and assessment report for
18 the Secretary to provide to Congress. Like I
19 said, I'll be going through these fairly quickly,
20 but I'll be happy to answer additional questions
21 on details after the presentation.

22 So as I mentioned, we did talk with

1 various -- various hazard material stakeholder
2 groups, and the purpose of those consultation
3 aspects was to obtain feedback on the priorities,
4 gaps, concerns, operational requirements
5 associated with using e-Systems.

6 We gathered information from
7 approximately 90 plus individual groups. We also
8 conducted public workshops and a lot of that
9 information is also available on separate
10 information papers that are available at PHMSA's
11 website.

12 So in terms of the pilot tests, they
13 were conducted between February and May 2015,
14 within five U.S. regions that align with PHMSA's
15 service areas. They included one rural areas,
16 which was a requirement under Map 21, and as I
17 mentioned the purpose was to actually test the
18 use of these systems.

19 So all of the participants involved
20 were volunteers. The representing shippers and
21 carriers, emergency responders and law
22 enforcement. We actually had, what was that, 35

1 entities that had volunteered, met the
2 requirements and were eligible to participate.

3 Unfortunately, only about 20 were able
4 to participate just because of the availability
5 of hazardous materials shipments that occurred
6 within -- with those participants within the
7 pilot test period, because we were actually
8 utilizing real life shipments during the
9 occurrence of these tests.

10 Emergency responders and law
11 enforcement actually conducted the simulations
12 with the participating shippers and carriers.
13 They collected the information and reported the
14 results of those tests using online
15 questionnaires. What was really the intent of
16 the pilot tests were to mimic real life to the
17 extent possible.

18 So the simulations were unscripted,
19 following participants' own policies and
20 procedures, using their own existing equipment
21 and resources, and during the test we still had
22 to use -- every shipment still had to have a

1 company shipping paper accompanying the shipment
2 as a requirement under Map 21. It had to still
3 stay within those current regulations. We
4 couldn't exempt from those. We were looking to
5 test our modes.

6 We actually conducted 21 simulations,
7 five emergency response simulations which cut
8 across all modes, an additional 16 inspection
9 simulations that were associated with roadway and
10 maritime. Unfortunately, we weren't able to
11 conduct any inspections with air and rail modes,
12 just to the availability or unavailability of
13 hazard material shipments within those modes with
14 our pilot test participants during the pilot test
15 period.

16 In terms of the time associated with
17 receiving electronic information during these
18 simulations, during the emergency response
19 simulations 60 percent of the time they received
20 the information in less than five minutes. In
21 all cases it was received within less than 30
22 minutes.

1 For inspections, it took a little bit
2 longer. Eighty percent of the time it was less
3 than 30 minutes. About half the time it was less
4 than 15 minutes. Part of the reason for this was
5 all the -- the majority of all the transfers was
6 actually provided not directly from the driver to
7 the inspector or responder but was actually
8 provided from an offsite office location.

9 So that created some additional time
10 lags and we expect if the driver had the
11 capability to provide the information directly,
12 that would have significantly reduced the time.
13 I should point out in all cases the electronic
14 information received did match that of the hard
15 copy shipping paper, and was representative of
16 the hazmat being transported.

17 Concurrent with the pilot test, we
18 collected data for the qualitative impact
19 analysis. We collected information not only from
20 pilot test participants but from a larger
21 stakeholder group, and we -- the information was
22 provided using online questionnaires.

1 So it was done at the same time as the
2 pilot test, so that's between February-May 2015.
3 We actually received 92 responders and responses.
4 Forty-one percent was from emergency response and
5 law enforcement, primarily from emergency
6 response, and 59 percent from across the
7 hazardous material industry, shippers, carriers
8 as well as also hazardous material trainers,
9 equipment vendors and a variety of others.

10 Because it was a smaller sample size,
11 we can't necessarily generalize to the broad HM
12 community. But it was indicative of potential
13 benefits in a number of areas. The majority of
14 respondents that had experience with these
15 systems, they believe that these systems offer
16 benefits in terms of safety-related benefits, as
17 well as associated operational and cost benefits.

18 So some of the additional pilot test
19 findings. In all 21 cases, the participants in
20 this was using their own equipment and was their
21 own choice. They all chose to communicate the
22 electronic shipment papers via a PDF format.

1 It was something that was easily
2 transmitted and received from all -- between
3 carriers or shippers and with the corresponding
4 inspector and responder, and it was easily -- it
5 could be read by those groups.

6 In some cases, the inspector responder
7 did indicate though that they had some difficulty
8 reading the shipping paper information on their
9 Smartphones, mainly due to the screen size and
10 try to move around and see all the information,
11 but in some cases also because the PDF that was
12 provided was a scanned copy of the hard copy
13 shipping paper, and it was in some areas a little
14 bit more illegible.

15 There was mixed feedback in regards to
16 potential benefits from our inspectors and
17 responders that participated in the pilot test.
18 Most responders, 80 percent actually felt that e-
19 Systems could positively affect the time needed
20 to respond to an incident, assuming that
21 connectivity was available.

22 Inspectors, 88 percent, felt that it

1 didn't provide any additional benefits over the
2 current paper-based system. I saw some mention
3 that some of the delays, and as I alluded to
4 earlier, some of the delays that we did encounter
5 in terms of receiving information was more due to
6 the information we provided offsite versus
7 directly from the driver, and in some cases the
8 person that was contacted to provide the
9 information may not have been aware of our pilot
10 tests that were --

11 They had to go through another step to
12 get permission to send us the information, and in
13 one cases it actually occurred during their off
14 hours due to different time zones.

15 Some findings related to the
16 availability of the electronic devices needed.
17 This is from the inspectors and responders' point
18 of view. Air and rail inspectors generally
19 already possess electronic devices capable of
20 receiving electronic shipment papers. Field
21 maritime inspectors, meaning Coast Guard recently
22 purchased tablets for their personnel.

1 However, those tablets were purchased
2 for other purposes and are currently not
3 authorized to use them for this, but they could
4 be modified for such. Roadway inspectors is a
5 little bit different. It's a more complex mode
6 than the other modes, and it varied in terms of
7 their ability.

8 But most roadway inspectors did have
9 laptops and access to HM information. Most
10 responders, those located within urban areas did
11 you have -- generally have the equipment in place
12 to be able to work with electronic shipping
13 papers. However, those that are in more rural
14 areas, areas of less connectivity or volunteers
15 need to rely more on their existing layered
16 redundant systems for ways of getting that
17 information electronically.

18 Whether that's through relay from a --
19 radios or what have you. I mean they have
20 systems in place, but they have to rely on those
21 more.

22 In terms of shippers and carriers,

1 many of the shippers in all modes already have e-
2 Systems in place that contain the hazardous
3 material shipping information. Air, maritime and
4 rail generally have that in place. Carriers are
5 roadway carriers, although it's a little bit more
6 different and more complex.

7 Many of the larger carriers actually
8 do have established e-Systems that can be easily
9 modified to communicate the information.

10 However, some of the others that either because
11 they require the paper for other purposes, other
12 business practices or their smaller operation
13 where it's not as beneficial for them from a
14 business perspective to have what they've
15 converted to an e-System.

16 For some of those, it may be more
17 problematic or less desirable for them to go, to
18 use e-Systems. The impact analysis findings, you
19 know, the use of e-Systems includes both safety
20 and security benefits as well as some
21 vulnerabilities associated with e-Systems. To
22 really understand the full magnitude of those

1 safety and security impacts, it's kind of -- it's
2 difficult to kind of quantify that at this point
3 until you have more operational experience with
4 e-Systems.

5 However, if e-Systems have been
6 verified and tested as being protected from
7 unauthorized access, they have the potential to
8 provide a more secure means for the transmitting
9 and storing of the information.

10 Cost-benefits and impacts for shippers
11 and carriers across all modes are expected to be
12 more common within the administrative areas than
13 the operational areas, and transition costs to go
14 to an e-System. It's expected to vary across all
15 modes, due to differences with respect to their
16 existing use of e-Systems or nature of their
17 operations, whether it be business type or what
18 have you.

19 Overall, the conclusion of the study
20 was that e-Systems can be a flexible and
21 effective alternative to the current hard copy
22 shipping requirements if certain performance-

1 based standards are met. That's kind of the key
2 part of that.

3 The report does recommend that a
4 rulemaking be considered to amend the current
5 regulations to permit the use, not mandate the
6 use of e-Systems and to set -- and to establish a
7 set of performance requirements or criteria to
8 allow for the use of these systems.

9 So in terms of the recommendations,
10 some of the specific recommendations related to
11 those performance requirements are that a point
12 of contact be available 24 hours a day, seven
13 days a week to obtain the information;
14 information provided electronically on demand
15 within a defined time interval; and that it is
16 also training requirements established for those
17 that are using those e-Systems and how to
18 communicate the information; that it includes a
19 performance definition in terms of what a
20 paperless hazard communication entails; and that
21 it be defined as being flexible in terms of the
22 use of different technologies; and that it

1 provides that the electronic information is
2 provided in an open, easily transferrable or
3 readable data format. An example is PDF but
4 there's others.

5 Some additional requirements or
6 criteria would include that for all carrier modes
7 they use a standard defined visual aid that would
8 be adhered to the exterior of the conveyance, to
9 indicate that electronic shipping papers are
10 being used for the transport of that material,
11 that communicates not only that electronic papers
12 are being used but how that information would be
13 obtained.

14 And in areas where there's known
15 problem areas of Internet connectivity, that they
16 have -- that the carrier has a backup means of
17 providing the information, and ideally the driver
18 actually can directly provide the information to
19 the inspector/responder.

20 We also recommend that additional
21 pilots tests be performed to (1) test the
22 performance standard that would be developed

1 during that rulemaking process, and (2) to expand
2 upon the pilot tests that have already been
3 conducted, so that looking at all modes,
4 utilizing a larger, diverse set of participants
5 over a larger -- along the pilot test period,
6 looking at other areas of known problems with
7 connectivity in terms of rural areas, geographic
8 areas.

9 Maybe doing -- by extending the pilot
10 test period, you could also look at weather,
11 areas where in terms of weather may have impacted
12 that connectivity, and possibly even looking at
13 intermodal transfers and a variety of other
14 technologies. One of the limitations of the
15 pilot test we had is with the -- we were asking
16 participants to use their existing equipment,
17 existing resources.

18 The ones that volunteered and
19 participated, they didn't have the means to work,
20 to communicate directly from the driver. They
21 didn't have tablets on board. They didn't have
22 an onboard system, so that they were providing

1 all the information for an office location.

2 We'll be looking at tests, additional technology.

3 So in terms of anticipating next steps
4 for the program, it's really those next steps are
5 slated to occur across three phases. The first
6 phase being developed that on a draft performance
7 standard, including the visual aids that would be
8 needed and they expect -- they're likely to vary
9 based on the mode, so there'd be a defined visual
10 aid for each one of the modes.

11 Obtain comments on that performance
12 standard and those visual aids, determine the
13 scope and approach for the pilot test and then
14 actually to incorporate those comments, conduct
15 those pilot tests, test that performance
16 standard, expand on the previous pilots and then
17 to the third phase being to actually finalize
18 that performance requirement and rulemaking to
19 allow for the use of electronic systems.

20 For FY '16, the focus will be on
21 putting together that draft performance standard
22 and visual aid and obtaining comments associated

1 with that. And there's a lot of information.
2 I'll go through that pretty quick. I'm sure
3 there's probably some questions. I'll be happy
4 to entertain those at this time.

5 (No response.)

6 MR. RANEY: Okay. If there's no
7 questions, if there's something you don't want to
8 ask at this point, I'll be available during one
9 of our scheduled breaks if you have -- oh sorry.
10 Yes.

11 MR. FRONCZAK: Hi, Bob Fronczak with
12 the Association of American Railroads. Did you
13 have a chance to look at our AskRail system that
14 we implemented back in 2014, late 2014 to
15 provide, you know, emergency responders
16 information?

17 MR. RANEY: We were present during
18 some presentations that were done associated with
19 that system that we got here, that were provided
20 here a PHMSA and we did talk with some of the
21 groups on that. Yes, so we were aware of that and
22 if I understand correctly, that's more for the

1 Class 1 railroads. Is that right?

2 MR. FRONCZAK: Well, right now the
3 Class 1 railroads are reporting single car and
4 full train contents to AskRail. The short lines
5 are reporting, you know, single car if possible.
6 The problem is with the short lines is they have
7 to actually feed the train information into our
8 rail line system in order to access that
9 information.

10 Class 1's have agreed to do that, but
11 the short lines get -- they don't have the
12 resources. Is this on?

13 MR. RANEY: Yes. As I mentioned, we
14 unfortunately weren't able to test, do a
15 simulation with the rail as an inspection. But
16 we did do a simulation on emergency response and
17 actually it was -- that worked well and it was
18 actually working internally to that railroad, and
19 they had their own emergency responders involved
20 with that.

21 MR. FRONCZAK: Yes, and AskRail
22 doesn't do -- doesn't reproduce the shipping

1 paper, and we worked with the International
2 Association of Fire Chiefs on this, you know, to
3 try to get the information that somebody needs
4 right within the first 60 minutes of an accident,
5 to get that type of information. Of course, the
6 other information's already on all locomotives.

7 MR. RANEY: Thank you. Any other
8 questions?

9 MS. HILTON: Hi, Cynthia Hilton with
10 IME. So if I understand what you're saying --
11 well, what I understood what you were saying was
12 that you were -- this project was about, you
13 know, like whether or not it would work, right?
14 Did I get that? Okay.

15 And so that involved you working with
16 all the parties that would be interested,
17 including the emergency responders. However, or
18 maybe the other speakers will address this.

19 I am interested to know whether or not
20 any of the emergency response organizations maybe
21 that are here today, you know, have embraced this
22 and are looking forward to this and see

1 advantages in this?

2 MR. RANEY: Yes. As I mentioned, I
3 mean there's always going to be variations in
4 that feedback and we collected feedback during
5 the consultation stage prior to the pilot test as
6 well as during the pilot test, and a number did
7 have reservations or concerns, because it was --
8 with the change.

9 But a lot of them also so benefits
10 associated with it. One of the things we heard
11 was that although they want to get the
12 information as quickly as they can, it's more
13 important that it's correct, and that if they
14 could live with a slight delay if it means that
15 the information that they're receiving is better
16 quality than what they're currently getting.

17 Another -- and they saw benefits in
18 terms of the quality of the data. As I
19 mentioned, all the emergency responders that
20 participated in the pilot test themselves, about
21 80 percent of them, they actually saw that there
22 would be benefits in the -- in the time of

1 receiving the information and responding to an
2 incident.

3 They also saw benefits in regards to
4 if there's a serious incident, it enabled them to
5 get the information without approaching the
6 vehicle because -- and that would help protect
7 them from dangers in terms of responding to that
8 incident.

9 So the one set had the largest
10 reservations were those in those rural areas or
11 those that for more of a volunteer responder, and
12 they may not have as much equipment, although
13 they are gaining equipment at this point in those
14 areas of low connectivity are also getting
15 smaller, and they already have existing systems
16 in place, backup systems in place to get that
17 information when they can't even -- when they
18 can't get it currently on the paper.

19 MR. BOYLE: One more quick question
20 and just to let Sam know, we're not going to cut
21 into your time. It looks like we'll be taking
22 like five minute setup breaks rather than a long

1 15 minute break.

2 So Bob says -- Bob Richard is our next
3 speaker used to work at PHMSA. That's how I know
4 who he is. So he says it will be quick, and
5 Mark, give him a quick answer too because we need
6 to get on.

7 MR. RICHARD: So I'll get to the
8 question eventually, but a little bit of comment.
9 Back in 2009, 2010 time frame, the agency was
10 funding the IAFC to do certain work, create a
11 fusion center where they were collecting data
12 about the efficiency of responding to incidents.

13 Part of that was there were trained
14 fire chiefs, retired fire chiefs that would go
15 out and actually investigate how some of the
16 emergency response worked in different incidents
17 that occurred around the nation. I would suggest
18 you go back to those reports and look at some of
19 that.

20 I agree with you that the criteria is
21 the most important aspect of this, because some
22 people are more advanced than others, and there

1 has to be redundant ways to share the
2 information. Initially, the emergency responders
3 and inspectors are very resistant to all of this.

4 But I mean there are so many benefits
5 of it. When you pull up to a truck that's on the
6 side of a road and, you know, there's been an
7 incident, a small release for instance, there's
8 plenty -- there's a number of different hazardous
9 materials covered by a number of different
10 shipping papers.

11 If someone has to rifle through all
12 those physical hard copies of shipping papers,
13 that's just very inefficient, and what we really
14 should be looking for is a manifest with
15 everything that's on that vehicle and be able to
16 communicate with the companies who are
17 responsible for those immediately. There's so
18 many beneficial ways to do that nowadays.

19 I mean if you look at how we do this
20 today, it's like we're living in the dark ages.
21 So hopefully a rulemaking will be expedited. The
22 performance criteria is very important, and

1 having that in there I don't see any way that
2 we're really compromising safety.

3 So it would be beneficial and I think
4 we could, you know, it would be a positive way to
5 get the information to the people at the scene,
6 protect them from, you know, inherent hazards
7 associated with leaks.

8 So you know, I think this is a great
9 effort and I just hope it can be expedited as
10 quickly as possible.

11 MR. RANEY: Thank you, Bob. Yes, I
12 mean that was our conclusion and again it's
13 making, as you mentioned, it's having that
14 performance criteria established that will enable
15 the use of it while maintaining the safety of it.
16 One of the -- the reason we talked about that
17 visual aid, that was one of the concerns that
18 inspectors and responders had, was that when they
19 arrive on an incident, how did they know to get
20 that information since now you kind of have two
21 ways of getting it out there.

22 They want to know immediately upon

1 arriving are they supposed to be looking for that
2 shipment paper in the door of the vehicle, or are
3 they supposed to be trying to contact someone on
4 scene or off scene to get that information,
5 however they got about doing that.

6 And I guess we've got to move along,
7 so I'll give it to Rick to give to Sam. But if
8 you have any other questions, I'll be available
9 during break. Thank you.

10 (Applause.)

11 MR. BOYLE: Thank you. Again, looks
12 like we're going on shorter breaks. We won't be
13 taking a 15 or 20 minute break. George is here
14 so we can get into the lithium battery
15 presentation. So without ado, we wanted to
16 invite somebody rather than -- who's thinking
17 about and designing systems at Volpe, somebody
18 that's actually using an electronic system. So
19 we've asked Sam to come in from UPS and they have
20 a special permit.

21 I don't want to cut into his
22 presentation, but they have a special permit

1 where we actually allow them on a limited basis
2 to use electronic communication. So we asked Sam
3 to come in and give an overview of that program
4 and his thoughts and the direction we should take
5 the program. Thank you.

6 MR. ELKIND: Thank you very much for
7 the opportunity to come and speak about this.
8 Our special permit that covers the use of
9 electronic communications is 15747. It was
10 granted to us in 2013 and we began using it in
11 June of 2014 as an active part of our business.

12 So in most situations, we are using a
13 -- we are not carrying a hazardous material
14 shipping paper in our small package feeder
15 network. So I want to help you understand the
16 boundaries of what I'm talking about.

17 We're using this in our tractor-
18 trailer internal distributions parts of the
19 company, and not in our pickup and delivery
20 operations. It is not part of the UPS freight or
21 the former overnight operation. It is not part
22 of our air freight operation. It's specifically

1 the small package distribution/internal
2 distribution process.

3 The success of the program relies on
4 the inspector or the emergency responder
5 identifying the trailer number that is being
6 queried and requesting information from a central
7 UPS telephone center that provides information.
8 The telephone number is shown here on the screen.
9 It's a dedicated number for this emergency
10 purpose and with that request a caller can
11 receive the information by email, by telefax or
12 verbally read over the telephone.

13 The special permit, by the way, has
14 been renewed and it will be in effect at least
15 through the end of June of 2019.

16 So our goals, UPS Small Package
17 Operations pick up and deliver 18 million
18 packages everyday. Our goals of using electronic
19 communications for hazardous materials are part
20 of larger framework to increase our efficiency
21 and use electronic processes where possible.

22 So as we approach the hazardous

1 materials program, we've built on technology that
2 we had already deployed for the UPS airline, and
3 we have been able to improve, this is one of our
4 goals, the resilience of links between our
5 scanning functions and the hazardous materials
6 data.

7 It also has demonstrated that we can
8 use electronic information for inspections and
9 emergency response, and the feedback we have
10 received has been positive.

11 I'm going to quickly go through some
12 process diagrams, and I'll start with -- well,
13 spend a little time on this one and then go more
14 quickly. But our process depends on electronic
15 information and paper both.

16 If you imagine that the customer
17 depicted in the upper left corner is a hazardous
18 material shipper, that customer uses a shipping
19 system to create documents that UPS will use at
20 pickup and delivery for the hazardous materials
21 shipment.

22 At the same time, that shipping system

1 makes an upload of an electronic record for the
2 hazardous material linked to the tracking number
3 for the package. The driver makes the normal
4 pickup using hazardous materials paper work in
5 the cab of the vehicle, brings it back to what we
6 call our origin center, the first building, and
7 there we have personnel who we refer to as
8 acceptance auditors who perform a check of the
9 package.

10 In doing that, they're using both
11 paper methods and also electronic methods and
12 you'll see on the screen here that we divide the
13 processes with that handy dotted line. But the
14 HMMS is our tool. We call it the Hazardous
15 Materials Management System. That is our tool
16 for managing the electronic information
17 associated with the hazardous materials shipment.

18 We follow normal document retention
19 processes and then advance the package. In the
20 airline, we have a loader who scans the package
21 into an air container and many years ago we had a
22 requirement created to be able to identify

1 hazardous materials on an aircraft remotely.

2 That process is really the backbone of what we're
3 doing here.

4 The loader scans the package into a
5 container, creates a container summary and builds
6 a no TOC (phonetic) for the aircraft operations.
7 So each flight has a record which is delivered to
8 the captain, that shows the identity and presence
9 of the hazardous materials.

10 So we mimicked that. That process
11 goes through to completion. As I said, I was
12 going to rush this for interest of time. We
13 mimic that on the ground side for our loading of
14 what we call our feeders. You would think of
15 them as our tractor-trailer operations.

16 There again, the loader scans the
17 package into the trailer that links the hazardous
18 material record to the trailer. We have a
19 manifest capability for the trailer. But we do
20 not provide paper.

21 At the moment when we -- at this
22 moment when we dispatch that trailer, it can go

1 either let's say to a rail yard for a topsy move
2 or it can go over the road, and in either case an
3 electronic record is used for that process.

4 So just to be clear on where in our
5 business model this kind of record is active,
6 these are the feeders connecting our buildings,
7 the tractor-trailers that we use for taking the
8 volume that we pick up during the day and putting
9 them into sorting facilities. Those tractor-
10 trailers are ones which are relying on electronic
11 records.

12 So if you look on the screen, the
13 package car that makes the pickup uses shipping
14 papers. The package cars that make the delivery
15 use shipping papers. At this time, we have not
16 done the engineering to make the electronic
17 process for pickup and delivery, although there's
18 lots of talk about how we might.

19 In the cab of the vehicle, the driver
20 carries to recognizable card, which is used to
21 supply the information to an inspector or an
22 emergency responder. You can see that the

1 telephone number for the inquiry is very
2 prominent on the card.

3 Now we've heard the comments from
4 Volpe that perhaps there's a need for an
5 identifier outside the vehicle. We're not too
6 sure that's practical. In the motor carrier
7 business there's an enormous amount of
8 interchange of rental and other equipment, so
9 that idea of the placarding may not be practical
10 in the long run.

11 Drivers also of course carry the
12 special permit that authorizes the use of
13 electronic information and they will have the
14 emergency response guide book as well. I want to
15 spend a little bit of time talking about the way
16 the information has been used.

17 Then I'm going to show you some
18 examples of the documents and then I want to talk
19 about some limitations, because it's not -- there
20 are some caveats. It's not used in every
21 application in our motor carrier operations.

22 So we have stars on the map that show

1 the states where calls have been originated in
2 the 21 months that we've been operating with this
3 special permit. There's a pie chart on the left
4 side of the screen that shows you the methods
5 that we have used to deliver information on
6 request.

7 So 55 percent of the time, the
8 information has been delivered verbally, and 32
9 percent of the time the information has been
10 delivered by email, 19 percent of the time by
11 fax. We have a performance requirement. The
12 information has to be delivered within five
13 minutes of the call being initiated and we track
14 that very closely.

15 DOT has put on us an obligation to
16 create a corrective action plan should we ever go
17 outside that five minute window, and twice in the
18 life of the permit we have had moments where
19 we've gone beyond the five minutes and corrected
20 accordingly.

21 If you look here, this is a hard graph
22 to read in the room, but the bar charts will give

1 you a sense of perspective. The bars are calls
2 that are either inquiries during on road
3 inspections or emergencies. The green -- I'm
4 color blind, I understand that it's green. The
5 green is said to be the inspections and the red,
6 again I understand it's red, are the emergencies.

7 So the very tallest bar in September
8 of 2014 was 22 calls. In that same month, we had
9 two emergency calls. The large -- this chart,
10 this bar here, August of 2015 for those of you in
11 the back of the room to give you a sense of
12 dimension, that's 12 calls for inspections and
13 seven calls for emergencies.

14 The continuous line across the top of
15 this chart is measured against the scale on the
16 right side of the graph, and that's the time,
17 average time each month to answer calls, and as
18 you'll see we average well below our five minute
19 performance requirement.

20 I can take this apart more if people
21 in the room are interested in particular months
22 and results. But I think what you see here is we

1 had a period of testing, where I think perhaps
2 inspectors were a little uncomfortable with the
3 idea. They did test and I think the results have
4 been satisfactory to them. At least that's the
5 feedback I've been getting through CVSA.

6 This is a sample manifest for a
7 hazardous materials load in a trailer. Again,
8 you probably have difficulty reading it,
9 certainly in the back of the room. But if you
10 look in the lower portion, read horizontally
11 across from left to right are the elements of a
12 required shipping description, ending on the
13 right with the emergency response telephone
14 number and the information provider.

15 This is a sample of a manifest for a
16 trailer that contains no hazardous materials, so
17 we can provide either one depending on what the
18 circumstances are. Then I want to end with a
19 couple of comments about tractor-trailer
20 operations, where our reliance will not be on
21 electronic shipping papers.

22 So first of all we have large-scale

1 customers from whom we pick up volume in trailers
2 or to whom we deliver volume in trailers, and
3 those tractor-trailer pickup and delivery
4 operations are not covered by a special permit.
5 It's a simple reason. Our process has not yet
6 accepted those records into our system, and we
7 have not validated those records so we don't rely
8 on them.

9 We also move trailers to Canada, and
10 because this is a U.S. DOT permit, not a Canadian
11 permit, we are going to issue papers to those
12 drivers who move those trailers. Then finally we
13 have air trailers that move loaded aircraft
14 containers from our buildings to the airport and
15 back, and for those legs, again it's an
16 engineering question. We haven't completed the
17 engineering to do that, so we rely on our
18 container manifests for those moves.

19 So looking at this in terms of our
20 goals, we definitely feel that the results are
21 favorable. We're moving in a direction that we
22 think is productive. We see that we have

1 simplified our hub processes.

2 We have allowed ourselves improvements
3 in our loading processes. In fact, we feel now
4 we have a whole lot higher confidence in what is
5 on a trailer being reported correctly than when
6 we were relying on people to move paper.

7 In addition to those benefits, I want
8 to make a point which is something that we as a
9 sustainable organization have to point out, and
10 that is that if you think of the paper that is
11 associated with each hazardous material and think
12 of the scale of commerce in the United States,
13 reducing the paper for those shipments is not
14 significant.

15 Let's just say hypothetically you look
16 at 10,000 hazardous material shipments in a day.
17 Multiply that across the year. That's an
18 enormous amount of paper that has to be made,
19 produced, printed and then thrown away.

20 So we believe that there are many
21 multiple reasons, those on the screen and others,
22 to link electronic records with hazardous

1 materials transportation, and we certainly are
2 appreciative to PHMSA for responding in this many
3 years of development that we've engaged in, to
4 open this special permit up.

5 We're very appreciative of the
6 emergency responders and the roadside inspectors
7 who are meeting our tractor-trailer drivers and
8 using this telephone information in place of
9 shipping papers. I, like Mark, am happy to take
10 questions if there are any. Cynthia Hilton.

11 MR. BOYLE: You can ask questions.
12 We have about five minutes. You can ask
13 questions of Sam or Mark at this point.

14 MS. HILTON: Hi, Cynthia Hilton with
15 IME. Thank you very much Sam. So I kind of have
16 two questions. The first one is I understood
17 that you mimicked this system based on your air
18 operations. So I don't know exactly why your
19 trailers that go from your hub to your airports,
20 you know, why that , because it's not allowed by
21 the special permit one, and two, we have number
22 two out.

1 So you can't take your trailers into
2 Canada. This is kind of also a two-part
3 question. Is that because -- is Canada
4 interested? You know, we have this RCC process
5 where we're supposed to be eliminating barriers.

6 Is this something that could be
7 advanced in that forum, and then just generally
8 worldwide, is there any other place in the world
9 that is exploring this kind of thing, or is the
10 rest of the world all on paper?

11 MR. KERCHNER: So question one about
12 our air trailers. Certainly, the information
13 links to the trailers. But we had focused our
14 engineering dollars elsewhere and haven't
15 engineered the combination.

16 MS. HILTON: Because you said those
17 were electronic --

18 MR. KERCHNER: Our process links all
19 the records to the containers, and it's simply an
20 engineering question. The engineering budget is
21 not infinite. The second question, we do take
22 our trailers into Canada but not with electronic

1 information.

2 We have not had dialogue with the
3 Canadian authorities about electronic records.
4 So I don't know what their openness is to that.
5 Your third question was about the other places
6 that may be looking at electronic records. We
7 are aware of some efforts in Europe.

8 They use the term "telematics" and it
9 seems, from what we have learned about that, that
10 there's an interest in augmenting communications
11 with electronic capability, not replacing. At
12 least that's our reading of it at the moment. I
13 could be inaccurate in saying that.

14 MS. HILTON: Okay, but the rest of the
15 world they have paper, right, where you operate?

16 MR. KERCHNER: At the moment.

17 MS. HILTON: Yes.

18 MR. KERCHNER: At the moment, we have
19 the greatest concentration of hazardous materials
20 businesses in the United States for us. Other
21 people will have a different experience. Bob.

22 MR. ELKIND: Yes Sam. Our system is

1 a little different, in that it's in the hands of
2 the emergency responder, and they can just use it
3 any time. Yours is a little different, where
4 they have to go get, you know, talk to the driver
5 it seems like. So security wasn't a big deal it
6 sounds like in what you set up.

7 MR. KERCHNER: That's a good point.
8 Well let me -- that gives me an opportunity to
9 say a couple of things, Bob. First of all it's,
10 you know, working with your industry that helped
11 us to move this technology into the ground
12 operations, so thank you for that.

13 The second thing is that we don't view
14 this as the end state for our electronic process.
15 We view this as a transitional process. The end
16 state we anticipate will have drivers equipped
17 with the information about hazardous materials.
18 I neglected to say that the driver's device in
19 the cab, which is used for dispatch and for a
20 number of other processes, does identify the
21 presence of hazardous materials by trailer.

22 Then your question about the security

1 aspect we, because it's somewhat enclosed, don't
2 view this as a security risk. But we do think a
3 future time where maybe, and I don't know where
4 this would go, devices of some standard read
5 remotely, we do think security will be an issue
6 there and I'm sure that our successors will want
7 to work that very carefully. No other questions?
8 Thanks.

9 (Applause.)

10 MR. BOYLE: My apologies. Instead of
11 a 15 minute break we'll take kind of a five
12 minute stretching, shuffling speakers and
13 everything presentation, get the next one ready
14 to go in about five minutes. Thank you.

15 (Whereupon, the above-entitled matter
16 went off the record at 11:01 a.m. and resumed at
17 11:06 a.m.)

18 MR. BOYLE: Sorry to be such a task
19 master, but I need you to take your seats again
20 please. I hope you enjoyed that long break that
21 I gave you of three minutes.

22 PARTICIPANT: Twenty four hours.

1 MR. BOYLE: What did you do with all
2 that free time? Since we're a little short of
3 time, what we're going to look for in this -- in
4 the next two sessions at least, until lunch gets
5 us hopefully back on schedule, we're going to
6 hold the questions until all three presenters are
7 done.

8 Then I'll have them either just stand
9 up in the front with a -- we'll have a hand held
10 mic and they can either stand up front or they
11 can sit down and we'll use a table mic. But what
12 we're going to do is hold the questions until all
13 the presentations are done, and then we'll not
14 only open up the phone, but we'll also open up
15 the microphone for anybody that wants to speak.

16 So I apologize if you have a question
17 and you have to hold it for two more
18 presentations. The next session we'll have is on
19 lithium batteries, and we've done some long-term
20 research with Carderock or large format
21 batteries. So if my notes are correct, we'll get
22 a little bit of summary on that, but we'll also

1 get the direction that we're headed in next.

2 Then we're also looking at thermal
3 runaway on lithium batteries. So we've got some
4 work going on with the Naval Research Lab. So
5 we're going to get a briefing on that, and then
6 although it's a little bit in the emerging
7 trends, we asked industry rep George Kerchner to
8 come in and give us his thoughts on not only
9 lithium batteries but batteries as a whole, and
10 some of the emerging risks or emerging trends or
11 some directions that we should go in.

12 So those will be our next three
13 presentations, and I'll turn it over to Daphne
14 from Carderock right now.

15 DR. FUENTEVILLA: Hello everyone.
16 Good afternoon. My name is Dr. Daphne
17 Fuentevilla, and I work for the U.S. Navy,
18 actually for the Naval Surface Warfare Center
19 Carderock Division, which is just a few minutes
20 outside of Washington, D.C., and I work in
21 lithium battery safety, and that is what my
22 presentation today is on.

1 I'd like to start out by having
2 everyone either take out your cell phones or just
3 think about where they are in your bags for a
4 second here while we watch this video. This is a
5 test. I actually ran this for you -- ran this
6 for you yesterday. You can actually see it start
7 to go on the left here.

8 You're looking at a commercial cell
9 phone that is strapped down to a heater plate.
10 We are abusing this battery with high
11 temperature, this cell phone with high
12 temperature, and we're going to watch and see
13 what happens.

14 [VIDEO PLAYING.]

15 DR. FUENTEVILLA: I ran this for you
16 because I wanted something that was pretty
17 relatable, that you could all see exactly what
18 was in your pockets. On the right, you're
19 looking at the thermal image of the same abuse.

20 This is an old cell phone. It
21 belonged to a colleague of mine. It was -- he'd
22 already fixed it, recharged it up and he

1 sacrificed it for a good cause. This particular
2 one did not catch fire, but those -- that smoke
3 is flammable. So if I had have put a sparker
4 right next to it, it would have caught fire.

5 So it smokes a little bit more. On
6 the right, you can see that the temperatures were
7 in excess of -- the white is 260 degrees, 260
8 degrees. So you can see that we are well above
9 that. We are actually -- we had thermocouples on
10 it. We were well in excess of 380 degrees
11 Celsius.

12 So the thermal runaway occurred with
13 the battery. This is a single cell in a cell
14 phone. The battery vented and it released this
15 flammable solvent. So the Navy -- so that's --
16 you can think about how many cell phones are
17 probably out there, and how many cell phones are
18 probably in transport.

19 The Navy deals with this problem too.
20 We sometimes deal with this problem on more
21 energy vent systems, because we're really looking
22 to, for our particular systems, to have really

1 energy dense power sources, and we deal with this
2 problem with -- I've got another video from one
3 of our battery tests.

4 This is from a few years ago. Can you
5 guys run the video there? This is actually at
6 test that we ran at one of our facilities, where
7 we're trying to simulate what this would look
8 like inside of a ship. This battery in
9 particular is going to be carried on board some
10 of our ships. We need to be concerned about the
11 storage of those batteries on the ship and then
12 what happens if there's an actual event.

13 How's it going? Two minutes ago this
14 worked perfectly. All right. I think we're
15 going to try to skip past it and see if we can
16 come back to it. It's not clicking forward.

17 (Off mic comments.)

18 DR. FUENTEVILLA: So really what I
19 want to convey here is that -- is that these are
20 -- these batteries are significant problems for
21 us. They're certainly problems for the Navy and
22 they're certainly problems for commercial

1 industry as well.

2 The Navy deals with these problems
3 through a -- we've been dealing with them for
4 decades since the 70's, through the Navy's
5 Lithium Battery Safety Program. Carderock is one
6 of the technical agents for the Navy's Lithium
7 Battery Safety Program. We are tasked with
8 evaluating the safety of every single battery,
9 lithium battery that's used by the Navy or the
10 Marine Corps.

11 My group has been doing this since
12 that program's inception. So we have to evaluate
13 the safety of each battery in its use scenario.
14 Now that's not something that that's a luxury
15 that I had within DoD. That's not something that
16 is quite as economically or politically feasible
17 from a transportation scenario.

18 However, there are lessons to be
19 learned from that same -- oh, here we go. Can we
20 advance the slides a couple?

21 (Off mic comment.)

22 DR. FUENTEVILLA: Okay, all right. So

1 there's certainly lessons, same lessons to be
2 learned from DoD that can be transferred to the
3 Department of Transportation. So what I would --
4 was going to do -- oh, here we go. We can just
5 skip past that to the next slide. Fantastic.

6 So what I was going to explain was
7 that batteries are stored chemical energy, which
8 I hope that everybody's aware of. If you think
9 about how many -- you know, really think about
10 how many of these things are out there, they
11 enable our use of technology.

12 When they're used appropriately and
13 designed well, the controlled release of this
14 energy provides us with electrical power in the
15 form of current and voltage.

16 When you are -- when they're not --
17 when they're abused, when they're not designed
18 well, then you can have the uncontrollable
19 release of this energy, which can result in
20 venting, fire, a release of toxic materials,
21 shrapnel.

22 You have high pressure events,

1 deflagration which if we ever get to show the
2 video, I'll be able to show you a nice shot of.
3 But those are the types of hazards that we're
4 talking about.

5 I already mentioned a little bit about
6 the Navy's Lithium Battery Safety Program, but
7 we've been using these batteries because they
8 provide a substantial increase in both the
9 gravimetric and the volumetric energy density
10 over other commercial battery types.

11 The Navy had had personal injuries as
12 a result of this use, and that was the reason why
13 the DoD had initiated the start of the Navy's
14 lithium battery safety program. Again, I had
15 already mentioned that Carderock is the technical
16 agent for this program, so I'll move right ahead.

17 So DOT/PHMSA's mission is to protect
18 people in the environment by advancing the safe
19 transportation of energy and other hazardous
20 materials that are essential to our daily lives.
21 And these batteries, while they're incredibly
22 useful, that uncontrolled release in the cases

1 when they are abused or if they're not designed
2 properly, poses a problem for this mission.

3 These are just some pictures from
4 recent events that have happened. I'm sure
5 everybody is familiar with hoverboards, cell
6 phone. This is actually from this past weekend,
7 you know. If you think about what's held by the
8 person, by the person sitting next to you on the
9 plane, the electric vehicle fires and 787
10 incidents. Carderock had been involved with NTSB
11 and the investigation into the 787 battery.

12 So in terms of the collaboration
13 between Department of Defense and Department of
14 Transportation in this -- in trying to deal with
15 these types of hazards, there are areas in which
16 our missions overlap. We have to identify the
17 hazard, we have to deal with hazard prevention
18 and we have to deal with hazard mitigation.

19 When we talk about hazard mitigation,
20 that hazard identification, what that means is
21 classifying the batteries and then certifying
22 that they're safe. When we talk about hazard

1 prevention, we're talking about characterizing
2 battery failure mechanisms.

3 And then when we talk about hazard
4 mitigation, what we're talking about is how you
5 detect failure before you have -- before it's too
6 late, and then how you contain it if you can't
7 stop it. So we have four, which I'm going to
8 touch on briefly, four different efforts going on
9 within the -- that cover all of these topics.

10 My colleague, Dr. Corey Love from NRL,
11 we're working with him on several of these. He's
12 going to follow up on my presentation with some
13 more detail about a couple of them. I'm going to
14 start out with just a real quick introduction to
15 each one of these, and then we'll move on to
16 Corey's presentation.

17 So first, hazard identification and
18 classification. We are looking at shock testing
19 criteria for large lithium batteries. The idea
20 here is that the design type tests as specified
21 in the U.N. Manual of Testing Criteria, require
22 large format batteries to be subjected to half

1 sine shock, a peak acceleration of 50 g and a
2 pulse duration of 11 milliseconds.

3 So large format batteries, some of
4 which can be quite heavy, see a large force -- a
5 larger force for the same acceleration as with
6 smaller batteries.

7 So we conducted a study where we were
8 looking at dynamic loads that were experienced by
9 these large format batteries during
10 transportation, and evaluating whether the
11 current shock testing was representative of what
12 it would see in a transportation environment.

13 We were also identifying when the
14 criteria for conducting shock testing on large
15 format batteries became unrealistic in terms of
16 the transportation environment. So this is just
17 a quick summary of what our results were. We
18 have a report which we can -- so if anybody has
19 any questions about this, we can talk more about
20 it during the question and answer session.

21 But our testing indicated that the
22 fixed acceleration and pulse duration parameters

1 could induce responses in some of these test
2 items that were not representative of abuse
3 conditions that were seen specifically during
4 transportation.

5 We correlated drop heights with the
6 50 g 11 millisecond half sine input accelerations
7 by weight, and we also looked at other different
8 heights and what those acceleration and input
9 accelerations would look like for different
10 heights, as well as for different impact
11 surfaces.

12 So we have three projects that I want
13 to talk about next, which are the upcoming
14 projects which we have just started on. These
15 are quantity, weight limitations for air
16 transport.

17 The issue is that current air
18 transport regulations limit lithium ion battery
19 quantities to 35 kilograms per package for a
20 cargo aircraft, and the severity of the hazards
21 are posed by these lithium ion batteries may not
22 correlate directly with weight.

1 So the objectives of this study are to
2 provide a hazard which encompasses electrical,
3 thermal, environmental hazards, thresholds that
4 are posed by these existing limits, evaluate the
5 hazard variability by cell size and by state of
6 charge on the weight basis, and then identify
7 other criteria that are associated with these
8 types of hazards.

9 The third effort that we're talking
10 about, this is more in line with hazard
11 prevention. We're looking at lithium battery
12 failure mechanisms in order to understand better
13 exactly what it is that's occurring, so that we
14 can have some better ability to either provide
15 standards for how to design batteries, or to
16 certify batteries properly.

17 So the transportation industry remains
18 vulnerable to these occurrences of low
19 probability high impact delayed cell defects that
20 can trigger internal shorts at some point in a
21 battery's life cycle, and understanding delayed
22 cell failure mechanisms will inform future

1 protections against battery failure.

2 So the objectives of that study are to
3 examine onset of lithium plating, the condition
4 of a solid electrolyte interface which helps keep
5 batteries safe, and copper dissolution thresholds
6 on lithium ion batteries.

7 It also is intended to provide a
8 mechanism for -- on mechanism-specific indicators
9 that are relevant to the sequence of events and
10 root cause failure for lithium battery-related
11 transportation issues. Then finally, I'd like to
12 talk about hazard mitigation containment and
13 basically looking at diagnostic technologies for
14 battery failures.

15 This is a big one. The energy density
16 of bulk packages of lithium batteries presents
17 challenges for containment of failure events.
18 These detection technologies will be able to
19 hopefully detect failures earlier, which can
20 inform choices about mitigation technologies and
21 activate mitigation earlier in order to improve
22 their effectiveness.

1 The objectives of that study are to
2 assess the effectiveness of emerging technologies
3 for detecting internal short conditions in cells
4 prior to thermal runaway events, and evaluate
5 which ones are practical for the transportation
6 industry.

7 There are several of these types of
8 approaches that are currently coming into the
9 prototype stage, and it's worth taking a look and
10 seeing what's available for transportation.

11 So, pretty quick presentation,
12 especially without the video. I'd like to
13 summarize by just giving my contact information
14 here. Our research team at Carderock includes
15 myself, Dr. Azzan Mansour, Jonathan Ko, Chris
16 Hendricks. I actually left two people off there.
17 We've got Mr. Paul Jalics and Mr. Thom Zhang here
18 in the room with us. And we have collaborators.
19 Dr. Corey Love is going to be talking next from
20 the Naval Research Laboratory.

21 We are also working and will be
22 leveraging some of this work. As I said, these

1 are of interest to DoD as well, leveraging work
2 that's going on with the Expeditionary Energy
3 Office at the U.S. Marine Corps, with our
4 colleagues at the Naval Surface Warfare Center in
5 Indian Head, and some of our industry
6 collaborators. Thank you very much.

7 (Applause.)

8 DR. LOVE: All right, thank you. I
9 have the privilege of going after Daphne. She's
10 sort of set the stage for you and attempted to
11 show some videos, but I have a DoD laptop so
12 maybe during the break we can show those videos
13 for anyone that's interested.

14 So, PHMSA's mission -- or let me first
15 start by saying, you know, my name is Corey Love.
16 I'm a materials research engineer in the
17 chemistry division at the Naval Research
18 Laboratory, and we're located in Southwest D.C.
19 along the banks of the Potomac River. So, close
20 by.

21 So, following along, you know,
22 Daphne's presentation, PHMSA's mission is safe

1 transportation of hazardous materials, right? So
2 what are sort of the objectives they use to roll
3 out that mission? Well, it's establishing
4 policy, setting and enforcing standards, reducing
5 the consequences if incidents occur, and
6 conducting research to prevent incidents, right?

7 So, what Daphne has just sort of
8 mentioned to you is, sort of from a large format
9 standpoint, what are some of those metrics, okay,
10 for shipping? What are some of those
11 enforcements, the standards that DoD needs to
12 set, okay?

13 And where I reside is a little bit
14 more on a basic research side of things. We're
15 sort of -- you see there's a little bit of
16 overlap between NRL and Carderock, and that's
17 because there's a lot of information-sharing
18 between our two organizations.

19 So, NRL, I would consider it more of
20 an incubator, more of a technology incubator
21 where we're focusing more on the fundamental
22 chemistry and materials processes. What's

1 happening inside of that can? What's happening
2 inside of the battery? And then based upon what
3 we learned, we sort of get it to sort of a
4 fundamental, more general standpoint, where we
5 can hand it off to Carderock and they can
6 actually do something very useful with that
7 information, okay?

8 So I'm going to talk about today
9 lithium battery research safety programs and what
10 they should encompass. So, a comprehensive
11 strategy for lithium ion battery safety would
12 include prevention, mitigation and containment,
13 okay?

14 They all sound about the same, so I'll
15 give you my definition. So, prevention is that
16 early on, real basic chemistry materials
17 processes, what's happening inside the can, okay?
18 Mitigation is more screening tools and
19 diagnostics, and what can we look for? What are
20 the signatures of an impending failure? What are
21 sort of small devices that we can employ to
22 identify those hazards before they become a

1 thermal runaway situation?

2 Lastly is containment. And so that's
3 more of an engineering approach, saying, okay, if
4 we incur one failure how can we contain that
5 failure to one individual package so it doesn't
6 propagate throughout the shipment? So those are
7 the three areas that I'm really going to focus
8 on.

9 Okay. So, from the military
10 perspective, you know, lithium ion batteries are
11 the ubiquitous power source for rechargeable
12 electronics. We talk about man-wearable,
13 portable electronics, small vehicles, robots,
14 unmanned systems and even larger propulsion
15 systems. So, that big yellow thing you see
16 there, that's LDUUV. That's large diameter
17 unmanned underwater vehicle. Essentially it's a
18 submarine packed with an energy section, okay,
19 for very long endurance missions.

20 Well, on the civilian side of things
21 you have this pretty much the same thing. You've
22 got portable electronics, e-cigarettes and

1 hoverboards, and now getting more traction into
2 electric vehicles and propulsion systems. So,
3 really large format batteries on the roadways.

4 So, why do lithium batteries present
5 such a serious threat? Well, you saw from
6 Daphne's cell phone video there's a lot of heat
7 and smoke and fire, in some instances, released
8 with a battery failure. One of the key things to
9 keep in mind is there are often no outward signs
10 of an impending failure.

11 So, from the outside, a battery pack
12 may look good, okay? So where I reside is sort
13 of inside the can. I want to try and find out
14 what's happening inside, when they are no outward
15 signs of an impending failure. And then
16 oftentimes only one cell failure is needed to
17 propagate through a shipment, okay? So all it
18 takes is one cell to go into thermal runaway to
19 produce enough heat to cause the neighboring cell
20 to then go into thermal runaway, and you
21 propagate down the line. So one cell can create
22 an enormous, enormous failure, okay?

1 So, as I mentioned, I reside inside of
2 the can. The chemistry and the materials
3 processes. This is just a cutaway of 18650, a
4 cylindrical lithium ion battery cell. I like to
5 put a schematic there, or put the icon for the
6 fire triangle, because you have all those
7 components inside of the can already, okay? And
8 if you were to go through the individual
9 components, the positive electrode, negative
10 electrode, there are oxidizing agents, there are
11 components which will release oxygen at high
12 temperatures. You have flammable organic
13 solvents that are present inside of the can,
14 okay?

15 So, what is the heat source? Well,
16 the heat can come from a variety of different
17 places. Internal short circuit, external short
18 circuit. An external short would be, you could
19 imagine, you know, a screwdriver bridging the
20 terminals between a battery.

21 Overcharging or rapid charging.
22 That's often the result of faulty electronics or

1 tampering with electronics. This is big for the
2 RC community. There are, you know, radio control
3 guys that are doing things in their garage and
4 sort of overriding the fail-safes that are in
5 place to get more energy into their batteries.

6 External heating. So, that would be
7 Daphne's example that she showed with the cell
8 phone previously.

9 Internal shorts are a little bit
10 different. So, there's a recent report that said
11 that battery failures, about 68 percent of
12 battery failures are a result of internal
13 shorting, okay? When we talk about internal
14 shorts, it's usually the result of the lithium
15 dendrite. So, lithium dendrite, it's a metallic
16 lithium component that's formed in the battery.
17 It bridges the gap between the anode and the
18 cathode, the negative and the positive electrodes
19 inside of the battery.

20 It causes an enormous amount of heat
21 generated. So you've got a large rush of current
22 through a very, very small surface area, and it

1 creates an enormous amount of heat. So that's a
2 really significant heat source, okay?

3 And just to show you, the picture on
4 the top left there is one morphology of lithium
5 dendrite. So it's metallic lithium. The bottom
6 image there is an example of a counterfeit cell,
7 and those can happen, as well. So, in this case,
8 an inferior battery has been stuffed inside a
9 superior can, okay, and mislabeled.

10 And on the right-hand side, those
11 images that are gold, those are taken from the
12 NTSB's report on 787. And NRL provided some
13 level of support into identifying the dendrites
14 and sort of the parameters necessary to form a
15 specific morphology of lithium dendrite.

16 Okay. So I'll just point out quickly
17 two documents that have sort of the foresight to
18 identify lithium batteries as a potential hazard.
19 And I don't know if anyone, walking into the
20 screening this morning through security, if you
21 were asked if you were carrying spare lithium
22 batteries.

1 I was. I thought it was a joke. I
2 thought Veda was going to jump out from behind
3 the bushes and say, "Got ya," you know. But it's
4 the threat is here, okay, and that's been
5 outlined in this R&D strategic plan from 2012 to
6 '17. It says there's an immediate hazard
7 associated with lithium ion and lithium metal
8 batteries.

9 In another document, Strategic Plan
10 2013 to 2016, calls out lithium batteries and
11 suggests to foster robust research and
12 development and innovation for risk management,
13 okay?

14 And so going back to my previous
15 statement, well, when you put together this
16 comprehensive safety program, you have to take
17 into account prevention. So, at the early
18 stages, try and prevent everything from
19 happening. If that doesn't work, mitigation for
20 identifying the sources of instability, and then
21 containment if a failure does occur.

22 So, failures in the laboratory are

1 very easily to induce, okay? We can strap a
2 cartridge heater to a battery and elevate the
3 temperature and get a thermal runaway event to
4 occur. Mimicking the real world failures, or the
5 failures that we see in the field, are very
6 difficult to do.

7 And so I identify sort of a research
8 need, is that, you know, we want to prevent
9 future incidents through approved testing and
10 validation methods which more closely replicate
11 failures that we see in the field. And so that
12 creates a technology gap.

13 Well, we really don't have the method
14 now to trigger those sort of real world failures,
15 and what I'm proposing here is things we could do
16 to the chemistry, some funny things that we can
17 do to initiate those failures in a much more
18 reproducible manner. And this eliminates a lot
19 of the testing time that's necessary, and also
20 gives us a sense of more of the realistic, as I
21 mentioned, field failures that we see in the
22 field.

1 And I'm not just speaking alone here.
2 This technology gap is also identified in the
3 U.N. Manual 38-8 which DOT relies on pretty
4 heavily for testing and evaluation.

5 So, I have a short little video. It's
6 not as exciting as Daphne's. So if we can get
7 that rolling, please.

8 And again, this was working earlier.
9 So what we're looking at, in a static mode here,
10 is a commercial graphite anode. So this is the
11 negative electrode in a commercial battery. What
12 we have is an in situ optical cell. It's
13 basically a battery that we can look at under the
14 microscope, so we have a window inside to get a
15 sense of what's happening inside of the can.

16 And if it were playing, what you would
17 see is lithiation of the graphite. So it
18 replicates a recharged cycle in your cell phone
19 battery. And as that happens, there's a color
20 change associated with that as lithium ions go
21 into the negative electrode.

22 You get to a certain point. The anode

1 can't accommodate any more lithium ions, and
2 those lithium ions now become lithium dendrites.
3 So, metallic structures start to form on the
4 edges of this electrode. And those are the
5 things we really want to understand, where
6 they're forming, when they're forming, what are
7 the conditions present to form and to grow these
8 catastrophic lithium dendrites? Because,
9 ultimately, it's the dendrites that cause the
10 internal short circuit.

11 So, again, if anyone's interested in
12 that video, we can get that rolling during the
13 break as well. I will say this is great, very
14 fundamental stuff, but we're actually
15 implementing what we're learning from this
16 experimental cell to drive standards for the Navy
17 and Marine Corps as far as low temperature
18 operation and what are the hard and fast
19 conditions that we need to stay within when we're
20 recharging in the field environment.

21 That was prevention. So, mitigation,
22 more along the lines of screening tools and

1 diagnostics to identify a potentially hazardous
2 cell before a thermal runaway event. So, the
3 research need is to prevent future incidents
4 through early warning, screening, fault
5 detection methods.

6 We have a way of doing that. We rely
7 on electrochemical impedance spectroscopy. You
8 could think of it as just doing some resistance
9 measurements, and we focus in on a very specific
10 area where we know it's tied to the state of
11 health of batteries. We sort of continually
12 probe that area and get information back.

13 And what we can do with that is we
14 could develop these state-of-health maps. So
15 that information that we're receiving now, we can
16 see where we are on this map. Okay, are we still
17 in the healthy regime? Have we deviated outside
18 of the health regime? Are we possibly damaged or
19 is there an internal fault?

20 And then as we go further off the map,
21 we know we're in an unsafe condition. The
22 chemistry has changed irreversibly, so much that

1 we have a potential hazard on our hands. So we
2 have been working at NRL developing this
3 technology for several years now. And it's at a
4 great place where now we can sort of roll it out
5 to a variety of chemistries, and really put this
6 methodology to its paces.

7 Okay. So, lastly, we talked about
8 prevention, mitigation, and last is containment.
9 As I previously said, it's more of an engineering
10 approach. So, the engineering solution right now
11 is to go in with the understanding that you'll
12 have one cell failure. How can you contain that
13 failure without it propagating throughout the
14 cargo shipment?

15 So, that's the research need. The
16 technology gap is really packaging materials that
17 can give you that non-propagating effect, okay?
18 You need things like fire prevention, you need
19 things like phase change materials that will
20 remove a lot of heat away from the situation,
21 okay? When you draw out that thermal signature,
22 you can greatly reduce the effect of a thermal

1 runaway situation.

2 And so the research opportunity here
3 would be, well, can you contain, you know, all
4 those things, all of those nice properties in one
5 packaging material?

6 And there's a strategy. On the left-
7 hand side here you see it's a polymer coating
8 that's been developed at NRL, and it's actually
9 for ballistics. It's a very thin polymer, and so
10 it's known for its impact resistance. So, you
11 probably don't need this level of impact
12 resistance for, you know, a pallet of lithium ion
13 batteries.

14 But what you could do is you can tune
15 the chemistry of that polymer and you can tune it
16 to the desired impact or the specific threat that
17 you may have. So it may be more of an automotive
18 impact or sort of a rail car impact. You can
19 tune the chemistry specific to the frequency of
20 that sort of impact event.

21 And as I mentioned, internal to a
22 multi-layered laminate, you'd have something with

1 fire prevention capabilities, really high
2 temperature materials. And there's a commercial
3 aerogel, it's the first application of aerogel
4 materials for insulation, that is used in DoD
5 right now for similar applications.

6 And so that was kind of quick, but
7 I'll thank you for the opportunity to present,
8 and I think we're going to move ahead and I'll be
9 happy to take questions during the break.

10 (Applause.)

11 MR. BOYLE: Our next speaker and then
12 we'll take questions at the end is George
13 Kerchner. He's from the PRBA. I always invert
14 the letters. I must be partially dyslexic. So
15 I'll just introduce George and we'll just keep
16 moving, and then we'll take questions for all
17 three of them at the end, and thank you two for
18 scaring me. Every time my phone buzzes now my
19 heart starts shaking. Thank you George for
20 coming.

21 MR. KERCHNER: So everybody knows I'm
22 sick, right? But thank you for -- thanks for

1 PHMSA for letting me come here. What I'm going
2 to present here is just where things stand right
3 now for the industry as far as packaging
4 performance standards, lithium battery
5 performance standards mostly at the international
6 level through IKO and SAE.

7 I think it's a good segue into what
8 Corey and Daphne just talked about, because I
9 think there's an opportunity here for the Navy,
10 NRL and for PHMSA and the industry to work
11 together on some of these issues, which I'll
12 explain in more detail as we go through here.

13 For those of you who don't know who
14 PRBA is, we're based here in Washington, D.C.
15 We've been here since 1991. We are an
16 association of battery and cell manufacturers.
17 But in addition, our members include product
18 manufacturers, medical device manufacturers,
19 airlines, packaging consultants, packaging
20 manufacturers in testing labs.

21 So it's a very diverse association and
22 I always say this when I give a presentation.

1 But when you think of PRBA, again just don't
2 think about batteries. We have a very diverse
3 membership and that really is a huge benefit to
4 me to reach out to our members, who have a lot of
5 expertise in a lot of different areas.

6 And particularly this particular issue
7 when it comes to safety, packaging, you know. We
8 have a lot of great expertise from those
9 different companies that I can tap into that have
10 a variety of interests in this issue, and we can
11 benefit from that as an association.

12 We obviously are very -- we are very
13 active on the international and state level on
14 regulatory policy and legislative issues. We are
15 members or observers at the U.N. Subcommittee as
16 well as the IKO Dangerous Goods Panel, and
17 occasionally participate in the IMO meetings on
18 Dangerous Goods.

19 So IKO, as most of you know, has been
20 very busy on lithium battery issues. They have
21 recently adopted very stringent regulations for
22 shipping lithium ion batteries on aircraft.

1 Starting April 1st, you'll be prohibited from
2 shipping lithium ion batteries on passenger
3 aircraft.

4 In addition, your lithium battery
5 cannot exceed 30 percent stated charge starting
6 April 1st. So those are two big changes coming
7 into effect April 1st. The other thing that's
8 going to happen is that IKO has partnered with
9 the SAE, Society of Aerospace Engineers, to
10 develop a lithium battery performance-based
11 standard.

12 They describe it as a packaging
13 standard. I don't view it that way. I view it
14 as a general performance-based standard, and I'll
15 explain why that is. As I noted, IKO has been
16 very busy on tightening the regulation for
17 lithium batteries. This particular performance-
18 based standard is just one of those issues
19 they've been working on that will proceed to
20 2016-2017.

21 And again, the standard rule generally
22 focuses on packaging. I do it as a performance-

1 based standard with a packaging component
2 associated with it, okay. So that's a very
3 important point there. The SAE and IKO had a
4 meeting the week of March 7th in Montreal where
5 they met for a week, talked about lithium
6 batteries and packaging.

7 It's hard to imagine to do that, but
8 that's how long they worked on this. So this is
9 a brand new standard that SAE is developing, that
10 will eventually be incorporated into the IKO
11 technical instructions. I'm assuming it will
12 eventually be adopted into 49 C.F.R.

13 So the intent here, the broad goal
14 here really as far as this particular standard
15 goes is to limit the thermal event within the
16 battery and/or the packaging.

17 That is, if you have a thermal event,
18 one cell goes in thermal runaway and maybe it
19 propagates to the next cells, the idea here is
20 with this particular standard is to limit that
21 within the packaging, and I know Daphne referred
22 to this a little bit in her presentation.

1 Some of the criteria, very broad
2 criteria that they're talking about with
3 developing this standard are listed there.
4 Limitations on external surface temperatures. No
5 hazard fragments can leave the package. The
6 package must maintain structural integrity.
7 Limits on flammable vapors and the pressure pulse
8 coming off the package.

9 Very, very broad criteria that again,
10 that meeting they held in Montreal the week of
11 March 7th, they were fine-tuning the standard.
12 This is going to have a very significant impact
13 on the industry once it is developed and once it
14 goes into effect.

15 So leading up to this standard, over
16 the last couple of years there's been a lot of
17 information in the press, a lot of information
18 from companies releasing press releases about
19 their secrets to meeting this potential standard.
20 The standard has been talked about for quite
21 sometime, but there are companies that have come
22 out with various solutions for meeting the

1 standard.

2 The Omega Box, for example, is a
3 company that we recently ran into, that has this
4 very large metal box that would theoretically
5 meet the standard that SAE is developing.

6 Pyrophobic (phonetic) is another company.

7 The one on the bottom left has this
8 box that has some -- has some interesting
9 properties to it that apparently can withstand a
10 thermal event involving a battery.

11 FedEx has their gel pack, a gel pack
12 where you would put this inside your packaging.
13 In the event there was a thermal event involving
14 one of the cells or batteries, the gel pack would
15 open up, cool the cells and prevent further
16 propagation to the next package.

17 So again, the packaging ideas do
18 abound. There's a lot of interest in the
19 packaging community in developing, you know, the
20 packaging that could meet the standard. It's a
21 very -- it's a very fluid process right now.

22 We don't know exactly what the

1 standard will require, but it's -- the good news
2 here at least is there's a lot of alternatives
3 out there to meet this standard, and that's a
4 good thing for the industry.

5 Americase has done a lot of work in
6 this area. I know many of you are familiar with
7 Americase's packaging. They also have a special
8 permit from DOT that authorizes the use of their
9 packaging for shipping damaged defective
10 batteries by air.

11 So I would have to say they're
12 probably head and shoulders above the rest of the
13 packaging manufacturers and designers out there
14 with regard to the type of packaging they have
15 available to potentially meet this standard.

16 They are a member of our association.
17 We're happy to have them on board, and have
18 worked with them on these issues for the last six
19 or seven months or so.

20 So again, I think again reaching out
21 to our members to participate in developing this
22 type of packaging and developing this standard is

1 really where I think it's going to be key, and
2 again Americase is going to I'm sure play a big
3 role in that.

4 I throw this out there because
5 everybody talks about hoverboards, you know. The
6 good news is if you've got a hoverboard -- does
7 anybody have a hoverboard in their house? Come
8 on, admit it. No? Nobody, come on. You know, I
9 go to make these presentations. I say who's got
10 a hoverboard and nobody raises their hand. I
11 swear.

12 But the good news is if you've got a
13 hoverboard, there is a Hovercover fire resistant
14 hoverboard bag you can buy from Amazon, and if
15 you're a Prime, Amazon Prime member, you get next
16 day air. So I throw that -- there's always -- I
17 always try to throw a little bit of humor in
18 lithium batteries, and that one usually gets a
19 good laugh.

20 But I find that just amazing, that if
21 you're a parent and you're buying Little Jimmy a
22 hoverboard, you also are going to buy a

1 Hovercover fireboard or a bag. But anyway.

2 So for the industry, the next steps
3 for us at least, and this is really important.
4 SAE, IKO they had this meeting in Montreal the
5 week of March 7th and there were probably 20 or
6 25 people in that room, and they should have had
7 50.

8 There were a lot of people that were
9 shut out of that meeting because they wanted to
10 keep it at a relatively small writing group. But
11 unfortunately they left a lot of people out of
12 that meeting that I felt could have contributed a
13 lot to that writing that standard.

14 So this meeting in Montreal a couple
15 of weeks ago, they did apparently draft a
16 standard. We haven't seen it. It's a draft. I
17 expect it will be circulated some time soon.

18 But they sent an email out yesterday
19 or last night that they're going to have a
20 conference call for April 11th, where they'll
21 present the standard, talk about it, give
22 everybody an opportunity to submit their comments

1 in writing.

2 Eventually I'm assuming they're going
3 to come up with a second draft, and then they'll
4 have another writing meeting. Then some time
5 maybe they'll develop the final standard by the
6 end of this year maybe. It's on the fast track,
7 there's no question about it.

8 And the standard, just to make sure
9 everybody's aware, this is all about air
10 transport. This is not about ground or sea.
11 This is all about air and the concerns with
12 lithium batteries in the cargo hold.

13 So again, this was IKO's idea for
14 developing the standard, and as I said before,
15 it's going to have a very significant impact on
16 the industry.

17 So what I'm suggesting here is with
18 PHMSA's interest in this issue, NRL and with the
19 Naval Surface Warfare Center, I think there's a
20 great opportunity for all of us to work together
21 in testing out this standard. Once this standard
22 comes out in draft form, it's going to have

1 criteria in there for forcing, you know, to
2 explain how to force your cell into thermal
3 runaway, okay. How hot does that thermal, that
4 temperature have to get to force that cell into
5 thermal runaway? What does the packaging need to
6 look like? What's the pass/fail criteria?

7 I think with our members, and again
8 because of the diversity of our members who do
9 manufacture billions of cells and safely ship
10 billions of cells and batteries every year,
11 there's an opportunity I think for us to work
12 together to test out the standard, test some of
13 the packaging that's in the marketplace and see
14 what works based on what SAE and IKO is
15 developing.

16 So that's my proposal or my idea, at
17 least for the folks in this room to think about,
18 because I think we have the resources in the
19 sense that we can get the cells and batteries.
20 We have the expertise and some of our members who
21 have the packaging we could test that out.

22 We have labs, members -- we have about

1 half a dozen members who are labs who can do some
2 testing as well, and are willing to donate their
3 resources for that. So again, I view this as an
4 extra opportunity for an industry-government
5 joint effort to work on this. I think it will
6 help SAE and IKO as they develop this standard,
7 to find out where the holes are in the standard
8 and maybe how to improve it.

9 So I have a video as well, and mine,
10 I know mine's going to work. Let's see. Nope,
11 it's not going to work. So it's weird. It does,
12 like everybody else. It seems it worked. I just
13 had it on my laptop a second ago. So there's no
14 way to -- yeah, it's weird.

15 So what this is -- I'll explain what
16 this is. There's no fire, okay. These are
17 packages of 18650 cells at 30 percent stated
18 charge, which is exactly how they're going to
19 need to be packaged for air transport in about a
20 week and a half, and they forced these cells into
21 thermal runaway.

22 They put a heating cartridge in the

1 middle of the box. The cells were shoulder to
2 shoulder and there's about 200 cells in the box,
3 and what this video shows is virtually nothing.
4 You get a little bit of smoke coming out of the
5 package. There's no fire, there's no explosion,
6 there's no, you know, what would be called rapid
7 disassembly, 30 percent stated charge.

8 And again, I think what you're going
9 to find, as SAE and IKO developed the standard
10 and we go out and do test some of this packaging,
11 at 30 percent staged charge, and again that's the
12 limit for your cells and batteries starting April
13 1st, there's going to be a lot of non-events, and
14 that's what this video is intended to show.

15 At 30 percent stated charge, you're
16 not going to get that propagation. You're not
17 going to get all the fire and everything
18 everybody's been talking about.

19 So I think that's very key for
20 everybody to understand, is while the packaging
21 standard or the standard SAE and IKO is putting
22 together while it's very important, those

1 limitations on stated charge are going to have a
2 very significant impact from a safety standpoint.

3 So that's all I've got for now. I
4 know we're tight for time and such, and I'll be
5 glad to take questions of the panel as well.

6 (Applause.)

7 MR. BOYLE: You want to turn this one
8 on as well, and then if we have any questions,
9 I'll just have you guys stand in front.

10 (Off mic comments.)

11 MR. BOYLE: Are there any questions?
12 We'll for about five minutes or so. Sam.

13 MR. ELKIND: Yes, Sam Elkind with UPS.
14 I have a question for Daphne. You made a comment
15 about working on a quantity measurement other
16 than mass for batteries for transport purposes.
17 There's a company that accepts some packages that
18 is interested in that, and then I have a question
19 for Corey after that.

20 DR. FUENTEVILLA: All right. So what
21 we're planning on doing with respect to that is
22 to take a look at what hazards are encompassed

1 with a mass limit of under and a mass limit of
2 over, and we're specifically focused on what are
3 you limiting when you say this mass indicator.

4 Mass is not directly tied to
5 electrochemical energy or the abusive energy
6 that's coming out of that potential hazard that
7 you're directly concerned about.

8 So we're going to take a look at how
9 those two tie together, and what other factors
10 can be used or controlled or are reasonable in
11 terms of a regulatory, from a regulatory
12 perspective, for defining how to limit the
13 hazard.

14 MR. ELKIND: Thank you. I appreciate
15 that. The comments you made at the end were very
16 interesting, because we have heard discussions
17 about there ought to be some limits of X or Y
18 type, and we just -- we don't know whether you're
19 talking about battery count or package count or
20 weight count or what. And so I think an
21 exploration along those lines would be very
22 interesting.

1 Corey, I have a question about the
2 dendrites you were talking about. It's
3 unfortunate. We've had experiences with lithium
4 battery incidents, fires, and for us they're
5 apparently new packages, packages of new products
6 going out into distribution.

7 So you're talking about dendrites
8 forming. I thought I understood it to be through
9 a charge/discharge cycle. Do they form early in
10 the process early enough that product that is,
11 so to speak new, going out the door has a
12 dendrite that poses a risk of short circuit.

13 DR. LOVE: Yes. So I would say under
14 certain conditions, it's possible yes. Thermal
15 cycling or thermal stress, especially on the low
16 temperature side of things. I think more
17 directly, if you're talking straight from the
18 manufacturer, it could be a manufacturing defect
19 or FOD or something that's inside of the can,
20 that can then propagate itself into a dendrite,
21 you know.

22 Typically, I'm focused more on the

1 recharging side of things and understanding what
2 are the exact -- what's that low temperature
3 boundary which we cannot go below for recharging
4 purposes to recharge safely. So I would say, you
5 know, and open it up to the floor, but it could
6 be, you know, a manufacturing defect or FOD or
7 something inside of the can that can get that
8 similar internal short circuit.

9 DR. FUENTEVILLA: I would just like to
10 follow that up. I agree with everything that
11 Corey said about that. It's been a challenge for
12 us on the DoD side to actually identify these
13 latent cell defects and when they're going to
14 show up.

15 We've seen battery failures that
16 occurred in the field with some of our systems,
17 where the battery's been in storage and it's got
18 a sign-out sheet, you know, for who opens the
19 door and it's been -- nobody's in there for two
20 weeks and then all of the sudden there's smoke
21 detection, which is -- that's not typical.

22 However, we've seen it. And trying to

1 understand why that's occurring and what is
2 changing to make that occur is difficult. That's
3 actually something that we're trying to take a
4 look at some of these basic failure mechanisms,
5 and look at dendrite growth, because we want to
6 understand that better.

7 We want to see where this is coming
8 from, why it's happening, whether it's a
9 temperature change, whether it's something inside
10 the cell and then vibration. You know, we want
11 to understand better why that's occurring and how
12 it's happening.

13 MR. ELKIND: We would imagine you're
14 dealing with first rated batteries and cells --

15 DR. FUENTEVILLA: We would hope.

16 MR. ELKIND: --and our concerns are
17 often focused on the possibility that we're
18 handling --

19 DR. LOVE: Yeah. We have the benefit
20 of identifying the vendor early on that we want
21 to work with and working with them through all
22 the R&D, and selecting the cells that meet our

1 criteria and standards. So we have the best of
2 the best cells and, as Daphne just mentioned, we
3 encounter some of the same problems, even with
4 those really top notch vendors.

5 MR. ELKIND: That's very interesting.
6 Thank you.

7 MR. RAJ: Just a couple of comments.
8 I think I was intrigued by what you said about
9 making connections between what we're doing in
10 DoD and PHMSA.

11 But I would also suggest that we
12 should make connections with what is being in
13 DOE. For example, for the last four years we
14 have an ARPA-E project, looking at how to predict
15 runaway events and developing sensors to detect
16 events before a fire occurs, and so those
17 technologies would be considered.

18 The second aspect of that is also risk
19 management. I was very intrigued by the slide.
20 We are looking at, for example, we are testing
21 hybrid power ship off the Norwegian coast called
22 Viking Lady, and what we look at in terms of

1 battery safety issues on board ship is use of
2 system-wide risk assessment method, similar to
3 what we've been using for pipeline.

4 So probably PHMSA should reach out to
5 PHMSA. But the idea was really to treat battery
6 as a system. Just like pipeline, you have a, you
7 know, fuel that's flowing inside the pipeline and
8 then you have all these environmental conditions
9 outside.

10 The battery could be regarded just
11 like that, and so we can look at it as a, you
12 know, barrier, number of barriers have to be
13 breached simultaneously before an event occurs,
14 those kind of things. Just a suggestion for
15 consideration in terms of risk management
16 approaches.

17 DR. FUENTEVILLA: Thank you. We're
18 actually very interested in working more closely
19 with ARPA-E on some of their technologies,
20 because there are similarities between what's
21 happening, what's being developed within DOE and
22 what's being worked on within DoD, and we do very

1 much take a look from a system safety perspective
2 is how we evaluate battery safety within the Navy
3 especially.

4 We're always concerned about not just
5 what the battery does but how any residual risk
6 impacts our platforms or our mitigation system
7 capabilities, and looking at each barrier and
8 what it takes to breach it, and then what's
9 needed to contain it.

10 MR. BOYLE: Okay. Thank you all.
11 Thank you George.

12 (Applause.)

13 MR. BOYLE: We're going to take about
14 two minutes so I can ask the LNG presenters to
15 come forward.

16 (Whereupon, the above-entitled matter
17 went off the record at 11:58 a.m. and resumed at
18 12:00 p.m.)

19 MR. BOYLE: I know we're taking some
20 of your lunch, so I won't take all of your lunch,
21 and I'll begin the LNG session by introducing
22 Dawn Johnson from Volpe, who's been doing some of

1 our work on small scale LNG work, as well as a
2 literature review on some of the testing that's
3 been done.

4 Then we'll turn it over to our
5 partners at FRA and our Engineering Group at
6 PHMSA, and then we'll close out with our R&D, my
7 colleague Veda, and he'll tell us a little bit
8 about where we're headed forward.

9 Hopefully this session, we're going to
10 keep it at about 45 minutes and we'll probably
11 have a little bit shorter lunch. So I apologize
12 for that. But without taking up any more time,
13 I'll introduce Dawn. Thank you.

14 MS. JOHNSON: Good afternoon everyone.
15 I'm going to be talking about two research
16 efforts that Volpe is doing in conjunction with
17 PHMSA on LNG work.

18 LNG stands for Liquefied Natural Gas.
19 The bulk of this presentation is going to be on
20 new and emerging LNG facilities, and then I have
21 a slide towards the end on some of our initial
22 research findings on fire testing and thermal

1 modeling associated with portable LNG containers.

2 Do I have to point this at any
3 particular -- it is the arrow button, correct?

4 PARTICIPANT: Yeah. Try the other
5 one.

6 (Pause.)

7 MS. JOHNSON: This is not a video.

8 (Laughter.)

9 MS. JOHNSON: Okay. Just an overview
10 on LNG. The abundant supply of natural gas in
11 the U.S. coupled with this lower cost when you
12 compare it to crude oil has increased the
13 domestic gas production in recent years. This
14 growth has also driven the development and new
15 LNG facilities and new uses for LNG that aren't
16 currently regulated under 49 C.F.R. Part 192,
17 which regulates gases that are transported via
18 pipelines, and also 49 C.F.R. Part 193 which
19 regulates LNG facilities specifically.

20 So just to get everybody kind of on
21 the same page, some properties of LNG, and this
22 is really -- these properties are common to all

1 of the new emerging facility categories that I'll
2 talk about in the later slides.

3 LNG is considered Class Division 2.1,
4 which is a flammable gas. It has a high methane
5 content and it's also considered a cryogenic
6 liquid. LNG is basically natural gas in a liquid
7 form, and it's in liquid form when it's at or
8 below minus 259 degrees Fahrenheit, which is very
9 cold. Hence, its cryogenic properties.

10 LNG is the cleanest burning fossil
11 fuel and when it's regasified, LNG has 50 percent
12 lower emissions than coal. It has negligible
13 oxides and it can be used by most energy sectors.
14 So it's definitely looked at in transportation as
15 a possible via alternative to traditional coal or
16 other types of fuel.

17 And when it's liquefied, LNG takes up
18 1/600th of the volume that natural gas does. So
19 when you liquefy it, you shrink the volume of it
20 exponentially. LNG is odorless, non-toxic and
21 non-corrosive and it rapidly evaporates when it's
22 exposed to the environment. When it's exposed to

1 the environment, what's going to happen is it's
2 going to change to gas, hence the evaporation
3 properties.

4 Some of the main risks associated with
5 an accidental LNG release, again this is when the
6 liquid would turn to gas. It includes fires,
7 explosions and exposure to the cryogenic effects
8 of LNG. Just so that everybody is aware, LNG is
9 forbidden to be transported by air and on
10 passenger rail.

11 Non-bulk transport is permitted on
12 roadways and waterways and UNT 75 portable tanks,
13 and bulk packaging is permitted on vessels. Bulk
14 packaging of LNG on rail has to be approved by
15 the FRA's Associate Administrator of Rail Safety.

16 So the problem statement that we're
17 looking at for PHMSA is PHMSA's Pipeline side
18 identified 12 and emerging LNG facility
19 categories that aren't currently regulated under
20 Parts 192 or 193 of 49 C.F.R. So what we were
21 charged to do is to do some research on these new
22 12 categories.

1 So the next two slides have the 12
2 categories identified in bullet form. I'm not
3 going to read these all to you, but I'll just use
4 some summary. So we're talking about LNG,
5 marine, export and import terminals that aren't
6 supplied by or connected to pipelines.

7 Some of the cargo transfer system
8 components associated with marine vessels and the
9 last valve on the storage tanks are when LNG is
10 transferred between those pieces of equipment;
11 various vehicles and tankers that consume LNG as
12 fuel or transport LNG; natural gas processing
13 plants that don't store LNG at the plant; some
14 distributed production facilities that use LNG
15 but don't store LNG; and also LNG facilities that
16 store or vaporize LNG that is produced on site,
17 as long as that facility is the sole consumer of
18 that LNG.

19 The additional five of the 12
20 categories include LNG refueling stations for
21 vehicles that use LNG as fuel; some LNG marine
22 and land depots where LNG is loaded onto

1 transport vehicles; floating LNG liquefaction and
2 gasification facilities not supplied by
3 pipelines; some LNG at satellite plants that is
4 consumed by power drill equipment.

5 This is known as the ultimate consumer
6 exemption, and finally LNG-based distributed
7 power plants that are supplied by pipelines that
8 serve only the pipeline operator, and also LNG
9 plants where LNG is supplied by means other than
10 pipeline.

11 So a lot of these are -- it's a lot of
12 verbiage here, but basically these are 12
13 categories were identified by PHMSA. In our
14 research, we did not find any additional
15 categories, so this presentation is focused on
16 these 12 categories.

17 So in our initial research findings,
18 we found for nine of those 12 new categories some
19 descriptive characterizing information. This
20 information included U.S. locations where those
21 types of facilities or operations are located;
22 some detailed process and equipment explanations;

1 as well as some safety, security and risk
2 information.

3 Out of those nine categories, we also
4 found specific risk and hazard information
5 associated with an accidental release for three
6 of those four categories. So that particular
7 risk and hazard information was specific to those
8 types of categories. They weren't following the
9 general properties of LNG. It was in addition to
10 the properties that I described on the previous
11 slide.

12 For three of the new emerging LNG
13 facilities, we didn't find any specific
14 information and no U.S. locations and no
15 descriptive process information. So again, this
16 is our initial research results here.

17 So some safety and security
18 information that is common to all LNG facilities.
19 We talk about basically four layers of
20 protection. The first is primary, which is using
21 appropriate materials and proper engineering
22 design when you're building the facilities, when

1 you are establishing these new uses for LNG.

2 You design these areas and
3 opportunities such that, you know, you remove any
4 hazards as much as you can. Secondary level is
5 if you do have a spill or a leak of LNG, to have
6 the appropriate means to contain it, such that it
7 doesn't spread and it can be quickly mitigated.

8 The third level would be Safeguard systems.

9 These include high level alarms, backup systems
10 and also shutoff operations, where if you were to
11 have a piece of equipment that failed or you had
12 a problem with it, operators would be notified of
13 the problem and then be able to stop it at the
14 source so the problem wouldn't get worse.

15 Then the fourth level is regulatory
16 mandated separation distances from communities
17 and public areas. So when a new LNG facility is
18 built, it has to be certain distances from the
19 public and from, you know, schools and other
20 types of vulnerable businesses, and also there
21 are required safety zones around LNG's ships.

22 So more specific safety and security

1 information that primarily deals with LNG
2 transport ships and also LNG transport trailers
3 and tanks. They have to be double-hulled and
4 this is a safety preventative measure, such that
5 if there is a leak you have another barrier of
6 containment that can contain the LNG.

7 And also with ships, they're required
8 to be inspected annually by the Coast Guard and
9 also by the Captain of the Port within 96 hours
10 of entry into a port. So all of the compartments
11 have to be inspected by the Captain of the Port
12 before it's allowed into the U.S. port.

13 DOT also has requirements for LNG
14 transport by highway, and also some specific
15 requirements for cryogenic liquids in cargo
16 tanks. So there are some regulations that do
17 deal with LNG that's transported in these
18 capacities, but they don't fully cover all of
19 these 12 new and emerging types of LNG facilities
20 and operations.

21 Some risks and hazard information.
22 These vary between public perception being that

1 sometimes, you know, people don't really
2 understand LNG and they've heard about previous
3 events where LNG explosions or fires happen.
4 Also, there has been some public perception in
5 recent years about LNG facilities being potential
6 terrorist targets.

7 You know, this is an area, you know,
8 if it were to be exploited could be a problem for
9 the general public. Some other emergencies
10 associated with marine cargo transfer system
11 components can include if the LNG's tanks
12 pressure valve go, that could compromise the
13 tank's structural integrity. Natural gas
14 releases if they're near a source of ignition and
15 oxygen could have the potential to ignite.

16 Extreme weather conditions, which
17 could promulgate an accident that, you know,
18 results in an emergency, and also when we talk
19 about vessels that are moving LNG, there's
20 congestion at berthing and mooring areas, where
21 you could have, you know, a vessel that strikes
22 another vessel, which could cause a rupture of a

1 tank, which would then result in an emergency.

2 Also shallow water areas where these
3 vessels are coming into if they were to, you
4 know, hit some type of rock or a reef underneath,
5 which could compromise the tank's structural
6 integrity. Also transfer operations.

7 When you transfer -- when you reduce
8 natural gas to LNG by cooling it, there's risks
9 associated with that because you're taking, you
10 know, a gas and you're cooling it very rapidly at
11 a very, you know, a very cold temperature.

12 You can crack a ship's deck, any type
13 of leak that results in that type of, you know,
14 operation if you have it as a liquid, and the
15 liquid then goes past the crack and it can go to
16 other areas of the ship, and if it's cold enough
17 that can result in its cryogenic features hitting
18 other components of the ship, compromising the
19 ship's structural integrity.

20 There's also -- the last bullet talks
21 about some fire test analyses that was conducted
22 by Sandia on bulk LNG transport carrier ships,

1 and these talk about LNG dispersion distance is
2 limited by the closest ignition source.

3 So basically if you have an ignition
4 source near where LNG is dispersed, that's where
5 the fire's going to happen and it's, you know, it
6 may spread a little bit but it's unlikely to jump
7 and jump and jump unless there are, you know,
8 additional volatiles and additional sources of
9 ignition.

10 LNG fires produce temperatures of 700
11 to 1,200 degrees Celsius, they're very hot, and
12 the flames can anchor to the ship structure.

13 So when you get something like this,
14 it's going to be limited to the ship, but you're
15 going to have probably a lot of damage on that
16 ship because the fire is so hot and it does --
17 the cryogenic nature of LNG will affect other
18 ship components.

19 If you have cross-winds, that also
20 promulgates the possibility that the fire will be
21 -- move around the ship also. One other finding
22 that was interesting that the LNG cargo tank

1 pressure increases minimally during a nominal
2 spill or fire. So you're unlikely, unless you
3 have other structural integrity issues, you're
4 unlikely to see one tank go up in flames and then
5 another one go up in flames unless that other
6 tank has been compromised structurally as well.

7 Some additional risk and hazard
8 information is that land-based LNG fueling
9 stations can be sensitive to heat entries. So
10 the LNG can boil off rapidly, again turning into
11 a gas. If you have an ignition source, that
12 could be a potential explosion or a fire.

13 LNG being a very cold fuel, handlers
14 need to be wary and wear appropriate protective
15 equipment, and they also have to have the
16 required training in order to know how to safely
17 handle those types of transfer operations.
18 Vessel to vessel LNG transfers are very complex.
19 There's multiple pieces of equipment on both the
20 vessel where the LNG is stored as well as the one
21 that it's going to be transferred to, and all of
22 those components have to match up.

1 And so each vessel that carries LNG or
2 it's being moved to has standard operating
3 procedures. Their crew has been trained on how
4 to properly transfer the LNG so that the
5 possibilities of an emergency are minimized.

6 So in addition to those procedures,
7 you also have vessel compatibility assessments
8 that are required to be done, such that it
9 reduces the chance of an emergency happening
10 during those transfer operations.

11 So some potential next steps for this
12 research effort is to work with industry to
13 further characterize and what was characterized
14 and determine any types of transportation impacts
15 for the three LNG new and emerging categories for
16 which we found no information.

17 Additionally, we'd like to conduct
18 site investigations for all 12 categories to be
19 able to further characterize and understand where
20 they are in the U.S., and understand some of the
21 operational procedures, as well as some of the
22 safety and security information that has been

1 gleaned by those new facilities in ways that LNG
2 is being used.

3 Also to conduct applicability and gap
4 reviews of the current federal regulations, based
5 on what these new and emerging facilities, how
6 they're using LNG and what components are at
7 these facilities, and also to identify new
8 opportunities with industry and other government
9 partners for additional research related to the
10 transportation risks associated with these new
11 and emerging LNG facilities.

12 The second research effort that we're
13 doing is a literature review, and it was trying
14 to determine whether any fire testing and thermal
15 modeling has been done on UNT 75 portable tanks.
16 What we did was we searched on LNG as well as
17 similar materials being compressed natural gas,
18 petroleum and diesel that have some similar
19 properties.

20 What we found was a literature
21 research of universities, all of the federal labs
22 as well as just a general research effort, you

1 know, looking on the web. We found no evidence
2 of fire testing and thermal modeling information
3 for UN T75 portable tanks, tank cars, iso-
4 containers and packages.

5 Now this information may exist at the
6 manufacturer level, but we didn't go to that
7 level, nor would we be able to based on
8 manufacturer's proprietary data. So that may be
9 something that would be a potential future
10 effort, if we were to make, you know, the
11 appropriate connections with industry and they
12 were to allow us to review those tests.

13 I guess I'll wait until questions,
14 until we have the next two presenters.

15 MR. BOYLE: Thank you Dawn.

16 (Applause.)

17 MR. BOYLE: We are going to hold
18 questions until the end, and now to discuss some
19 of the research on containment and transport of
20 LNG from the FRA, Federal Railroad Administration
21 side, bring Francisco Gonzalez up please.

22 MR. GONZALEZ: Good afternoon. Does

1 this work? Oh yeah, good, and I knew that the
2 videos were not going to work, so I didn't bring
3 any.

4 (Laughter.)

5 MR. GONZALEZ: In FRA hazardous
6 materials and tank car research, our mission is
7 to reduce the incidence of hazardous materials
8 releasing from rail tank cars and other
9 containers. Our goal is to provide support for
10 the Office of Railroad Safety in PHMSA, to
11 develop new regulations and standards and best
12 practices.

13 So we do a lot of this research,
14 provide this information to the community and
15 also the industry, and they can develop also some
16 of the best practices like in the AR for example.
17 This is a list of all the hazardous materials and
18 tank car projects that I manage.

19 Right now we're not going to talk
20 about all of them, because we don't have all day,
21 but we want to talk about the last three, which
22 is only for LNG commodity, LNG as a fuel and also

1 some of the tank car and iso-tank car -- ISO tank
2 fire testing.

3 At the LNG commodity rail transport in
4 commerce, it can be transported by tank car or an
5 ISO tanks. Also, we're going to talk a little
6 bit about the regulations related to tenders and
7 also as a commodity. LNG is used as a fuel for
8 powering locomotives and also we're talk about
9 LNG tanker design issues and crashworthiness.

10 Right now as in the LNG commodity and
11 rail transport, right now we have special permits
12 if some people want to transport LNG in ISO
13 tanks. What we do -- what we've done is to
14 contract with Volpe and do a crashworthiness
15 assessment on the transportation of ISO tanks on
16 rail.

17 Some of the concerns that we have is
18 the potential consequences of an accident on --
19 when it's transported into, in rail. Some of the
20 consequences may be significant, and also some of
21 the hazmat train accidents or some of this
22 transportation is going to be under are -- can

1 occur in dense population areas or when there is
2 no access to that train.

3 So it could be hard to reach with
4 emergency equipment, either because of the
5 population or because it's hard to get there. So
6 right now what we do is in the approach that
7 we're taking is to develop equipment information,
8 gather all the information and equipment, on the
9 ISO tank and also on the rail car or the flat car
10 or the well car that it's going to be
11 transported, define some of the accident
12 scenarios and do a crashworthiness analysis of
13 equipment in those accident scenarios.

14 So some of the accident scenarios that
15 we're looking into is there are three general
16 categories of train accidents, train to train
17 collisions or head-on collisions, grade crossing
18 collisions and derailments. Some of these
19 sources for these accidents we're using are FRA
20 railroad accident investigations, PHMSA hazardous
21 release investigations and also NTSB
22 investigations.

1 There have been several developed
2 scenarios before in tank car crashworthiness that
3 we have done, and also under the TAG, which is
4 the Tank Car Advisory Committee or Group with AR,
5 FRA and PHMSA and the industry, and to see what
6 are those scenarios of concern or general
7 scenarios on derailments.

8 So we have five LNG tanker scenarios.
9 For example, we have train-train like I just
10 mentioned, grade crossing scenarios, rollover
11 accidents, head impact or shell impact.

12 On the three tank car scenarios that
13 we have done on my program, we have done several
14 testing on head impact, center seal impact and
15 offset shell impact. So we have done those kind
16 of scenarios on either modeling or the actual
17 testing.

18 So Step No. 2 will be the
19 crashworthiness analysis approach. The container
20 performance in scenarios is to be evaluated in
21 three phases. First, they interpolate,
22 extrapolate from existing LNG tender and hazmat

1 tanker analyses and tests. That has been done on
2 the tank, on the LNG tender, on the tank car
3 tender, not on the ISO tanks. So we're going to
4 take some of those scenarios and some analyses to
5 feed into this program.

6 The Phase 2 will be a simple fire
7 engineering analysis, to see what -- how can they
8 survive or how, what would be the survivability
9 of the ISO tank in transportation. Also after
10 that, we will do a detailed computer simulation,
11 to see are there more detail in some of those
12 scenarios and then how can we learn.

13 Throwing out the status and next steps
14 on this task is equipment description. We've
15 gathered the information in sufficient detail for
16 the initial evaluation. We're getting some of
17 the information on the ISO tank, how is this
18 contracted with the material and all that, and
19 also what are the rail cars that are going to be
20 used to transport these.

21 It could be a flat car or it could be
22 also a well car, and see what other safety

1 features they're going to put in this, to make
2 sure that these ISO tanks are in place. The
3 accident scenarios, we drafted discussions and
4 they're used from accidents information in
5 previously developed scenarios like I mentioned.

6 An assessment of crashworthiness
7 performance in scenarios. Like I mentioned,
8 interpolate from existing assessments, perform
9 some survive engineer analysis and do a more
10 detailed computer analysis. Now all these --
11 those two information, this information will be
12 used in a risk analysis or crashworthiness
13 assessment by FRA, PHMSA or maybe some other
14 people who are going to transport this material.

15 We know the risk frequency but there's
16 consequences. So the accident scenarios may be
17 used as a part of the analysis on the frequency
18 term. The crashworthiness analysis, the resource
19 may be used as a part of the risk analysis
20 consequence term. In other words, but the
21 details of how crashworthiness information is
22 used depends on particulars of the risk analysis

1 approach.

2 So Leonard is going to talk about a
3 little more of the analysis or the risk analysis
4 that they do, and Volpe's doing some risk
5 analysis and also the companies or the railroads
6 that are going to transport these, they're also
7 doing a risk analysis. So some of the
8 information that we're going to obtain here will
9 be feeding to that risk analysis.

10 Some of the regulations that are in
11 place in commerce for LNG shipments by rails is
12 the LNG shipments in commerce in rail tanker is
13 not authorized. So there has to be a special
14 permit under 49 C.F.R., and it will be issued by
15 PHMSA. In other words, the tank cars that are
16 being used are like DOT-113, cryogenic liquid or
17 cryogenic tanks for cryogenic liquids.

18 So that can be transported in that,
19 but it's not authorized. LNG is not authorized
20 for transport. It has to be a special permit.
21 LNG shipments in portable tanks on rails are
22 authorized, but it has -- need a special approval

1 needed from FRA if it's going to be transported
2 by rail. So in commerce and vessels, and also in
3 road, they are -- they are authorized to
4 transport it.

5 Now the regulations of LNG tenders,
6 that means when this -- either a tank or ISO tank
7 is fueling or is used to fuel the locomotive,
8 there is no coordination in the use of LNG in a
9 tender to carry and feed fuel to a locomotive
10 provided that it's proper condition and is to
11 safe to operate without unnecessary danger or
12 personal injury.

13 LNG tender is subject to FRA's
14 statutory authority under Chapter 207 in the
15 locomotives, because it will be treated like a
16 fuel tank. LNG tender is not subject to HMR
17 requirements because it will be part of the
18 locomotive, as long as it complies with the
19 locomotive act or chapter.

20 Associate Administrator letter to
21 industry on safety rationale in HMR is applicable
22 to the assigned operation of LNG CNG tender. So

1 the FRA has been working a lot with the industry,
2 to make sure that this tender in some of the
3 pilot programs they have done, to make sure that
4 it's safe to be transported and used as a fuel.

5 Applicant to obtain an FRA concurrence
6 letter before using LNG tender to fuel as
7 locomotive, fuel a locomotive. Here's an example
8 of a LNG tender feeding a locomotive. This is
9 one of the pilot projects that CNG analysts have
10 used, and you can see the tender is in the middle
11 between the locomotives, and that tender is
12 fueling the two locomotives to transport it. Not
13 to transport it, I mean to fuel the locomotive
14 assembly.

15 Right here is the iso LNG tender
16 constant. This is pretty much the same
17 principle. The only thing is this is an
18 isocontainer. This one it could be -- I think
19 this one they only use is to fuel just one
20 locomotive. Is that right Leonard?

21 MR. MAJORS: To both of them.

22 MR. GONZALEZ: To both of them, okay.

1 So it's the same principle; it's just a smaller
2 container.

3 Now FRA is participating in the LNG
4 tender cars. Melissa Sherman, Michael Rush and
5 also Steve Clay. They participate on the AAR
6 TAG, which is the technical advisory group, the
7 AAR, the industry and also the FRA and PHMSA
8 participates.

9 So they've been doing that for a while
10 and FRA participates and induces the industry to
11 develop a specifications for future LNG tender.

12 The crashworthiness analysis research
13 is being conducted by ARA in support of AAR, and
14 by Volpe in support with FRA. Research is being
15 conducted cooperatively. Like I mentioned, those
16 scenarios that we've -- that I described for the
17 ISO tank, David Terrell from Volpe, he has done
18 this work for LNG tender on tank car. So that's
19 why we're using kind of the same scenarios.

20 AAR LNG TAG is charged with assuring
21 the functionality as well as the safety of
22 product on the LNG tenders. Real quick right now

1 we're going to -- before, so we can go to lunch,
2 this is dynamic crashworthiness scenarios. These
3 are the scenarios that we're considering.

4 For example, if a locomotive or parts
5 of a locomotive tender locomotive hits a wall
6 that is a highway grade crossing and something
7 hits the tender in transportation, and also if
8 it's a rollover in case of a derailment.

9 This is something that we have done
10 before on tank car research, that we put them on
11 the well in TTC, and then we hit on the middle on
12 the shell, and also during head testing.

13 So we can do these kind of scenarios
14 also for a tender -- LNG tender in a tank car.
15 This is another one, kind of a quasi-static
16 crashworthiness scenario that we're proposing
17 that we can do. Real quick on these scenarios.

18 So what is FRA doing to promote the
19 safe use of LNG? Like I mentioned, participate
20 in the AAR's TAG and develop on the standards.
21 We do a lot of modeling and study on the licensed
22 tender crashworthiness on different accident

1 scenarios along with the industry; evaluate
2 special petitions of permits to transport it; and
3 review petitions in commerce for the LNG in
4 portable tanks.

5 So some of the nearer terms -- the
6 longer term plans is monitor and collaborate with
7 the industry in its development of tank car
8 tender standards, and that will be for the tank
9 car not the ISO tank, because the ISO tank is
10 already done. But the safety on going in between
11 -- you know, when the material or the LNG, the
12 natural gas is moved from the ISO tank to the
13 locomotive.

14 Continued computer modeling of
15 accident scenarios, perform physical tests on
16 tank cars and ISO tanks in Pueblo, Colorado in
17 the test centers. So about one or two years, in
18 the next three years. Perform fire testing on
19 tank cars and ISO tanks; use industry standards
20 and their results to amend current regulations.

21 We're talking about the cooperation
22 between PHMSA and FRA. What we're doing is we're

1 going to fire test and also crashworthiness
2 testing on tank cars in my side. In the side
3 with PHMSA, they're more interested also in the
4 ISO tanks.

5 So what we're trying to do is to
6 cooperate and provide some information or do a
7 contract, for example, when we do these kind of
8 tests, do it on both. Do a tank car and ISO tank
9 in a crashworthiness scenario, whatever the
10 scenario will decide that is more important and
11 we can get more information, and also a fire
12 test.

13 Dawn mentioned that what we did is to
14 try to find out, see if this kind of fire testing
15 they have done in other parts of the world in the
16 country, and we find out that it's not many they
17 have done. So we have to come out with the
18 information. I think Sandia has been doing some
19 of the testing and also Melissa Sherman has been
20 doing some research and literary research on
21 that. So we -- we're waiting for that result.
22 So before we put the contract, we need to find

1 out what has been done, what would need to be
2 done before we start doing the testing.

3 Just to finish it up, the Broad Agency
4 Announcement, we have done this for -- you know,
5 every year. So this year we have three different
6 topics. So anybody who is interested, go to
7 these websites and you can read what is the
8 criteria or the in other words request for
9 information or proposals or concept papers, to
10 see -- for example, on the first one is
11 protecting hazardous materials tank cars from
12 punctures and heat.

13 The second one will be quantity of
14 lading laws under bridge condition. In other
15 words, if the tank car is breached and some of
16 the material comes out, how much of that material
17 comes out?

18 Sandia is doing a lot of -- DOE and
19 Sandia are doing a lot of the other studies. So
20 we kind of want to try to complement some of the
21 other research ideas that we need to know, and
22 especially in the transportation of these

1 materials, crude oil for example.

2 And also fire performance of alternate
3 fuel tenders. In other words, we know that it's
4 not a lot of fire testing done on these materials
5 -- on these containers. So we want to have ideas
6 and other papers, did anybody have ideas how to
7 do it or how to perform these tests. Thank you
8 very much.

9 (Applause.)

10 MR. BOYLE: We're going to your
11 questions at the end as we have time. Our next
12 presentation from our engineering shop -- from
13 the PHMSA engineering shop, and it will be Mr.
14 Leonard Majors. Thank you Leonard.

15 MR. MAJORS: Good afternoon. I'm here
16 to kind of highlight a project. It's more of a
17 proposed research project that we want to do like
18 a safety assessment of LNG transportation overall
19 as a commodity.

20 So as an overview, LNG is an emerging
21 clean energy technology and it's beginning to be
22 used as Francisco highlighted, as Dawn

1 highlighted, as an alternative fuel for
2 locomotives and ships. As this -- as these modes
3 develop and these opportunities come about, there
4 are going to be new opportunities for exporting
5 and also transportation domestically. These
6 shipments are going to go through some high --
7 you know, high population areas, some may go
8 through low population areas as well.

9 So the proffer statement; as the
10 previous presenters highlighted, you can only
11 transport LNG currently in UNT 75 portable tanks,
12 MC-338 cargo tank motor vehicles, and rail
13 shipments require approval by the FRA.

14 As Francisco highlighted, the DOT-113
15 tank car is being considered for cryogenic
16 shipment by rail, but it is not authorized. So
17 there could also be a potential way you could
18 have rail cars that could enter the commercial
19 market as well.

20 As I said earlier, expanded use
21 creates more opportunity, and more opportunity
22 creates, you know, a safety -- the need for a

1 safety assessment and that's what PHMSA's going
2 to do with our safety assessment.

3 So what type of work do we want to do?
4 So we want to do something that is, you know,
5 kind of like a commodity flow study or an
6 estimate on commodities flow, because currently
7 nobody knows how much is being shipped and no one
8 has identified where this shipping will go, which
9 mode is more effective.

10 Everyone's gearing up for rail, but
11 currently you can go by highway, you can go by
12 vessel. Most of these ISO tanks are being --
13 I've heard of a couple of ISO tanks being used
14 for specifically by a company to fuel a
15 commercial ship. So highway transport is being
16 utilized right now, but as it expands, you could
17 see more shipment by rail.

18 Also we want to do a modal risk
19 assessment, a risk by mode, you know. One
20 highway truck versus 20 rail tank cars or how
21 many rail tank cars could be shipped is also
22 something we want to look at. Packaging. As I

1 mentioned, right now you can only have a UNT 75,
2 but that could expand into a tank car.

3 So a tank car could obviously cut --
4 lower your risk because you have one tank car
5 compared to maybe, I don't know, two or three
6 portable tanks. So that could create a risk
7 reduction.

8 Overall, we want to do a safety
9 assessment so we can kind of get away from having
10 to do all these approvals, and that way we can go
11 undertake a rulemaking and have the information
12 and analysis to back up the rulemaking in the
13 future. That way, you know, we can kind of, you
14 know, cut out the government in the process of
15 trying to transport this material.

16 So I kept my presentation short
17 because I'm kind of hungry too; so any questions?

18 (Applause.)

19 MR. BOYLE: Leonard is my favorite
20 speaker. Now before lunch, a little questions
21 too. We'll have Veda. He's going to give a
22 little bit of a look forward as to what PHMSA's

1 plans are, then we'll have a few minutes for
2 questions and then you get a shorter lunch,
3 because I'm not one to miss lunch very often
4 either. So turn it over to Veda, then we'll do a
5 few questions.

6 MR. BHARATH: Hello everybody. So I'm
7 the lunch gatekeeper, so I'll go as slow as
8 possible, and I have several videos.

9 (Laughter.)

10 MR. BHARATH: I'm kidding. So yeah,
11 just to summarize what everybody did, Dawn,
12 Francisco and Leonard, you know, Volpe looking at
13 the small scale stuff and FRA looking at tender
14 cars and other issues associated with
15 transporting LNG by rail.

16 The thing is, as Rick and Lad
17 mentioned earlier today, the need for LNG and the
18 demand for LNG use is going to increase
19 significantly over the next few years. So we
20 need to be pretty proactive, as Sam just
21 mentioned, on lines in addressing those needs.

22 So as stuff associated with that, not

1 even associated with DOT, there's a lot of issues
2 going on non-transport related, for instance, one
3 highlighted here -- maybe not. Where they were
4 looking at LNG spills in a static sort of
5 situation. This is really good information for
6 if mitigation of circumstances associated with
7 like for instance rail transport.

8 There's some way you could sort of
9 anticipate how this LNG dispersion might happen
10 if there's a breach in the cars, because LNG is
11 sort of twofold as people were saying. It's a
12 cryogenic liquid as well as flammable. LNG
13 furthermore, like when it gets breached into the
14 air, it's denser than air so the gas tends to
15 stay at the bottom. So you have a high
16 flammability risk for a longer period of time.

17 I won't go through -- so we don't
18 really want to get to the point of where issues
19 happen, and then we want to like address the
20 issues after they happen. Again, going to
21 emphasize that we want to be proactive when it
22 comes to LNG work, and this is the obligatory

1 Lac-Megantic highlights here. This was an
2 accident that happened in Canada. Maybe two
3 people will know what I'm talking about here in
4 the room.

5 Yes, but we do want to get the point
6 where we have an open collaboration between
7 industry and PHMSA and FRA, to get to the point
8 like they have in this highlight here, where
9 crude, you know, put on a good rail car, safety
10 precautions in place, but we want to have it
11 proactively before any issues arise.

12 So I wouldn't go through this. You
13 guys can look at it, but this is just some of the
14 possible directions that the research for LNG
15 wants to go into. Again, this is not going to be
16 really effective and possible if we don't partner
17 actively with for instance our modal partners
18 like FRA, as well as other agencies like DHS, and
19 I know we have a few here in the audience so --
20 and as well as industry.

21 And that's it. Is that quick enough?

22 All right. Questions.

1 MR. BOYLE: So does anybody -- Bob,
2 I knew Bob would have some. I'll turn on the mic
3 so that you can ask them. If you can introduce
4 yourself before you make -- ask your question
5 we'd appreciate it, because the court reporter
6 doesn't know who everybody is.

7 MR. FRONCZAK: Yeah. Bob Fronczak
8 with the Association of American Railroads. We
9 are working with FRA on the tender, right? And
10 Francisco talked about that, and we have looked
11 at different crash scenarios, that sort of thing.
12 That's a different, you know, application in our
13 opinion.

14 In other words, it is -- you've got a
15 tender next to a locomotive that's going to be
16 occupied. So we believe that extra regulatory,
17 you know, considerations ought to be considered.
18 For LNG transportation in tank cars, we don't
19 think there's additional research necessary.

20 In other words, Transport Canada has
21 already authorized LNG in tank cars. So we've
22 got tank -- you know, potentially tank cars

1 running around in Canada already. We transport a
2 lot of other cryogenic liquids in tank cars. In
3 our opinion, the only reason that we haven't
4 authorized LNG -- and unless you can find
5 evidence otherwise -- is that there hasn't been a
6 need, you know, other than the tender
7 application.

8 So you know, we think you're kind of
9 setting up an extra regulatory requirement for
10 LNG in tank cars, and if you do it for LNG, why
11 don't you have to do it for every other hazardous
12 materials that -- you know, material that is
13 transported in tank cars? So just a comment, not
14 really a question.

15 MR. GONZALEZ: Yeah, thank you, and
16 you're right. I mean on the tender side, we're
17 doing a lot of work and you're like we need to do
18 a lot of regulatory on the transport -- not
19 transportation but on the tender issue, make sure
20 that it's safe and I know Phani has done a lot
21 of that work.

22 On the person on the tank car -- I

1 defer that to them. But you're right. I mean
2 the DOT-113 we know is a cryogenic, and it was
3 not -- it was not authorized or it was not set in
4 the regulations. So I don't know what the future
5 on that is.

6 MR. MAJORS: Well Bob, just to speak
7 on that, we would like the railroads'
8 participation in developing our safety
9 assessment. If you guys could, you know, meet us
10 at the table and kind of identify some areas that
11 we, you know, kind of need to explore and
12 research, we'd be open to look into it, you know.

13 I think, you know, not to compare
14 crude oil to LNG, but some of the concern is that
15 if you get an incident with crude oil -- I mean
16 with LNG, you might not have the same results.
17 Well, you won't have the same results as crude
18 oil. It could be -- I don't want to speculate
19 worse or whatever.

20 But I mean, you know, we need to
21 really get a handle on it before we end up being
22 back in in the rulemaking, like we have been in

1 the past.

2 MR. SRIDHAR: I'm Narasi Sridhar
3 from DNVGL. I had a question. On the last
4 slide, you talked about the future. You
5 mentioned a lot of risk factors and so on. I
6 didn't see something about interactive threats,
7 about how a couple of different events could
8 interact and increase. Is this something you
9 guys thinking about or --

10 MR. BHARATH: Yeah, yeah, and like for
11 instance I think Francisco might have slightly
12 touched on that before. We're looking at some
13 intermodal events, you know, for railway
14 crossings and so on like that, where we have like
15 some type of intermodal incident, and also kind
16 of over -- to some degree with that, we have some
17 interest in like human factors and how this could
18 influence them --- possible risk involvement.

19 MR. RAJ: This is Phani Raj from the
20 FRA. I just want to address Bob's concerns.
21 While I know that DOT-113 is actually -- is
22 authorized to carry even liquid hydrogen, which

1 is much, much colder than the LNGs.

2 The concerns that we have is not so
3 much as there are single shipments of LNG, but it
4 is really unit trains. So we have no idea what
5 happens if an LNG -- let's say in a unit train,
6 one LNG car breaches and it exposes the other LNG
7 cars to a fire. Nobody has done those
8 experiments. We don't know what -- LNG -- by the
9 way, those people who may not know, LNG tank cars
10 and the UNT 75 ISO tanks are double-walled,
11 because you have to have that in between the
12 inner tank and the outer tank to prevent the heat
13 leak going into the LNG side.

14 So we have no idea what kind of
15 puncture resistance these have, what kind of fire
16 resistance these have and certainly when we are
17 talking about their using -- authorizing DOT-113
18 for LNG, we can simply authorize it and somebody
19 transports, you know, 10,000 cars a year from a
20 single shipment -- single shipper rather, the
21 risk goes up by the volume of transportation, not
22 by just a single car.

1 So that is a concern. We want to be
2 able to understand really how the survivability
3 of these tank cars will be -- or ISO tanks
4 carrying LNG will be. So that's the reason for
5 proposing some of these tests that we are
6 proposing.

7 The second issue that I want to make
8 a comment on Dawn's presentation. I have been
9 working the LNG issue, the industry and the
10 hazards for 35 years. The word explosion and LNG
11 do not go together. If that were the case, part
12 193, which was instituted in 1978, would have
13 included a requirement to assess the damage of an
14 explosion.

15 It is not there, and I have done
16 myself experiments, fairly large experiments in
17 China late in the 1970s, where we actually really
18 tried to explode a LNG vapor stoichiometric
19 mixture; it is an absolutely perfect mixture of
20 air and LNG, with dynamite. It wouldn't explode.

21 The word explosion really means a
22 detonation. So we should be -- as a regulatory

1 agency we should be very careful what words we
2 use, because the public is going to latch onto
3 that and then it will come back to us to haunt.
4 So we should be very careful about what words we
5 use, especially the words explosion, which is now
6 associated with Lac-Megantic and other things.
7 So we should be very careful. Thank you.

8 MS. JOHNSON: I agree with you sir,
9 and that comment came up in the presentation
10 relative to a public perception. So whether it's
11 real or not, that perception is out there in the
12 public. I found a number of newspaper articles
13 that talked about people being concerned about
14 having a new LNG facility near their homes and in
15 their residences because of -- they were
16 concerned about explosions.

17 So I agree with you, and you know,
18 there's an awareness piece that's coupled with
19 training and operations, and understanding how
20 this is used, but thank you.

21 MR. RAJ: My concern was use this
22 property criteria --

1 MS. JOHNSON: Oh okay. I apologize.

2 (Simultaneous speaking.)

3 MR. BOYLE: We'll allow -- because I
4 know I'm getting weak from not eating. So Bob
5 will be our last commenter, and then I'll tell
6 you what our plans are for lunch. Thank you Bob.

7 MR. FRONCZAK: Yeah. Bob Fronczak,
8 AAR again. I would say that if the concern is
9 unit trains of LNG, we have no, you know, no idea
10 at all whether that is really, you know, what
11 people are considering. I mean I think people
12 are considering small volumes at this point in
13 time and it's going to take a while to get there.

14 Authorize it in tank car in, you know,
15 single shipments or something until you get -- do
16 the research. That's my last comment.

17 MR. RAJ: Just to the matter of --

18 MR. BOYLE: One more. Bob, you have
19 a lunch partner now.

20 (Laughter.)

21 MR. BOYLE: What we're going to do is
22 Phani.

1 MR. RAJ: One sentence, one sentence.

2 MR. BOYLE: It's never been one
3 sentence, Phani.

4 MR. RAJ: There is always the special
5 permit rule for specifically asking for shipments
6 of LNG in tank cars.

7 (Simultaneous speaking.)

8 MR. BOYLE: See what respect I'm
9 getting to have lunch. Bob and Phani, you may
10 take this to the cafeteria. What I'd like to
11 look at -- we're going to say 1:30, but it will
12 probably be 1:35. Let's try to take about 40
13 minutes for lunch.

14 If you don't know where lunch is, go
15 out to the main atrium when you came in, turn
16 right, go through the elevator, down the stairs
17 and back up the stairs. Please, if you do not
18 have any government badge at all, eat lunch with
19 somebody that does. You'll need an escort over
20 to the cafeteria.

21 (Whereupon, the above-entitled matter
22 went off the record at 12:35 p.m. and resumed at

1 1:40 p.m.)

2 MR. BHARATH: Afternoon everybody. We
3 might just want to start the program immediately
4 in the interests of time.

5 All right, so we're going to go right
6 into cylinder compressed gas research; and first
7 up we have from PHMSA, our Engineering Branch
8 Brian Moore, and he's going to talk a little bit
9 about cylinder failure. Yeah, so without any
10 further introduction, Brian.

11 MR. MOORE: Good afternoon. My name
12 is Brian Moore. I'm an engineer in the
13 Engineering Research Division at PHMSA. I'm glad
14 to be able to talk to you today.

15 First off, to correct what David just
16 said, I won't be talking about cylinder failure.
17 Actually what I'd like to speak to you about
18 briefly is the ultra-large composite cylinders.
19 So that was just a small thing.

20 In any case, PHMSA first became -- or
21 I'd say Office of Hazardous Materials Safety
22 first became aware of and involved with ultra-

1 large composite cylinders through Hexagon
2 Lincoln's special permit request, which was filed
3 -- I want to say approximately 2008, to
4 manufacture, mark and sell a hazardous material
5 transport system which is a steel frame ISO
6 frame, which contains multiple large composite
7 cylinders, each of which is a maximum of 40 feet
8 in length, four feet in diameter approximately
9 and a working pressure of about 3,600 psi, and
10 each of which has a water capacity of
11 approximately 8,500 liters.

12 So this permit took from -- I want to
13 say maybe 2008. It was authorized finally in
14 2012. Its service is for 2.1 to 2.2 gases, and
15 particular CNG. What we're noticing from the
16 industry is that there is interest in the energy
17 applications for being able to transport natural
18 gas CNG on the roadway and by vessel.

19 So that was our first introduction to
20 that particular type of technology, and from
21 where we stand right now, we're starting to see a
22 couple of other companies come in to request

1 similar special permits.

2 Currently, the regulations that
3 support these types of composite cylinders are
4 the ISO 11119-3 and the 11515. Now the 11119-3
5 as you can see only authorizes up to a 450 liter
6 water capacity, whereas the 11515 allows you to
7 go from 450 to 3,000. These are for composite
8 cylinders with non-load sharing plastic liners,
9 which is another key part of this technology.

10 We're not dealing with metal, so we
11 definitely have a -- in addition to the high
12 stake -- high strength to weight ratio that you
13 get from having the lightness of that composite
14 and its strength. We're also reducing the weight
15 by not having a metallic liner.

16 So that was something that was -- you
17 know, in terms of the size of these cylinders, a
18 very key risk that had to be analyzed and looked
19 at very carefully in authorizing this particular
20 special permit. However, as you can see from
21 what's said above on the slide, each one of the
22 hexagon tubes has a maximum water capacity of

1 8,500 liters.

2 So the standards fall short in that,
3 you know, we're already authorizing the
4 manufacturers to go beyond what the strict
5 requirements are for the two ISO standards. So
6 with that said, in terms of trying to understand
7 where, you know, this technology might go and
8 what we might need to anticipate in terms of
9 providing for adequate safety in transportation
10 of these commodities with this particular type of
11 technology, some of the key questions that we
12 think of are possibly, you know, what are the
13 risks?

14 What do we have to think about, you
15 know, in terms of the design, manufacture,
16 transportation of these systems? What risks are
17 we encountering and at what point do we say the
18 risk is too great for, you know, what we like to
19 have in place?

20 Secondly, a very unique manufacturing
21 design, or even transportation issues associated
22 with these systems. We've gotten an analysis

1 from -- for instance, from Lincoln Hexagon, but
2 in terms of having a more comprehensive
3 understanding of what's going on, what we might
4 need to look at as this technology continues to
5 develop, we don't know.

6 Also for very long tubes now, as I
7 showed you on the previous page, the current
8 technology only allows up to 40 feet in length.
9 However, there is indication that industry wants
10 to go even higher on service pressure -- or
11 excuse me, working pressure, and also higher on
12 length.

13 So does that introduce any type of
14 physical phenomena in terms of the design and
15 manufacture of these tubes by going, you know, so
16 high in length, whether or not there might be
17 particular bending, stress-related issues,
18 whether or not there's any type of modal type of
19 behavior that might need to be analyzed? Who
20 knows.

21 Then lastly, what are the practical
22 limits of this technology? These are just some

1 of the questions that can potentially be asked
2 with regard to this technology given its newness.
3 So currently, there are no research efforts
4 underway for this technology. Currently, I'm
5 working on one new special permit application by
6 a company named LightSail Energy, that's in its
7 final stages of the evaluation process.

8 There may be other special permit
9 applications that are soon to come down the pipe
10 towards one of our offices for evaluation. So
11 given that, there is a need I think to get a more
12 comprehensive understanding of what's going on
13 with this technology and where it may lead.

14 Some of the existing gaps, to
15 reiterate, are the risks. We don't necessarily
16 know what all the risks are, and we don't know,
17 based on having an introductory understanding of
18 this technology, where we might want to draw the
19 line on the risks at the end of the whole
20 analysis, as this technology comes to even
21 greater fruition than it is at this current
22 state.

1 Rollover, you know. How these systems
2 will behave under rollover conditions is also
3 something I think is very important to look at.
4 The Lincoln Hexagon system, one of the key
5 components that allowed it to be authorized was
6 the fact that it had a fire protection system.
7 For cylinders that are this massive, in terms of
8 using a standard type of pressure relief device,
9 it just wasn't feasible.

10 So Lincoln Hexagon actually developed
11 a system which allowed it to -- the cylinder --
12 each cylinder to sense a heightening of the
13 temperature at any length along the tube. But
14 you know, this was the -- of course this was one
15 of the key technologies that allowed this special
16 permit to be granted.

17 But there may be a need for additional
18 research in terms of fire protection and/or fire
19 suppression. That was one thing we haven't seen
20 and we may want to look at. Is there any avenue
21 out there for a fire suppression system as
22 opposed to just protecting it?

1 The current Lincoln Hexagon system and
2 the way I think that it is currently going,
3 industry is -- for this fire protection system,
4 it acts just like a regular PRD. Once the system
5 is initiated because of a pool fire or some sort
6 of a fire scenario, it just vents the entire
7 product.

8 So you have, you know, 8500-plus
9 liters, you know, going out of this entire system
10 until it's reached, you know, its empty state.
11 Of course it will be safe, but then you've lost
12 your entire load of product. Is there any way
13 for you to prevent having to prevent the fire or
14 stop this fire while also retaining your whole
15 loading?

16 So that basically in a nutshell gives
17 you an idea of what we might be looking to do
18 with regard to this technology, and with that
19 said I can take any questions for a few minutes,
20 if there are any out there in the audience.

21 MR. SELK: Steve Selk, Homeland
22 Security. Is there any other corresponding

1 technology that's in service today at that size
2 and pressure in steel construction?

3 MR. MOORE: I can say no. In terms of
4 the dimensions and size, absolutely not, you
5 know. When I'm thinking of ASME vessels or any
6 ISO vessel, you know. You won't find any there
7 maybe over a foot or two in diameter. Maybe
8 comparable in length but definitely not in terms
9 of the cross-sectional area.

10 I think that's a -- I think it would
11 be actually weight-prohibitive to do something
12 like that in steel, although it will probably be
13 safer if you did do it in steel.

14 MR. SELK: So that might figure
15 predominantly in your risk calculations, is the
16 quantity of material and pressure?

17 MR. MOORE: Right, absolutely, yes.

18 MR. RAJ: Phani Raj from the FRA. A
19 question I have is in the risk assessment that
20 you plan to undertake. Are you also looking at
21 the vulnerabilities of the boss and the fittings
22 on the thing, because that to me represents

1 probably a more severe, you know, possible
2 failure.

3 MR. MOORE: Yes, absolutely. You
4 know, those are two critical points at which the
5 cylinder is mounted. In addition to that,
6 maintaining the interface between that metal boss
7 and the rest of the composite material and the
8 liner, keeping that -- those surfaces sealed is
9 something that's very critical.

10 I can only -- although I've spent a
11 lot of time over the past months getting familiar
12 with this technology, I can only still grasp at
13 some of the basics of what all of that means. So
14 I would definitely say that would be part of a
15 risk analysis that we would need to know more
16 about.

17 MS. LU: So this is a question from
18 online. Are these large composite cylinders only
19 approved for highway use, and if so, are other
20 modes anticipated?

21 MR. MOORE: Currently, it is
22 authorized both for highway and for sea vessel.

1 I don't anticipate this will ever make it out of
2 those two. I can't see any type of application
3 where -- you know like for instance cargo
4 aircraft even. I don't how that will work.

5 I just -- at this point in time, I
6 don't see aircraft as being something that would
7 be feasible for that type of technology. But I
8 mean who knows? But at the moment, I think it
9 will restricted to roadway and vessel.

10 MR. RAJ: Again, this is Phani Raj
11 from the FRA. Actually, we have a proposal from
12 an organization that wants to use these kinds of
13 CNG, compressed natural gas at 4600 psi to be
14 used as a tender for a locomotive, but not the
15 gas transportation across the coupler, but use
16 the natural gas in the tender to develop -- to
17 have a gas turbine and then generate electricity
18 and pass the electricity across the coupler. So
19 yeah, rail application is also coming.

20 MR. MOORE: You know, actually I did
21 misspeak. I didn't think of rail. Most of the
22 stuff I do is with cylinders, so I very rarely

1 look at rail. So I never think about rail. But
2 yeah, I think that that might be a possibility.
3 So yeah, thank you very much for correcting me.

4 Anyone else? Thank you very much for
5 your time.

6 (Applause.)

7 MR. BHARATH: All right, that was
8 good. Keep it moving, probably catch up on some
9 time. The next speaker is Refaat Shafkey from
10 the Engineering Branch as well, and he's going to
11 talk to you guys about PRDs, pressure relief
12 devices.

13 MR. SHAFKEY: Thank you Veda, and as
14 introduced, I am Refaat Shafkey and I'm also part
15 of the Engineering group here. My presentation
16 -- my research presentation topic, as you can see
17 is there. It's evaluation of the safety
18 effectiveness on the use of pressure relief
19 devices on cylinders containing compressed or
20 liquefied gases and mixtures.

21 It's kind of a mouthful, but
22 essentially what we are saying is that we want to

1 look at the safety effectiveness of PRDs,
2 pressure relief devices. As you know, these are
3 required for compressed gas containment here.
4 According to the U.S. regulations, Title 49
5 C.F.R. 173.301(f), requires them for use on
6 division 2.1, which are non-flammable gases, 2.2
7 division, non-flammable gases and even for toxic
8 gases, division 2.3 gases.

9 For the low toxicity gases, the PRDs
10 are required. So why do we require them? The
11 logic behind this requirement for pressure relief
12 devices is that to prevent overpressurization-
13 type, catastrophic failure of cylinders. So if
14 for some reason the pressure were to develop and
15 go reach the cylinder's burst pressure, instead
16 having a catastrophic rupture you will have a
17 more benign leak before break type failure.

18 That's the logic. That's kind of
19 accepted here in North America, but this logic is
20 not shared universally because the practice in
21 Europe is very different. They usually don't use
22 PRDs on most of their, you know, compressed gas

1 containers, with the exception of maybe carbon
2 dioxide, nitrous oxides, storage which has very
3 high developed pressures. Usually they are not
4 used.

5 Their logic on that side is that
6 actually having PRDs actually creates more
7 problems, because they often end up developing
8 unintended leaks. If you have a flammable gas,
9 the leak will lead to -- can lead to fire, and a
10 smaller problem which either would not have
11 existed now can spread to other surrounding
12 cylinders and you can, you know, have a bigger
13 problem if all the surrounding cylinders also
14 have flammable gases. You will have a proverbial
15 situation of adding fuel to the fire.

16 So you know, we have different
17 perspectives, and some additional background on
18 the use of PRDs, where did they actually
19 originate? The original use of the PRDs was
20 actually in what are known as active pressure
21 systems like ASME steam boiler would be an
22 example of an active pressure system in which the

1 pressure is continuously building up.

2 So you need a PRD there, and that
3 concept was borrowed from there and got into the
4 -- you know, our compressed gas containments are
5 not active pressure systems. They're static or
6 passive pressure systems. So the pressure is not
7 continuously being built up.

8 It raises a little bit because the
9 temperature radiations will result in some
10 fluctuations in the actual developed pressure in
11 the cylinder, but the pressures are way, way
12 below the cylinder's rupture pressure.
13 Typically, the rupture pressure of a cylinder is
14 like for DOT 3, a break-type vessel.

15 The ISO 809 type vessels is 2.5 times
16 their service pressure. So that sum of pressure
17 is never, ever going to be achieved in any of
18 these applications. So we have to really rethink
19 the basis for using PRDs, and I will give you a
20 little example as we move along to -- hopefully I
21 can use that.

22 Okay. So this is an example to give

1 a little background perspective. So the question
2 to ask is how many PRDs are used on each
3 cylinder? So typically for small cylinders we
4 will only need -- say just one would be
5 sufficient.

6 But the requirement for sizing and
7 venting capacity for -- is actually determined in
8 accordance with CGA, Compressed Gas Association
9 standard S-1.1, which is incidentally also
10 incorporated in our regulations by reference. So
11 that determines how many PRDs, how much venting
12 capacity you need to have and what would be the
13 number of PRDs and how many PRDs could go on a
14 particular containment.

15 So as an example, you know, I think
16 for one PRD usually is a part of the valve. But
17 if you have multiple PRDs that are required, then
18 for large cylinders they normally have sort of a
19 hexagonal-type nut which allows multiple PRDs to
20 be put at each end, and that thing is called a
21 bull plug.

22 So for large tubes they have to use

1 bull plugs at each end to accommodate multiple
2 PRDs, and I have an example here. Well, it
3 doesn't show up on the screen, so only on the
4 wall. Anyway -- yeah, but it doesn't show up on
5 the screen, only on the wall. Okay.

6 So the example is a hydrogen chloride
7 trailer with seven tubes, and what it requires is
8 it requires two bull plugs at each end. So each
9 bull plug has six PRDs. So 12 in a cylinder and
10 on seven cylinders you will have 84 PRDs.

11 So that's a whole lot of points where
12 you can develop leaks and failures, and
13 potentially consequences of any one of them
14 leaking would be, if it's hydrogen chloride, you
15 know, it's doing in 2.3 gas you can have health
16 issues, you can have fatalities, you can have
17 evacuation requirements for a large area.

18 So I think that kind of puts things in
19 perspective, that if we're going to have the
20 PRDs, we should know whether they are really
21 doing any good or are they increasing the risk,
22 or we can continue to believe that they actually

1 prevent catastrophic failure by having a benign
2 leak before the actual eruption.

3 So I just -- we need to get a little
4 -- technically some perspective on the benefits
5 of using PRD. I guess it's based on the previous
6 example it should be -- it should not be hard to
7 come to that conclusion, and the goal of our
8 research here is to minimize the risk obviously
9 and to enhance safety and handling the
10 transportation of compressed and liquefied gases.

11 Now this project that we are working
12 on is a little, you know, unusual research
13 project because normally in a typical research
14 project you say, okay, we have a little
15 hypothesis. We do some tests and either prove or
16 disprove hypothesis.

17 Well here, we're not going to be doing
18 any tests. We have to look at a slew of
19 information that is all over the place in the
20 forms of accident reports, incident reports and
21 different agencies have done those reports,
22 different -- and they have been kind of formatted

1 differently. So it's difficult to bring all this
2 information to a common baseline denomination and
3 be able to do any technical evaluation on those.

4 But that's the intent, is that we will
5 kind of look at the information that is out there
6 and try to cover the cylinders from 50 -- less
7 than 50 liters to small size cylinders to large
8 cylinders over 500 liters. And then some sort of
9 limited risk based assessment will be performed
10 to determine the PRD's role in the prevention or
11 enhancement of the accident or incident severity.

12 This gives a little description of
13 what we have been trying to do. What we have
14 done is we have tried to look at all these
15 different reports that exist, you know. Some of
16 them are like DOT's incident reports. For every
17 incident there is a report, but those are not
18 technical reports.

19 Those are kind of anecdotal reports,
20 you know. The inspector goes there, sees what he
21 sees and listens to what others have said and
22 kind of makes some assessment as to what could

1 have happened. Not really very good for any
2 technical assessment. Then there are some
3 reports from NTSB, some Chemical Safety Board
4 reports. There are also reports from Transport
5 Canada and some European reports from EIGA,
6 European Industrial Gases Association. Also
7 reports from Gas Association.

8 There are also some reports which the
9 companies have, and they may or may not be
10 willing to share that information, and then there
11 are some sort of experts which have some
12 anecdotal information. They have some views on
13 how certain things could have happened, could
14 have been prevented.

15 So our project has been to gather all
16 this information and sort of kind of try to
17 filter out what is technically relevant and kind
18 of come up with a little summary of technically
19 relevant things for which we can do a kind of --
20 a comparative evaluation and come up with some
21 sort of conclusion on what exactly has been
22 happening with the PRDs, whether they have been a

1 source of adding to the risk or actually
2 minimizing the risk of accidents or incidents.

3 So I guess the end of the day, we want
4 to -- after we have done the evaluation analysis,
5 we want to be able to tell whether the PRDs
6 prevented catastrophic failure, whether the PRDs
7 initiated or aggravated the accident or incident.
8 The use of PRDs have no impact; that could also
9 be the case on the accident or incident.

10 The segregation or storage of
11 cylinders properly could have had adverse or
12 favorable impact on the accident and incident,
13 and any other facts that have become apparent
14 will be evaluated. So it would be kind of
15 looking at all this database, all the history of
16 accidents and incidents and trying to sort of
17 filter out how these PRDs have contributed to the
18 accidents.

19 After we're all done, hopefully at the
20 end we would be able to come to some sort of
21 conclusion and say that if the PRDs are indeed
22 required or should be used, then this project

1 should help establish the conditions where the
2 PRDs should be required, and the conditions where
3 the PRDs should not be required, and also the
4 conditions where the PRDs may be permitted but
5 should not be mandatory or required.

6 So I hope that at least we will be
7 able to get to this at the end of the project,
8 and with that, I come to the end of my
9 presentation. I thank you for your attention,
10 and I guess that takes us to --

11 (Applause.)

12 MR. BHARATH: Any questions? Pretty
13 complex subject.

14 MR. SHAFKEY: So I guess I must have
15 done very well then?

16 MR. BHARATH: Yeah.

17 (Laughter.)

18 MR. BHARATH: Do you have a question?

19 (Simultaneous speaking.)

20 MR. SRIDHAR: I'm not going to let you
21 go that easy. Narasi Sridhar from DNVGL. We are
22 faced with the similar kind of things on other

1 areas where we have to assemble a whole bunch of
2 diverse kinds of knowledge and uncertain
3 information and so on. So I'm just curious what
4 methodology are you planning to use to arrive at
5 a risk assessment?

6 MR. SHAFKEY: Yeah, I guess I will --
7 that's why I had used the word a limited risk
8 assessment, because I don't know we are in a
9 position or the contractor that we have
10 contracted the work, the research project to, is
11 in a position to do any actuary-type risk
12 analysis.

13 So it would be more of a qualitative
14 type risk assessment, but what they are doing is
15 trying to put a little summary of different
16 reports and so that it's kind of put on a similar
17 format, so that the information is technically
18 evaluatable. Because if you have different
19 reports, they have been written in different
20 ways. It's difficult to compare one set of
21 information with the other.

22 So they're trying to write little

1 summary briefs from which we will be able to do a
2 little comparative evaluation. So that will be
3 the basis on which the incident and accident data
4 from different sources would be evaluated and
5 compared.

6 MR. RAJ: Phani Raj from FRA. We are
7 actually grappling with the same kind of problem
8 on tank cars, whether we should have pressure
9 relief devices or not. So when -- in the last
10 slide you said you had several different criteria
11 for, you know, having or not having, can you
12 define for me what the accident means?

13 MR. SHAFKEY: Well --

14 MR. RAJ: With an improved fire
15 exposures.

16 MR. SHAFKEY: Of course, and I mean
17 fire explosions, and for us an incident is a
18 leak.

19 MR. RAJ: Exposures.

20 MR. SHAFKEY: Exposure?

21 MR. RAJ: Yeah.

22 MR. SHAFKEY: Okay, fire exposure as

1 well. Of course it would be, because in a
2 stricter sense, the rationale quoted for PRDs is
3 that it will prevent the rupture of a cylinder in
4 case of a fire, whether that works or not in many
5 cases.

6 But I guess the thrust that I had was
7 that the likelihood of cylinders being in fire is
8 far less the risk of that, as opposed to the PRDs
9 leaking and leading to fire if it's a flammable
10 gas, because right now it's a flammable gas.

11 So if you have a flammable gas and it
12 leaks, and there is some friction or some other
13 source of ignition and you have a fire, then
14 everything else will become irrelevant. Whether
15 the cylinder explodes or not, it's going to
16 happen so fast that the whole thing will actually
17 develop in a big inferno.

18 MR. RAJ: Actually, the concern is not
19 so much the leak as the real damage and actually
20 sheering off of the PRD itself in a mechanical
21 accident.

22 MR. SHAFKEY: Right. That can happen

1 too, and you're right. I mean that's the other
2 way of looking at it as well, because that can
3 happen on road transportation. I saw the
4 physical damage to the PRDs.

5 MR. BHARATH: Any other questions?

6 MR. SHAFKEY: Okay. Thank you very
7 much.

8 (Applause.)

9 MR. BHARATH: All right. Next up,
10 from the Compressed Gas Association we have Mr.
11 Jack Wert.

12 MR. WERT: Thank you. Good afternoon
13 everyone. As was just announced, my name is Jack
14 Wert. I'm with the Compressed Gas Association.
15 I'm a technical manager working for the
16 Compressed Gas Association, and just a little bit
17 of background on me before we get going -- and it
18 will be brief.

19 I've been in the industry, compressed
20 gas industry for 23 years, and I've been with the
21 Compressed Gas Association now for 12 years. And
22 for the CGA, I manage several technical

1 committees and then outside CGA, I participate on
2 numerous ISO committees, TC-58, SE-2, SE-3, SE-4,
3 which are valves, cylinder construction and
4 requalification, and then I also participate at
5 the United Nations on the subcommittee of experts
6 of TDG and GHS.

7 So I've got a full spectrum of
8 perspective that I'm looking at this with. At
9 the same time, I'm combining that with what the
10 membership has provided me to present to you,
11 feedback on the presentations.

12 First, I want to thank you for
13 inviting me. My little world revolves primarily
14 around cylinders and those gases and those
15 regulations. And I realize there's a much bigger
16 world out there than just that, and so many of
17 the presentations given today just opened my eyes
18 to the other endeavors that are going on and
19 they're very sincere, very intense and the goals
20 are very noble. It's very pleasant to see
21 something like that.

22 I think having these forums once a

1 year, it's a great idea. The many forums even
2 better. Okay. So let's take it from there.
3 You're asking to give feedback. The first thing
4 I would like to talk about -- ah, MAE.

5 I know that the OHMS R&D has an
6 ongoing project for the development and
7 refinement of mobile acoustic emission, and that
8 they have and others have indicated that this
9 technology may be the best suited for inspecting
10 composite cylinders.

11 From what I understand in the United
12 States, OHMS R&D has the foremost -- is the
13 foremost in leading this type of methodology
14 forward, and that's handled both by the R&D group
15 at OHMS and that has carried through to the
16 International Standards Organization, the ISO
17 committees, where several of the gas committees
18 from around the world are learning about MAE.

19 Up until now, composite cylinders have
20 been judged for fitness of service if they pass
21 the -- during manufacture if they pass the
22 performance criteria, and then after that

1 requalification is official, you look for any
2 type of damage done to the fibers, any type of
3 damage done to the external or internal of the
4 cylinder.

5 Well that's very subjective, and our
6 guidelines are extremely conservative. So we're
7 probably at times taking vessels out of service
8 that are fit for service. However, there are
9 things that could happen down the road with the
10 development of composite cylinders that are going
11 to need a better method of inspection.

12 MAE shows promise to be that method of
13 inspection. It sees the full body, all the way
14 through the composite layers of the cylinder into
15 the lining, and that can tell us a lot more than
16 discoloration or dent marks or broken fibers on
17 the external surfaces of the cylinder. It tells
18 about delaminations in the volume of the
19 wrapping. It can tell us about deformities in
20 the liners.

21 Several reasons to move forward with
22 MAE, and it would give us a quantitative or at

1 best -- or at least a semi-quantitative
2 measurement of the fitness for service and so
3 it's moving ahead in ISO. OHMS R&D is taking the
4 spearhead on behalf of North America, and we
5 really would like to see that continue. We
6 support that.

7 We do support that as members of ISO,
8 and I think it's necessary given that composite
9 cylinders are in almost every conceivable
10 application in the U.S., North America and around
11 the world medical gasses, SCBAs, CNG, aerospace,
12 industrial applications. They can be found just
13 about everywhere, and there are as many variances
14 in sizes and pressure ratings, liner materials as
15 there are applications.

16 We start from metal liners, move to --
17 which is now becoming more and more prevalent in
18 North America, the polymeric liners, and then
19 there's even linerless, linerless composite
20 cylinders. It's really important that we get a
21 handle on this going forward.

22 We're taking cylinders and because of

1 their exemptions or special permits or
2 specifications, they're limited to a finite
3 service life and perfectly good cylinders are
4 being taken out of service and scrapped because
5 we do not have the technology with a high degree
6 of certainty to say it's fit for continued
7 service.

8 So I think that is one development
9 project CGA will certainly support. There's a
10 large number of composite cylinders that have
11 been fielded and serviced for quite some time, as
12 you all must know, there's tens of thousands
13 around the world. This is not just a North
14 American effort. This is, as I said, an ISO
15 effort and therefore a global effort.

16 CGA would encourage the continued
17 research of MAE to develop and refine the
18 capability to inspect and requalify the ever-
19 evolving composite cylinder. In particular, I
20 put polymer liners down there because we're
21 starting to see more and more of them, and I
22 think we need to get a handle on that.

1 Pressure relief devices. Refaat,
2 thank you very much. Thank you very much. CGA
3 supports continuing research on the use of
4 pressure relief devices. We've been looking at
5 this now for about two years, and it primarily
6 consists of as much literature searching as we
7 can, with the exception of a test done in the
8 Mojave Desert.

9 The literature searches so far have
10 not given us a beacon to go one way or another
11 with PRDs, either by class or by specification of
12 the cylinder, okay. The Mojave Desert test is
13 briefly there. It shows us some promise.

14 There are two trailers, some fitted
15 with PRDs, some not with PRDs. Some distant to
16 the end of where a fire was, some on the end
17 where the fire was, and the fire was 200 gallons
18 of fuel oil that was ignited and allowed to burn
19 out, fully charged tubes. None of the tubes
20 ruptured and all of the tubes, after the testing
21 and metallurgy were done, proved to be fit for
22 service.

1 So that tells us a little bit of
2 something, enough confidence to say that maybe we
3 should consider taking PRDs off of permanent
4 gases for certain specification cylinders, say
5 the 3 series. It still needs to be determined.

6 Along the lines of the research, I
7 know OHMS R&D has employed Barlen and Smith to do
8 a literature search and formulate next steps, and
9 I would encourage that this research be wrapped
10 up because I think everything is done; isn't it?

11 MR. SHAFKEY: Right. It still needs
12 to have the conclusive analysis part.

13 MR. WERT: Okay, okay.

14 MR. SHAFKEY: So the literature search
15 part and putting them in a summary format is
16 done.

17 MR. WERT: Okay. I didn't want to cut
18 you short there. But what I want to say is the
19 research itself, the research is coming to a
20 conclusion. But when it's done, analyze the
21 results, Barlen and Smith's research and
22 formulate the next steps. Is the research done?

1 If so, here is how to assign PRDs as indicated
2 earlier. If not, is further research needed and
3 identify the objectives.

4 Is a risk assessment approach by
5 itself adequate? I know people, anybody who's
6 performed risk assessments know how risk
7 assessments work. They're tough. We've got
8 plenty of risk assessments submitted by our
9 member companies. They all generally agree, but
10 assumptions made along the way don't necessarily
11 agree. So it has a lot to do with your
12 perception and how you operate. So that's why
13 the question's asked, is the risk assessment
14 approach by itself adequate?

15 Something that was brought up early on
16 and we just did not have the resources to do, is
17 there a need to model and confirm the model by
18 testing? Should you set up a model and determine
19 what happens to a cylinder in a fire, the heat
20 transfer, the developed pressure, the weakening
21 of the steel?

22 All of those parameters, the millions

1 of parameters that go into that, and see what it
2 says. And then take that model and take some
3 cylinders and do some tests and validate the
4 model or adjust the model, okay. So that now you
5 have something maybe you can work with as a model
6 or calculation rather than going around blowing
7 up cylinders.

8 The research obviously would have to
9 cover all the physical, chemical properties of
10 all the various gases you deal with. Okay, let
11 me move on. Okay, so that's it. Pressure
12 release devices, we support that. And then
13 here's something, it's the last one. Extension
14 of requalification periods.

15 We note in Europe, they extended the
16 requalification periods to 15 years on what is
17 analogous to our 3A, 3AA cylinders, and I don't
18 how much science was put into that. I've not
19 been privy to that. CGA is looking at that, but
20 not gaining a lot of traction.

21 However, we would suggest that DOT
22 begin to look at this, not as an immediate -- not

1 in the immediate future but rather over time,
2 specification by specification, after adequate
3 investigation and consideration.

4 For DOT 3A, 3AA qualifying for ten
5 years, go to 15 years. What requirements and
6 controls would be required, total UE before 15
7 years' service, UE requalified; qualification
8 every 15 years, dedicated service, positive
9 pressure non-return valves.

10 For specific specifications only those
11 made after a given date, and this is driven by
12 better utilization of the cylinder fleet and all
13 the things that I have spoken about this morning
14 are driven by global harmonization and safety.

15 With that, that is the end of my
16 presentation or my comments. I will take
17 questions.

18 MR. BHARATH: Any questions for Jack?

19 MR. WERT: Okay. Thank you very much.

20 (Applause.)

21 MR. BHARATH: All right. You're going
22 to keep the dial moving here. Next, we're going

1 to move into the Crude Oil Classification
2 subsection of our forum.

3 First up in our lineup is David Lord
4 from Sandia National Lab and he's going to talk
5 today a bit about crude oil characterization.
6 David.

7 MR. LORD: Okay. Well first thank you
8 for inviting me to talk about our research
9 project. So my name's David Lord. As you know,
10 there is a team of people working on this
11 project. Can we move to the next slide or do you
12 want me to advance it? Okay, I can advance it.

13 Okay, and since this is a multi-
14 disciplinary project, we have expertise in a
15 number of areas. I am currently the project
16 technical lead and my area of technical interest
17 is in crude oil properties.

18 But being that we do a lot of
19 combustion testing in this work scope, we have
20 combustion expertise, Anee Ludeka (phonetic), Tom
21 Blanchard. We also are working on issues related
22 to variations in crude oil quality to the supply

1 chain and crude oil properties.

2 So we have help from the University of
3 North Dakota EERC. We have also have hydrocarbon
4 sampling and testing specialty embodied with Ray
5 Allen and Allen Energy Services, and also we're
6 doing a substantial amount of data analysis in
7 EOS modeling, with some help from Dave Verdine
8 (phonetic).

9 So I'm going to go through my outline
10 here, problem statement and objectives. Talk
11 about project governance and work flow, and then
12 once you see the project governance slides you'll
13 understand what Task 2 and Task 3. Task 2 and 3
14 are really in a project sense are where the major
15 testing is going to occur, and then I'll leave
16 you with the project management contacts and a
17 list of current project publications.

18 So problem statement and embedded
19 technical objectives. So crude transport by rail
20 poses risks recognized by U.S. and Canadian
21 regulators, and the hazards have been realized in
22 a number of high profile train derailments

1 leading to spills, environmental contamination,
2 fire, property damage and fatalities.

3 It's an open debate on whether the
4 types of crude, i.e. tight oil per se versus
5 conventional production have a significant
6 bearing on the severity of transportation
7 accidents, and I just took a couple of government
8 report images here that probably most in this
9 crowd are familiar with; the top one being from
10 Casselton, North Dakota and the lower one being
11 from the aftermath of the Lac-Megantic derailment
12 and subsequent fire.

13 So moving on to the project
14 objectives, and I've color-coded this primarily
15 according to the top two black color-coded have
16 to do with studying oil properties, and the lower
17 bullets relate to studying the combustion
18 properties of fuel once it's in the fire.

19 So what one of the initial questions
20 is related to what should we be measuring in
21 terms of crude oil properties and how should we
22 capture the sample, and does the sample capture

1 method actually have bearing on what the
2 analytical results say in the end, primarily
3 because many hydrocarbon fluids actually contain
4 dissolved gases, and those dissolved gases have a
5 way of escaping containment unless you actually
6 retain pressure on them and bring that
7 pressurized sample all the way to the lab.

8 So in the language of the slide here,
9 the first thing we want to do is determine what
10 sample capture and analysis methods are suitable
11 for characterizing select physical properties of
12 crudes, that exhibit some volatility, and then we
13 want to evaluate which of these select physical
14 properties of crude oils, and in particular,
15 tight versus conventional production that are
16 moved within the rail transport environment, that
17 have some bearing on flammability risks.

18 So that's the crude oil
19 characterization part, and then the second phase
20 of the project, once we settle on what are the
21 best ways to go grab your volatile oil sample and
22 take it to the lab and test it for the physical

1 chemical properties, once we've settled on that,
2 then we're going to go get large scale samples,
3 3,000 gallon samples, out from the field and
4 bring them over to Sandia and measure their
5 combustion properties.

6 Those would be things like flame
7 dimensions, surface emissive power, selected
8 oils. Again, this would embody a sample set that
9 would include tight versus conventional oils, but
10 under controlled burn scenarios that have bearing
11 on hazard determination.

12 We would compare combustion properties
13 to existing published data and other flammable
14 liquids and that would come from the public
15 database as well as what we have at Sandia.

16 So other flammable liquids would
17 include methanol, ethanol, jet fuel and hexane to
18 name a few. Then we would evaluate if the
19 selected tight oils that we studied exhibit
20 measurably different combustion properties from
21 conventional crudes or other reference fluids
22 tested previously.

1 So what we're really looking at is
2 trying to figure out if the properties of the
3 crude oil involved in the fire have a bearing on
4 the severity of the combustion event that
5 follows.

6 But we're not looking at in this phase
7 of the project the probability of ignition. In
8 all of our tests, we assure that the oil is
9 ignited, just as we did for the methanol,
10 ethanol, jet fuel, hexane tests.

11 What we want to look at is the
12 severity of the fire itself, the combustion event
13 itself and have objective measurements for
14 measuring, valuating that.

15 So on to project governance, you know,
16 who are the players here. So Sandia National
17 Labs, located there in the middle of this
18 diagram, is the lead technical lab. That's my
19 employer, and we are directly funded by the USDOT
20 and the Department of Energy, and we are
21 supported in kind by Transport Canada.

22 Those three government agencies are

1 basically jointly advising Sandia through the
2 crude oil coordination -- Crude Oil Research
3 Coordination Steering Committee. Sandia, while
4 we didn't have a lot of the expertise needed in-
5 house, there are certainly other capabilities
6 like going out and actually capturing the crude
7 oil samples and analyzing some of those samples
8 in commercial facilities. We reach out to other
9 subcontractors to help with some of those
10 services.

11 So now just a snapshot of the overall
12 project workflow. Okay, so let's just start with
13 Phase 1. We'll move across.

14 Phase 1, which has been completed, was
15 a literature survey followed by a sampling and
16 analysis plan, a literature survey basically
17 looking at the problem and trying to figure out
18 where the gaps in knowledge that would be useful
19 to try to close with subsequent work.

20 Once we identified those gaps, we
21 basically put together a sampling and analysis
22 plan to address that. Like I say, Phase 1 was

1 completed, and we do have a literature survey and
2 a sampling analysis plan that were put out in the
3 public domain, and I'll give you references to
4 those at the end of this presentation.

5 That then transferred to Phase 2,
6 which is the experimental phase of the work, and
7 that's where we are currently. I have this
8 broken down into -- we conceived of six tasks
9 that we wanted to complete in order to evaluate
10 all of the open questions that we at least
11 envisioned in this phase of the study.

12 Right now we are currently funded for
13 four. So as you as I have them listed there,
14 Tasks 1, 2, 3 and 4 are currently funded. Task
15 5, which involves rail car performance and Task
16 6, which is kind of a broad-based sampling around
17 North America, of different types of crudes, that
18 is at the concept phase only. So the rest of
19 today's talk will focus on what's actually been
20 funded and underway.

21 In the end, after all this work is
22 done and we also have what I've envisioned as an

1 implementation phase, in which all stakeholders
2 hopefully would come together to utilize the
3 knowledge gained during the prior phases, to
4 inform decisions on industry best practices,
5 standards and regulations.

6 And another important component of
7 this is that we've been using regular public
8 outreach in each of these phases, to let's say
9 make sure that stakeholder interests, at least
10 technical interests are addressed. So we have
11 reached out and gotten participation in terms of
12 say technical peer review of our plans and our
13 reports with the American Petroleum Institute,
14 Crude Oil Quality Association, Canadian Crude
15 Quality Association.

16 As we go forward, I would like to
17 engage with ASTM and GPA as we move toward, you
18 know, later phases. But that's yet to be
19 determined, and we also have utilized some of the
20 knowledge and data from the U.S. Strategic
21 Petroleum Reserve to do some of our early design
22 work.

1 Let me just move forward. I'm going
2 to overlay color-coded boxes here just to
3 indicate again, reinforce that we've completed
4 Phase 1. We are currently in the middle of Phase
5 2 and then possible future work embodied there in
6 red.

7 So this is a high level project
8 schedule. If you align, this is in the U.S.
9 fiscal year system. If you align Year 1 Q1 with
10 basically the beginning of this fiscal year,
11 October 1st, 2015, this is kind of where we are.
12 You can see we're near the end of the second
13 quarter.

14 We intend to finish all activity level
15 work, if we -- if everything proceeds as planned.
16 Finishing activity level work, that means
17 actually collecting samples, running tests,
18 burning oils by the end of Q3 in Year 2, summer
19 of 2017 and then the final reporting rollouts,
20 public relations, that type of stuff would be
21 occurring near the end of the second year,
22 basically the end of FY '17. That's our current

1 plan.

2 So let me just give you some
3 screenshots of some of the tests that we're
4 intending to do. We're looking at crude oil
5 properties and combustion tests.

6 So as I alluded to before, Task 2 is
7 looking at what are really the best ways to
8 capture an oil sample and to test it for its
9 basic physical properties, understanding that
10 some crude oils exhibit some volatility.

11 And it is the volatility or potential
12 volatility of tight oils that has been at least
13 publicly implicated in being a factor in the
14 severity of certain accidents. I meant that's
15 really one of the hypotheses we want to test, is
16 volatility, embodied in a crude, responsible for
17 or relatable to the severity of a combustion
18 event.

19 If you don't adequately capture all
20 the gases from the source material and get them
21 all the way to the lab and all the way to the
22 burn test, well then you actually haven't tested

1 the parent sample. You've tested something that
2 has changed along the way.

3 So this -- largely this effort around
4 Task 2 is making sure that when you go out and
5 collect the sample, you retain all the gases and
6 the volatility properties that are exhibited at
7 your testing or your sampling point in the field
8 is retained all the way to the lab.

9 So we're going to compare sample
10 capture and analysis methods for two selected
11 North American crudes. Now one question comes up
12 is well why just two? What we're doing here is
13 -- what we're doing is we're doing a series of
14 sample capture and analysis methods. We want to
15 have a normalized sample and compare the methods,
16 so that your source material is the same but all
17 your methods vary.

18 And that's -- that's our initial
19 attempt. Again, the experimental variable is the
20 sample capture method and the sample analysis
21 method, not the material itself.

22 Later in the program, we will then

1 narrow down to the sample capture analysis
2 methods that we're comfortable with, and then the
3 experimental variable will actually be the source
4 material to see how the source material varies.
5 But that's more Task 4 and Task 6.

6 So anyway, on to Task 2. So Sandia
7 and Transport Canada will administer parallel
8 tests. When I mean parallel, in that Sandia and
9 Transport Canada will both bring contractors to a
10 site and we will capture a variety of -- we'll
11 capture an oil through a variety of means and
12 analyze them through a variety of means as well.

13 We'll do a critical review of, in
14 particular, open versus closed capture and
15 applicability for use on minimally stabilized
16 oil. Now some of the properties we're interested
17 in are crude oil vapor pressure, VPCRx at T at
18 selected V over L and temperature. We are
19 looking at pressurized by virtue of gas,
20 pressurized gas chromatography, light ends
21 concentration.

22 Again, this kind of goes back to many

1 gas chromatographic methods used in the crude oil
2 industry for analyzing oil quality is run at
3 atmospheric pressure. So you can take a
4 pressurized sample, depressurize it at the bench
5 top and then inject it into a GC.

6 Well, the problem is is you've just
7 done a separation process right before it goes
8 into the GC. So even if you got your sample all
9 the way to the lab, if you didn't put it into a
10 pressurized GC analysis, you've lost your light
11 ends. So we're going to make sure that we have
12 continuous pressurization of our samples from
13 sample capture all the way to analysis.

14 But we will also do unpressurized gas
15 chromatography as well to do compare side by
16 side, as well as simulated distillation. We'll
17 do unpressurized physical property measurements
18 for molecular weight-specific gravity and
19 viscosity, and I think we're also actually, and
20 this is kind of a new development, is we've also
21 got access to some pressurized specific gravity
22 methods.

1 So we'll try to do some pressurized
2 versus unpressurized specific gravity as well,
3 and also, at least it may be familiar to this
4 group, flash point and initial boiling point
5 measurements as well.

6 I'm going to -- the next slide I'm
7 going to show you is our experimental matrix.
8 Maybe I'll walk through this a little bit. I
9 don't expect you --

10 I prepared this slide for the Crude
11 Oil Quality Association and the Canadian Crude
12 Quality Association and they, they're both
13 familiar with these particular standards for the
14 sampling techniques and the property
15 measurements. I don't expect this crowd to be
16 necessarily.

17 But what I want to impress upon you is
18 that for a given sample, and we're going to
19 collect two samples out in the field, we want to
20 compare these various methods, pipeline, closed.
21 These are all pipeline or closed sample
22 acquisition methods versus what they call the

1 Boston Round, which is basically an open vessel.

2 We're going to take all these to the
3 lab and compare the pressurized samples to the
4 unpressurized samples as they go through this
5 suite of analyses. The analyses are over here
6 going across the top, to include true vapor
7 pressure, three different means to measure the
8 composition, all of which -- this is a completely
9 pressurized compositional analysis. This is the
10 combination of pressurized and unpressurized.

11 This ASTM D8003 is a relatively new
12 Canadian method that they believe has some
13 promise, and in particular Transport Canada,
14 who's sponsoring that test. They're very
15 interested in that. Then we'll do these physical
16 property determinations as well.

17 So we're really trying to get after
18 what is the best combination of sample capture.
19 So in the end, we're going to try to identify
20 which sample capture methods and which sample
21 analysis methods give us a self-consistent set of
22 data that give you a composition and physical

1 properties that are, again, self-consistent,
2 especially for systems that have dissolved gases.

3 So that's Task 2. Now onto the --
4 onto the actual combustion tests. Once we have
5 down-selected to methods here that are adequate
6 to the purpose of bringing the whole sample back
7 to the lab to do the property and combustion
8 testing, we will then go out and get large-scale
9 samples and throw them into the fire.

10 So we're going to select four North
11 American crudes and we're going to do the basic
12 property measurements. So when I say basic
13 property measurements, I'm going to go back a
14 slide. The leading, the leading candidates from
15 this table will then be used to characterize the
16 properties of these four large samples, and these
17 samples will necessarily span a range from tight
18 oil such as Bakken, Eagle Ford, with high
19 visibility to baseline light sweet oils, for
20 instance the West Texas Intermediate, the
21 Louisiana light sweet, which is kind of at the
22 middle range, to then a specialized, a specially

1 stabilized crude from the U.S. Strategic
2 Petroleum Reserves, to try to at least --

3 We're envisioning that these oils will
4 span some measurable range of parameter space,
5 from volatile, higher volatility to lower
6 volatility, and that's the intent of working with
7 these four samples. This doesn't pretend to get
8 the highest, most volatile material versus the
9 lowest, but it does at least span a measurable
10 range.

11 We'll compare these results. We'll
12 put these into fires, control burn scenarios, and
13 we'll compare these to the performance of
14 ethanol, methanol, jet fuel, gasoline that we
15 have tested in the past. So let me just go to a
16 few images of burn test configurations.

17 These were photos that were taken
18 during prior Sandia fire testing. One
19 configuration that we're going to look at is the
20 pool fire. As you see, that's the top image
21 there. That's about a five or six meter pool
22 fire, I believe, in their outdoor facility, with

1 a hydrocarbon liquid fuel.

2 We'll be looking at things like
3 surface emissive power, how much power
4 potentially is coming to an object outside of
5 that fire. How much would that be. Heat flux
6 to engulfed objects, flame height and fuel
7 consumption rate.

8 Regarding fireballs, we're going to
9 set up a fireball configuration as well. We'll
10 be looking at similarly surface emissive power,
11 heat flux to nearby objects, and then we would
12 also be interested in and we'll have some high
13 speed photometric diagnostics out there to look
14 at fireball diameter and fireball duration.

15 That is it for the kind of scope that
16 I was planning on talking about today. If you
17 are interested in reaching out to the various
18 sponsor contacts for more information, just so
19 you all know, Evan Frye is our U.S. Department of
20 Energy contract officer; Joe Nicklous here at DOT
21 and at Transport Canada Barbara Di Bacco is the
22 primary point of contact.

1 My information, contact information is
2 given here, and then our program manager at
3 Sandia over this work is Erik Webb, and I'd also
4 like to just identify, since he's here, Carlos
5 Lopez is a new line manager who helps -- who is
6 associated with this project. So Carlos will
7 also be in the next version of these. He will be
8 listed there.

9 We have several project publications,
10 and you can see those. Those are available. I
11 know the top one's available in the DOE/OSTI
12 website. That's our literature survey we did
13 about a year ago, and then associated sampling
14 and analysis plan is posted on the DOE energy.gov
15 website.

16 Going forward, we actually have the
17 Crude Oil Coordination Steering Committee, I'm
18 going to back up here, has a public relations
19 subcommittee, and so I'm going to turn Mark Raney
20 here. Mark is actually going to be coordinating
21 our project level public relations.

22 So he would be a point of contact

1 going forward as well, if you want to understand
2 what the project level information is. We have a
3 number of reports for every one of these phases
4 of the project, Task 2, Task 3, Task 4.

5 We're going to have a public sampling
6 test plan that will be posted to the public, and
7 then when all the results are done, we'll have a
8 public release technical report as well, plus
9 periodic presentations at public venues like this
10 and conference-association type presentations.
11 So that's it.

12 (Applause.)

13 MR. BHARATH: Questions for Dave?

14 Great.

15 MR. SELK: Can you just quickly tell
16 us --

17 MR. BHARATH: Can you say your name,
18 sorry?

19 MR. SELK: Steve Selk, Homeland
20 Security. Can you quickly tell us what method
21 you use to come up with the fireball?

22 MR. LORD: Okay. So yes, the fireball

1 is going to be a -- we're creating a durable,
2 reusable pressure vessel with a -- basically a
3 rupture disk on top, basically a custom designed
4 rupture disk such that we -- add a pneumatic
5 hammer on the top to make sure that it goes under
6 the selecting conditions, and then we'll have
7 burners essentially igniting the fire or the fuel
8 plume as it goes up.

9 MR. FRONCZAK: Bob Fronczak,
10 Association of American Railroads. To show I can
11 provide constructive feedback, you said you're
12 looking at a Phase 4 and the RSI/AAR Tank Car
13 Safety Research and Test Project has done
14 modeling of the using AFFTAC to look at the
15 different crude oils and the impact on tank cars.

16 So it's something that we've already
17 provided DOT. I know we've provided it to FRA.
18 I don't see Francisco here, but they've already
19 got it.

20 MR. LORD: Okay, and that would be --
21 what we'll do, the relevance at this work Task 5,
22 as I have it rail car combustion testing and

1 modeling, we would be utilizing that. If I
2 understand the scope of what you did, we would be
3 utilizing that as the literature base from which
4 to do our Task 5 experiments and modeling.

5 MR. FRONCZAK: Yeah. I mean we've
6 already done the modeling, so you might want to
7 do some verification, but you --

8 MR. LORD: Yes, yes.

9 MR. BHARATH: All right. Next up for
10 the home team, Michael Klem from the Sciences
11 Branch. He's going to talk about W-Ink Crude
12 Classification.

13 MR. KLEM: Okay. Thanks Veda. Last
14 year I was up here talking about PHMSA's interest
15 in potentially funding this project, based on
16 some preliminary data that Joanna Aizenberg
17 presented at a meeting to FRA based on a six
18 month seed project that she had on there, looking
19 at a special substrate she had, more or less kind
20 of like a silicon chip that was modified to
21 specifically change colors when wetted with
22 different flammable liquids, and then using that

1 color change as an indicator for what that
2 flammable liquid was.

3 In her preliminary data she was
4 looking at could we differentiate packing groups
5 1, 2 and 3 based on this wetting technique.
6 Well, the interest PHMSA had is we were dealing
7 with the crude oil topic that David had just
8 finished. You know, looking at the dramatic rise
9 in crude by rail shipments, about 423 percent
10 just from 2011 to 2012 alone.

11 Knowing that there are differences in
12 crude oil, depending on where it is in the supply
13 chain, where it is sourced, when it is sourced,
14 what the ambient temperatures are. Is it blended
15 with other crudes and how is it packaged?

16 The idea was this chip that she was
17 presenting that could differentiate potentially
18 packing groups, couldn't differentiate other
19 physical properties, because to determine those
20 packing groups, it's based on physical property
21 testing.

22 The idea was this could be a portable

1 test method that could be used in the field. The
2 idea was this would require little to no training
3 to use. In the ideal sense you'd put the chip
4 in, it's covered with liquid, the color changes.
5 You would have something like an iPhone or some
6 type of image capture device, and then it would
7 spit out.

8 The idea that we can now test in the
9 field, our field agents could use this to get a
10 rapid indication of physical properties; first
11 responders could use it for maybe identifying
12 chemical spills; industry may be interested in it
13 as a cheap, affordable way of testing at
14 transloading facilities, you know, test the
15 material as it's being loaded.

16 So today, I would like to give a
17 little bit of information on -- this we decided
18 to go ahead and fund this, and we have now
19 completed the first quarter of this two-year
20 project. To give you kind of an update of where
21 we started, where we are right now and where
22 we're going.

1 The idea again is a colorimetric
2 assay, and this -- I don't really have it. So
3 what we have right here is kind of a render of
4 the final product we want to get to. We want to
5 take this from being a bench top device, a basic
6 research device and get it to the point where we
7 can have a commercially available product where
8 you have a plunger.

9 You push it. It extracts a liquid up
10 into the device, syncs wirelessly with, say, your
11 iPhone. The software component is a feature of
12 this. So can we write software that will have a
13 matrix to determine in what we have a case here,
14 is can we identify hazard class? Can we identify
15 what the specific material is? Can we identify
16 packing group?

17 We can have things like specific
18 chemical or physical properties? Can we tell
19 vapor pressure? Can we tell what initial boiling
20 point is, and do this as a cheap method? So the
21 chip she has can be chemical specific. So here I
22 have a couple of examples. Up top, what she

1 shows was a couple of common cleaning solvents.

2 I got methanol, ethanol, isopropanol.

3 This is one chip, one set of modifications,
4 different responses depending on what that liquid
5 be put on there. So at least among these
6 cleaning solvents, this one chip can discriminate
7 between what each one is.

8 Other solvents, water, acetone,
9 isopropanol. Again, unique responses, one chip,
10 one sets of modifications. It could discriminate
11 against that. Over here, just looking at
12 ethanol, it's not just what the specific material
13 is; it can discriminate based on concentration.

14 Here we're getting, you know, at least
15 in this setup right here, less than 20 percent
16 alcohol. The chip reads out the word drink.
17 Above 20 percent alcohol, it reads out drunk. So
18 material-specific response, concentration-
19 specific response. Now I'm going to keep this at
20 a high level and try to avoid showing
21 reflectivity data and a whole bunch of other
22 things.

1 But it can discriminate based on
2 carbon chain. One carbon chain up through 12
3 carbon chains with specificity. So a wide range
4 of indicators, excuse me, a wide range of
5 responses to determine products. She's developed
6 a range of like what she called 15 common
7 solvents, and the first quarter for this work
8 she's been able to get a 96 percent success rate
9 at identifying these common solvents.

10 The way the chip works is by the way
11 these solvents wet the surface. Now PHMSA's
12 interest again is this crude oil classification.
13 We've talked about dissolved light ends,
14 volatiles. Well if the wetting of the chip to
15 get this response is only one thing, that's the
16 wetting behavior, you have a volatile component,
17 we have a drying behavior.

18 The chip, more or less, has pores.
19 Liquid goes into the pores in this wetting
20 process, you get a color change. As it dries,
21 and it's going to dry based on its volatility,
22 that pattern's going to change. Looking at the

1 volatility changes, at least this drying change,
2 that 96 percent accuracy goes up to 99 percent
3 accuracy, 99.9 percent accuracy in their tests.

4 So we've got now ways of looking at
5 volatility. Volatility is tied into a lot of
6 these crude oil properties that we've been
7 talking about with these light ends. You know,
8 we can talk about flammability; we can talk about
9 vapor pressures.

10 So her work is now going on and
11 looking in there, and who can benefit from this?
12 Again, this is a chip put into something that you
13 just have to coat it and it changes color and
14 then your smartphone, because they're working on
15 the software at the same time, tells you what the
16 properties are.

17 No training requirement other than how
18 to use the software. It's a push button right
19 now. Now they don't have a commercial device.
20 The current device that they're working on at the
21 bench top right now is more or less a light box.
22 It's got a little plastic box that sits on top of

1 it.

2 It's more or less a pipe head. It
3 does a suction in there. The liquid gets drawn
4 up, the chip changes color. They had an iPod
5 Touch as their camera source and their software
6 device. In two years they want to have this --
7 or one year, depending on how things go, they
8 want to have this as a commercial device.

9 So we're looking at two years of
10 funding, and now this is looking at some of the
11 milestones that we set out in the statement of
12 work that we're looking to hit. The first
13 milestone was to develop a scoring system. This
14 is how does a chip respond to various solvents?
15 How would it respond to various crude oils, and
16 can they write a software product to
17 discriminate?

18 So looking at this petroleum products,
19 within the first quarter they have completed
20 this. They have the dynamic range of the chip
21 now defined across a variety of different organic
22 components, and they are comfortable going

1 forward looking at being able to discriminate
2 different crude oil samples.

3 The second milestone was to
4 demonstrate a software that is capable of doing
5 this. So not just getting this in the lab,
6 having a trained student or a Ph.D. or a postdoc
7 looking at this saying okay, this change based on
8 reflectivity data on this research grade
9 instrument, I know what this is. They now have
10 the software able to identify this with a high
11 degree of specificity and accuracy.

12 Again, this is within three months of
13 the start of this project. You know, other
14 milestones that they were looking to have done
15 within the first year, we're still looking at
16 this first quarter results. Now we begin to look
17 at indicator functionality for looking at
18 flammability criteria, volatility, vapor
19 pressure.

20 So they have this substrate that
21 they're looking at. They're now looking at using
22 other substrates. More or less if people know

1 what a photonic crystal is, they're looking at
2 photonic crystals which don't respond by wetting,
3 but respond by gas penetration with time, which
4 is going to be correlated to vapor pressure.

5 So all this light end talk and all
6 this testing, open versus closed, getting things
7 to the lab, making sure, now we have a sampling
8 method that can do it all in one extraction. At
9 least that's in the ideal sense. That is what is
10 ongoing. That is what is going to be looked at
11 in Quarter 2 amongst other criteria.

12 The wetting criteria they have, that's
13 what completed. The drying criteria is an
14 ongoing feature they're looking at to have in
15 Quarter 2 of this and at the end, develop a
16 physical model of volatility profiles, of
17 flammability mixtures. This is also in progress.
18 They are now taking samples collected by PHMSA
19 field agencies, or crude oil samples from a
20 variety of locations, which are going to have a
21 different amount of light ends dissolved in
22 there.

1 The idea was is that PHMSA would have
2 these characterized with their -- by our labs
3 that we've contracted out. So we know what's in
4 there. We know what their properties, you know,
5 what their physical characteristics are.

6 Now she's going to benchmark this chip
7 and going in toward getting a device, and can
8 they get a similar type of response or
9 determination in terms of minutes, rather than us
10 having to ship it out to the labs and have them
11 perform all of these ASTM tests on them.

12 So kind of the outline that they have
13 agreed to right now, you know, develop this
14 indicator assay based on wetting. Note that was
15 supposed to be a three quarter project. They're
16 calling it done within one. So we're already
17 going to be gaining benefits and looking at other
18 criteria.

19 Develop criteria based on drying.
20 Four quarter project. They are now going further
21 into this within the first quarter than they
22 thought possible before they started this work.

1 Phase 2, note these are like second year goals.
2 So this is what you may be looking forward to
3 hear, based on the success of this first year, if
4 we choose to go forward in funding.

5 Image analysis, composition, response.
6 Again, can we now get the software to tie into
7 the chip getting into these vapor pressure
8 analyses. Can we get this all integrated into
9 one to start to go into device manufacture.

10 Adapting to diverse test conditions.
11 Again, this is currently on the lab bench right
12 now. It's in a light box, a iPod Touch.

13 They want to develop a device now that
14 can handle robust conditions, to go from minus 10
15 centigrade up to, I believe it was 80 Centigrade.
16 So they want to have it be applicable in the
17 field, not just on the bench, and then a user
18 interface for a kind of a rapid spill.

19 So like one of the cartoon pictures I
20 have there had this little iPod, like iPhone
21 screen up there that said flammable liquid, class
22 and then, you know, kind of an identification.

1 Can we actually now, instead of talking about
2 this, have a practical application of this?
3 Again, last half second year, but we're already
4 so far ahead on the first year.

5 Last time I talked with Joanna, she
6 feels with potentially some additional seed money
7 thrown in there, she could have this executed
8 within one year. Develop prototype device.

9 Again, if we choose to go forward with the second
10 year of funding, this would be looked at at the
11 end of the second year, and then submission of
12 quarterly reports and the reporting requirements
13 is a thing in here.

14 So that's what I have right. If Veda
15 wants to cut me off, so -- questions.

16 MR. BHARATH: A couple of quick
17 questions?

18 MR. LORD: Is the chip a MEMS chip?

19 MR. KLEM: It is not a MEMS chip. I
20 was avoiding getting into any technical detail.
21 It's a reverse, it's a reversal of a chip. So
22 it's a standard depth, but then they have this

1 vapor phase deposition thing in there to modify
2 the poor behavior, and then introduce various
3 chemical moieties in there, which would affect
4 the wetting behavior on different sections like
5 that drink, then, or that drunk.

6 Different sections of the chip and
7 depth. So you don't just have the surface
8 chemistry in there; you have the depth profile
9 going in there, and they have ways to get in
10 there and modify that. So you're chemically
11 altering the watability, which also means you're
12 changing the volatility as it dries off.

13 MR. BHARATH: Anyone else with a quick
14 question?

15 MR. KRATOCHVIL: Joe Kratochvil,
16 International Association of Fire Chiefs. Just a
17 quick question about the goal for first
18 responders. Was this intended as a first off the
19 truck meter, or was this going to be designed for
20 verification and identification?

21 MR. KLEM: You know, I don't know what
22 she had in mind when she first proposed it, you

1 know, to set that. But I think the idea was
2 you're coming in, you have an unknown, and before
3 you, you know, you want to get into that, you
4 kind of want to know what that is, what the
5 hazard is associated right there.

6 So I would say, you know, minutes on
7 the scene. If you could put this in there and
8 get, you know, a common response to what it could
9 be. If you can't say read the placard on the
10 spill or you don't have the shipping paper, or
11 you can't get access to that information. It
12 would get you more of a is this caustic, is this
13 flammable, do I want to have -- is it okay to
14 send my people in there, or do I want to have
15 them withhold until we can have other treatments
16 come forward?

17 MR. KRATOCHVIL: Okay, yes. Just I
18 see some issues. If you can get it where it
19 reads vapors, that's fine. But I could see some
20 issues if you've literally got to go to a
21 product. Before it identifies you've got to wet
22 it, that you could be putting people into a

1 harmful environment unknowingly without using
2 other stuff. So that's why I asked.

3 MR. KLEM: Yeah.

4 MS. LU: -- time for one more
5 question.

6 MR. BHARATH: Okay. Yeah, let's make
7 it quick, because it's online.

8 MS. LU: Okay, it's online. Are there
9 considerations on --

10 MR. BHARATH: Do you mind?

11 MS. LU: Oh okay.

12 MR. BHARATH: Just go ahead. Michael,
13 we'll reiterate the questions.

14 MS. LU: Are there considerations on
15 how to ensure a representative sample is being
16 tested? For example, how does the same sample
17 get drawn into the test device or chip, and is
18 that test open to atmosphere?

19 MR. KLEM: Okay. So the question was
20 how are we making sure it's a representative
21 sample cell. So in the case of crude oil, how
22 are we going to make sure that the light ends are

1 retained? Well, in their current experimental
2 design, it was in our last quarterly report,
3 they're looking at have, building a closed system
4 in terms of if you're going to look at the
5 photonic crystal that's going to respond to vapor
6 pressure -- it's going to have an enclosed
7 cylinder in it.

8 I forget what the dimensions are, what
9 the orifices are. But you know, you're going to
10 have a liquid introduction system, so you're
11 going to have a, like, closed pressurized
12 cylinder, kind of an FPC floating piston cylinder
13 type device.

14 It's going to push the crude oil into
15 there because of course, since these have
16 dissolved gases, these are non-equilibrium
17 conditions, what the vapor to liquid ratio is
18 going to be is going to impact the response of
19 the chip.

20 So you're going to have a closed
21 system. You're going to -- introduced in there
22 to maintain these closed conditions. You're

1 going to vary how much liquid in there, and then
2 you're going to have more or less the chip up on
3 top, detector coming up through the, you know,
4 impinging down on there.

5 You fill from the bottom, at least in
6 the gross schematic. So the experiment is
7 designed to maintain all the gases, because the
8 moment you vent to atmosphere or you do, you open
9 it up, you're going to lose. You no longer have
10 a representative sample.

11 So at least the sample PHMSA is going
12 to provide, they're going to come in floating
13 piston cylinders. They're going to tie those in
14 with metal tubing. They're going to maintain
15 compositional integrity throughout.

16 MR. BHARATH: Okay, thanks. Thanks,
17 Michael. All right. So right about now we have
18 time for a break. We're going to push the break
19 back a little bit. If you all could be back by
20 3:15 it will be good, so we could keep on time.

21 (Whereupon, the above-entitled matter
22 went off the record at 3:08 p.m. and resumed at

1 3:15 p.m.)

2 MR. BHARATH: All right, thanks
3 everybody. We're going to go right into it.
4 First up in the Energetic Materials section of
5 the afternoon session, we're going to have
6 Richard Tarr from the Sciences Branch, talking
7 about chained and unchained fireworks and then
8 black powder equivalency. Richard.

9 MR. TARR: Thank you. Just a little
10 background. I've been with PHMSA previously RSPA
11 for over 23 years now, working most of the time
12 with energetic systems but I did a stint working
13 in cylinders for a few years.

14 Today I'm going to talk about a topic
15 related to explosives, and it's dealing with
16 chained and unchained fireworks. Basically,
17 display fireworks are the things we all get to
18 see at the 4th of July, and we need to -- we're
19 looking at evaluating the -- is the risk of
20 chained and unchained display shells essentially
21 the same? Should they be regulated the same by
22 DOT?

1 We want to look at these using a
2 standardized test used for classifying
3 explosives, and those are the tests found in the
4 U.N. recommendations, and it's called the Series
5 6 test. Just an example here. You see the chain
6 shells on one side. They're also typically put
7 in boxes and unchained shells on the other side.

8 So the problem, well just to
9 understand, so basically in a chained situation,
10 all those shells are chained so that when I light
11 one, the whole series in that chain is
12 essentially lit instantly. I mean within
13 milliseconds, every shell in the chain will
14 ignite.

15 And in the display they're all loaded
16 in tubes and they all shoot up in the air and
17 they look gorgeous. But in transportation,
18 what's the risk, and then versus you know when
19 you ship shells unchained, they're all still put
20 in the same shipping boxes.

21 So, you know, when you light the first
22 shell, it still may be only half a second before

1 the balance of the shells goes off. So we're
2 trying to answer is that time enough to change,
3 potentially change the classification of these
4 two materials?

5 So do shells react differently from an
6 unchained versus chained, and evaluating that
7 under the U.N. test scheme. So in that scheme,
8 we basically have three tests classifying being
9 able to differentiate explosive risk, and those
10 tests are single packaged tests, Test 6A; stacked
11 tests, 6B; and bonfire. I'll explain a little
12 about how they differentiate in a moment.

13 History. For years, I mean my whole
14 career here, we've approved display shells under
15 a default classification standard called the 87-
16 1. This standard, and under the standard we
17 reviewed chained and unchained shells the same.
18 Then there was a concern that got raised a few
19 years ago. Is the risk the same?

20 Since we didn't really have any data
21 to support it, I've gone to the U.N. and asked
22 them. They have done extensive testing on

1 fireworks, fireworks and classification. But one
2 of the things they did not look at is the impact
3 of chaining shells and how it impacted
4 classification.

5 So we decided we would invest and do
6 this research on this, and this is research
7 that's currently being carried out now. So
8 although the U.N. standard is not currently
9 adopted, it does allow shells up to six inches to
10 be classified as 1.3G fireworks. So that's the
11 target and does chaining impact that
12 classification?

13 So now I'm just outlining the project
14 that we had proposed and that we're currently
15 funding. We're going to look at overall three
16 different types of shells, some smaller shells so
17 you get a lot of them in a box; generally that's
18 72 shells in each shipping box, and the most
19 common that we see are assorted colored shells on
20 firework displays, and that's typically how
21 they're shipped.

22 The ones that are chained are the ones

1 you see at the end of the fireworks show, your
2 finale. So we're going to compare those to the
3 small shells. Then of course everyone likes to
4 salute. They're chained and they're in many
5 finales.

6 So we're going to look at the risk of
7 what would be considered probably the highest
8 hazard shell in transportation, which are the
9 salute shells, and we'll see if they
10 differentiate between the chained and unchained
11 configuration.

12 Then under the U.N. default system,
13 the largest shell that they approve is a six inch
14 shell. So then we'll -- we'll take a look at
15 that as well. That's my biggest fear, this
16 little change in this one or, whatever. Probably
17 not my biggest, but one.

18 So we use the six inch chain as the
19 highest level, and then of course compare them
20 all to using U.N. as the baseline for the
21 classification of a 1.3, 1.3G firework. So yeah,
22 the project -- so we consisted of selecting those

1 three or three different shells in chained and
2 unchained.

3 Then we'll do the test. We're going
4 to do all the tests regardless. Normally in
5 classification tests, once something says it's
6 this level of classification you stop. But
7 because of the nature of the research, we want to
8 do and get as much replicate data as we can.

9 So we'll conduct all the tests. We'll
10 do the single packaging test. That's basically
11 you take one package, you ignite a shell inside
12 and you're looking at propagation from shell to
13 shell within that single package. The stack test
14 is similar, but you put two packages adjacent to
15 it, and then you're looking at propagation not
16 only within but two adjacent packages.

17 These are -- the first two tests are
18 pretty highly confined tests. You put about a
19 meter of sand or gravel or generally sand on top
20 of the packages. Then the last test is a bonfire
21 test, where you just put it on a rack and see how
22 it reacts in a fire situation.

1 We're going to collect all the data
2 and see how it -- see what it tells us in terms
3 of is there -- is the classification of these
4 products essentially the same? So that's our
5 research goal for this project as a whole. You
6 want to go into the next? Okay. So I'll move
7 down. So that's chained in a nutshell.

8 The next project, which is -- has been
9 written up, is ready to be, I hope, submitted for
10 bids, is a project that's called black powder
11 equivalency test. This project's history here is
12 that we have no test to really -- to evaluate the
13 properties of black powder and assess its risk in
14 transportation.

15 Now you have to put this in context in
16 the whole scheme of how black powder is
17 incorporated in fireworks. So it's a critical,
18 it's a major element in fireworks approved under
19 the APA standard, and about in the third
20 revision, 2001, we changed the standard to allow
21 what we identify as equivalent formulations of
22 black powder.

1 But we never developed tests that
2 could assess or measure those equivalent
3 formulations. It's been a very highly debated
4 topic in terms of what's equivalent and what's
5 not. So we want to put this to bed. We want an
6 answer to definitively identify the equivalency
7 of black powder.

8 The formulations of black powder are
9 not what they used to be. Although we identify
10 black powder in our regulations as mixtures of
11 charcoal, as potassium and sodium nitrate, that
12 was a while ago. Things have changed. The world
13 has changed. But you know, the regs may be slow
14 to change.

15 But anyway, what we know is industry
16 has changed these formulations of black powder,
17 and they've gone to what I would call more
18 energetic oxidizers, sometimes more energetic
19 fuels. So how can we identify this risk and be
20 sure that we maintain the risk and don't exceed,
21 you know, in consumer fireworks, the 1.4G risk of
22 fireworks, and in professional fireworks, of

1 course the 1.3G risk of fireworks?

2 So in all of this, we're going to look
3 for -- we want to find this test or tests to be
4 able to assess this risk and hazard of black
5 powder. So the project here is first, there's a
6 lot known about black powder. We really need to
7 do an extensive study of what's out there, what's
8 published, what do people use to qualify, do QC
9 work, to ensure that black powder meets or
10 maintains a standard?

11 So is there something out there that
12 we could use or capitalize on, some information
13 I'm hoping we can use. Then couple that with,
14 you know, look at the U.N. test manuals. Are
15 there tests that might be very useful in terms of
16 incorporating or potentially modifying to assess
17 the properties of black powder?

18 Then we go on. Once we do the
19 research, then let's, you know, I think -- okay
20 these are my ideas, that the type of testing is
21 going to be to look at the power of these
22 explosive substances, burning rate of the

1 substances, or a very popular test is a time
2 pressure test, where you confine the substance in
3 a very small space and look at its pressure
4 profile as it's burned or as it's ignited.

5 We want to do this based on what we
6 find out in the literature, based on what the
7 experts out there who know black powder. Take
8 that insight and develop a test scheme.

9 Then write up a matrix of the powders
10 we can test, look at what the various
11 formulations of black powder are, commercial
12 black powder, you know, the many black powders
13 that are incorporated in fireworks today, and
14 then from that matrix, you know, just do as much
15 testing as we possibly can. We've built a large
16 database to understand and assess the properties
17 of black powder.

18 I do want to test. I think it's
19 important to test alternative formulations,
20 compositions, use in fireworks to see how the
21 energy or characteristics, explosive
22 characteristics of those comparative black

1 powder.

2 I mean although black powder is sort
3 of the standard for energetic composition, you
4 know, how do other compositions compare, in terms
5 of looking at the overall risk of the
6 compositions that are used in fireworks today?
7 And with luck, that's it. Thank you.

8 MR. BHARATH: All right, questions for
9 Mr. Tarr?

10 MS. HECKMAN: Julie Heckman, American
11 Pyrotechnics Association. Just a couple of quick
12 things. With the chained and the unchained
13 shells, have you selected the contractor, the lab
14 yet to do the test?

15 MR. TARR: SMS was awarded that, yes.

16 MS. HECKMAN: Okay. When the testing
17 is done, can industry observe?

18 MR. TARR: I don't know. I mean --

19 MS. HECKMAN: I'm just thinking we'd
20 probably like to, if there was a possibility to
21 just observe the tests that are being done, just
22 for --

1 MR. TARR: I mean it's certainly not
2 being done in secret. It's all going to be
3 recorded. All the data will be released to the
4 public.

5 MS. HECKMAN: I would just think
6 curiosity on this one.

7 MR. TARR: Yeah I think --

8 MS. HECKMAN: I'm sure we'd have a
9 technical consultant that would be there.

10 MR. TARR: The biggest challenge is
11 really timing, because we're really pressed to
12 get this -- the chained one done. I'm traveling
13 out to SMS next week to witness as much testing
14 as I can in that week. So -- but I know setting
15 up visits out to there, yeah they need advance
16 notice.

17 I would certainly never object to it.
18 I don't think the department would, but it's
19 making it and coordinating it would be the
20 complication.

21 MS. HECKMAN: Oh yeah. No, and I
22 wasn't going to ask for that. I was going to say

1 if they said it was next week and we had one
2 person that wanted to go. That's all.

3 MR. TARR: We're definitely doing
4 testing next week.

5 MS. HECKMAN: Thank you. I'm glad to
6 know it's going forward. The other thing is with
7 both of these projects, even though right now
8 it's really about the APA and all of our
9 importers and the approvals that we do issue to
10 fireworks, you know, this is a global issues, and
11 the International Symposium on Fireworks, which I
12 am a director of so I'll make the pitch now, the
13 next symposium is April 2017 in Japan, and I
14 think you should present both papers. If you can
15 get both projects --

16 MR. TARR: Jerry, do you hear that?

17 MS. HECKMAN: If you can get -- if
18 you can get both papers done, I think this would
19 be really important technical information to put
20 forward in that platform.

21 MR. TARR: Well certainly the chain
22 research should be done. The black powder one

1 is, you know, I can't speak for that. We did
2 just -- we're just finishing up the research on
3 the waste treatment for fireworks, and we hope
4 that that would be a forum to present that
5 research as well.

6 MS. HECKMAN: I think any of those
7 would be great topics. Thank you.

8 MS. HILTON: Are you going to be
9 participating in the roundtables tomorrow?

10 MR. TARR: I'll be here.

11 MS. HILTON: Okay. So maybe in the
12 interest of time I'll just hold my question, but
13 I've got --

14 MR. TARR: Just save it. Okay, I'll
15 be here.

16 MR. BHARATH: Any other questions?
17 Okay, thank you.

18 MR. TARR: Thank you, Veda.

19 (Applause.)

20 MR. BHARATH: All right. Next up we
21 have Andrea Dunham from the Sciences Branch.

22 MS. DUNHAM: Thank you Veda. Again,

1 my name is Andrea Dunham, and I am with PHMSA's
2 Sciences Branch. I'm a chemist. I'm going to
3 talk today about enhancing the classification and
4 testing of energetic materials. Now what exactly
5 do I mean by that?

6 Well for certain, well-understood
7 items with defined parameters, can we classify
8 these using alternative tests, streamlined
9 classification, fewer tests, no tests even while
10 maintaining -- still maintaining the equivalent
11 level of safety to the regulations?

12 And of course to do that, to determine
13 new areas that we can do that, we would require
14 research. So keeping that in mind, our goal of
15 why I'm talking here today is to help, get
16 together and help come up with ideas and areas in
17 which different materials or different items can
18 be classified differently.

19 This would be ideas for future
20 research. If we can do this, we can increase
21 efficiency, not only for industry because perhaps
22 less testing will be required but for PHMSA as

1 well, eliminate unnecessary tests. Again, I want
2 to reiterate that anything that we do if we were
3 going to deviate from what's currently in our
4 regulations need to be supported by research. It
5 needs to be supported by data, and we need to
6 maintain our safety equivalency to our current
7 method.

8 So we are already doing this in some
9 ways. So I want to start out giving you a few
10 examples of ways that we really, we already do do
11 this. This is just an idea of what is possible.
12 One example are jet perforating guns. Currently,
13 jet perforating guns that are manufactured to
14 certain specifications that are outlined in the
15 AESC/IME standard, and that contain already-
16 approved, DOT-approved explosive components such
17 as shaped charge, detonating cord, and
18 manufacturing according to the standard they can
19 receive an EX from the DOT without classification
20 testing and without review, a technical review.

21 Small arms ammunition. Small arms or
22 ammunition, if it meets the requirements in our

1 regulations can be self-classified for the
2 manufacturer. Again, this doesn't mean that they
3 don't need to be tested, they don't need to be
4 reviewed by PHMSA.

5 Fireworks, as we were just talking
6 about, is another example. Fireworks, if the
7 devices meet what's outlined in the APA standard,
8 if the chemicals are on any approved list and if
9 they pass thermostability testing, they can apply
10 for an EX and receive an EX from us, but
11 classification testing isn't required if you meet
12 the standard.

13 This is an example on the right if
14 you're curious, that is an example of a jet
15 perforating gun -- a supported tube -- you can
16 see it has shaped charges, set detonating cord.
17 The components are approved by DOT. So what kind
18 of research can we do to support any of these
19 ideas? One example would be shaped charges.

20 Shaped charges are fairly common
21 articles as you saw on the previous slides. They
22 are within jet perforating guns. They tend to

1 have the same common explosives, the same types
2 of liners if they have liners. Here's an example
3 of a conical-shaped charge with a liner.

4 In the past, we have used weight to
5 differentiate between different classifications,
6 but what we are missing is research to help us
7 determine where these different classification
8 division boundaries are. So just for an example,
9 would net explosive weight, could we see this
10 difference between Class 1-1 behavior and Class
11 1-4 behavior? Or wouldn't we start seeing
12 effects outside of a package in classification
13 testing?

14 So this is an example of where we need
15 research, and if we can get research to support
16 this idea, we could perhaps come up with a
17 standard for shaped charges, and a way to have
18 the streamlined classification.

19 A few other examples, and this of
20 course is not an exhaustive list. It's not an
21 exclusive list. These are things that we came up
22 with to kind of start a conversation. Analytical

1 standards are extremely desensitized explosives.
2 At what concentration would you start -- would
3 you stop seeing an explosive? How dilute does
4 something need to be for it to not be an
5 explosive?

6 This is something that we don't have
7 a lot of data on. So right now, any explosive
8 content needs to come to us, needs to go to a
9 test lab. But is there a low amount that it
10 would not be considered an explosive?

11 Electric matches and igniters are kind
12 of like shaped charges, examples of articles that
13 are fairly common, well-defined. So what we
14 would need to do is identify the parameters and
15 supporting test data to possibly incorporate
16 these in some way.

17 Smokeless powder packagings, another
18 example. Smokeless powders are also classified
19 as a 1-1 or a 1-3 and can be packaged down to,
20 you know, 1-4 classification.

21 MR. BHARATH: That's the video.

22 MS. DUNHAM: Okay. So for example, is

1 there a conservative packaging that could be used
2 for smokeless powders that meet certain defined
3 parameters, that would result in a 1-4
4 classification without the extensive testing, or
5 with less testing?

6 So what are the parameters, how can we
7 define these parameters and what testing would
8 need to be done to maintain confidence in the
9 classification and maintain this equivalent level
10 of safety?

11 All right. So that was quick and
12 brief. We are having, tomorrow, a breakout
13 session on this. So I'm hoping that this gives
14 you an idea of what we're looking for, and for
15 those interested in tomorrow, we want to use that
16 forum tomorrow to expound upon all of this,
17 entertain additional ideas, things we haven't
18 thought of, and ways to move forward.

19 MR. BHARATH: Cool. Any questions for
20 Andrea?

21 (No response.)

22 MR. BHARATH: Well, you know where to

1 catch her tomorrow. You get the plug for the
2 breakout session.

3 (Applause.)

4 MR. BHARATH: All right. The next
5 subsection we're going to move into is related to
6 emergency response, and first up we're going to
7 have Dave Brown from Argonne National Labs to
8 talk about the protective action distance
9 estimation and the ERG, which is the emergency
10 response guidebook. Thank you Dave.

11 MR. BROWN: Yes, and this doesn't
12 quite match the title that was in the agenda, but
13 -- or closely matches what I'm going to talk
14 about.

15 So I'm going to talk first about just
16 a little background on the emergency response
17 guidebook itself and the protective action
18 distances, then talk about some of the analysis
19 procedure we use in determination of the
20 distances, and then delve into reactivity
21 considerations, and by reactivity I mean the
22 reaction of these TIH materials with the natural

1 surfaces and surroundings, which is actually a
2 mitigation mechanism that we've been looking at
3 experimentally for PHMSA.

4 So most of you are familiar with ERG,
5 but just a real quick background. It's obviously
6 developed by DOT I think back in the 80's.

7 The first one was maybe '87. Right
8 now it's on a four year upgrade cycle, so every
9 four years there's a new version that comes out.

10 The 2016 version, I think as Rick had
11 mentioned, is at the printers now. It catalogues
12 over 1,300 materials cross-referenced by a common
13 chemical name and U.N. ID number. For a small
14 subset of these materials, about 250 plus toxic
15 by inhalation substances, there are protective
16 action or initial isolation and protective action
17 distances.

18 These materials are pure substances,
19 generic substances, mixtures and solutions, and
20 water reactive materials, which is a little
21 different than the other reactivity I was going
22 to talk about. Water reactive materials are

1 materials that are normally non-TIHs. They may
2 be toxic but they're not an inhalation toxicity.

3 But if you get them wet, they release
4 toxic by inhalation materials and are thus a
5 considerable hazard in those instances. So
6 delving down into the initial isolation
7 protective action distances, the distances are
8 provided for small spills and large spills.

9 Small spills are everything up to 200
10 liters spilled; large spills are everything else,
11 up to and including tank cars. So that's a huge
12 category of potential releases. There's a
13 snippet at the table here from 2012, just showing
14 how it's laid out in the guidebook.

15 For the protective action distances,
16 they're also provided in terms of day and night.
17 So the reason that is is because the dispersion
18 conditions and the dilution within the atmosphere
19 is much different in the day versus night, day
20 being much more convective and a lot more
21 dilution and shorter distances to a safe
22 concentration, night being the opposite end.

1 For six what we call high volume
2 materials, large spill distances are further
3 broken out by container type in transportation
4 mode, highway or rail. An example -- the file
5 here.

6 This gives the distances in so-called
7 Table 3 and there's three tables. There's Table
8 1, which is the initial isolation protective
9 action distance; Table 2 is for the water
10 reactive materials and what these materials
11 produce. Usually they're HCl emitters but some
12 emit phosphine and other types of nasty
13 materials, and Table 3 is some more specific
14 tables for six materials, chlorine, ammonia,
15 sulfur dioxide, hydrogen chloride, hydrogen
16 fluoride and ethylene oxide.

17 Those six materials comprise over 95
18 percent of all TIH transportation. So we sought
19 to give them a little more special treatment. So
20 these are -- this is an example for chlorine.
21 It's broken out by rail car, highway, tank truck
22 or trailer, multiple ton cylinders or single ton

1 cylinder, multiple small cylinders, all being
2 large spill releases.

3 This table has the same look and feel
4 as what's in the guidebook, but here I've given a
5 comparison of 2016 versus 2012, and if you look
6 very carefully, you'll see the 2016 numbers are
7 quite a bit smaller, especially for the low wind
8 speed cases, and this is because of the
9 experimental work we've done on reactivity that
10 I'm going to talk about in a bit and how that's
11 reflected in the guidebook.

12 I will point out that Shannon Fox,
13 who's in the room, has also done a lot of work in
14 chlorine releases out at Dugway, and they just
15 did a nice series of tests last fall. They're
16 going to do another series this fall, and that's
17 really going to help guide and influence the
18 chlorine numbers going forward.

19 Now, the analysis procedure.
20 Basically, the way we've been doing for really
21 since '93 now is looking at it at a very risk-
22 based approach. So how does one balance the risk

1 of over-protection against or balance the risk of
2 insufficient protection with the risk of over-
3 response?

4 And you know, the solution really is
5 the risk-based approach, where we specify a level
6 of protection which is essentially the percentage
7 of time that the protective action distance will
8 be sufficient. The model we use for this is
9 something we've developed over last 20 years
10 that's called CASRAM, Chemical Accident
11 Statistical Risk Assessment Model, and it's a
12 Monte Carlo-based approach which I'll talk about
13 in a little bit.

14 The components are emission rate
15 models, dispersion models. We have a very
16 extensive meteorological database built in.
17 Actually, that slide's a little bit out of date,
18 because now it's about 11 years of data or ten
19 years of data for over 100 cities.

20 It's closer to 150, as well as
21 ignition, thermal radiation and blast
22 overpressure algorithms, which have been used in

1 the past but aren't part of our ERG work right
2 now.

3 So the tools and data we use in this
4 are the transportation regulations themselves,
5 because that really informs the containers that
6 these materials are shipped in. We've done a lot
7 of work with historical accident data, mainly the
8 HMIS database, which gives us a good idea of how
9 much is typically released in an accident.

10 Commodity flow data for certain
11 chemicals, meteorological data as I indicated,
12 obviously chemical property data comes into the
13 mix and of course the models within CASRAM.

14 So the analysis steps are basically
15 you simulate over a million accidents for every
16 chemical, sort results into small, large spill,
17 day and night, and set up a protective action
18 distance as the 90th percentile of that, and that
19 is that level of protection that I've talked
20 about before.

21 It's noted then for six major
22 chemicals on transportation mode we have much

1 more specific or container-specific information
2 as I mentioned a few slides back.

3 Another key element of this besides
4 the models themselves, the physical release,
5 source and dispersion models are what protective
6 health action are we using, and the basis for the
7 protective action distances is the AEGL-2, the
8 AEGL-2. Again, I assume most of you are familiar
9 or at least have some familiarity with the AEGLs.

10 The chart definition of this really is
11 the threshold for serious long-lasting health
12 effects or an inability to escape. There's three
13 AEGL values that are published. There's an AEGL-
14 1, which is basically a no effects limit. The
15 AEGL-2 is defined up there, and an AEGL-3 which
16 is more of a fatality threshold, where you expect
17 to see fatalities to show up for various
18 sensitive populations.

19 As mentioned, these do apply to
20 sensitive populations. So the health values can
21 be quite conservative. For chlorine, for
22 instance, the one hour AEGL-2 is two ppm. So if

1 you release a tank car of chlorine, generally you
2 have to go out quite a ways before that dilutes
3 down to a two ppm level.

4 In the ERG analysis, we used both
5 interim and final AEGL values, and we have a rank
6 ordering process. If a final AEGL-2 is
7 available, we use that. If not, if an ERPG-2,
8 which is a similar criteria that was in use
9 really before the AEGLs came around, we would use
10 that. Then we go to an interim AEGL-2.

11 If none of those are available, then
12 we actually have to fall back to LC-50
13 concentrations, which are the lethal
14 concentrations for 50 percent of the population,
15 and there we use one percent of that value. So
16 for 2016, fortunately, AEGL-2s were available for
17 most of our list. A lot were published really
18 between 2010 and 2012 and '14.

19 Right now, most of the rest are ERPG-
20 2s and then we only have 25 now that we really
21 have to rely on this LC-50 concentration data
22 for.

1 Now the interesting part, reactivity
2 considerations, and this really delves into the
3 work we've been doing recently for DOT. The
4 reactivity in the surface definition of these
5 materials has been recognized in the modeling
6 community anyway as being a real gap in the
7 understanding of these hazardous material
8 releases.

9 There's been, you know, a lot of
10 attention paid to the fact that for, you know,
11 some of these major accidents that have occurred,
12 we don't see the concentrations or these, you
13 know, serious health effects going out as far as
14 the models might suggest given the release
15 amounts and the meteorology.

16 So you know, one of the key parts of
17 this, at least I think, is this reactivity on
18 surfaces, and the consumption of the material
19 both, you know, in the near source area but as
20 well as, you know, kilometers out as it's
21 drifting through vegetation and reacting with the
22 ground.

1 There's been a lot of studies that
2 have shown that looking at, for instance, AEGL-3
3 concentrations, which is a point a lot of people
4 have looked at because it's generally only a few
5 kilometers out, the distances of those
6 concentrations are significantly reduced if one
7 makes some fairly realistic assumptions about
8 surface deposition.

9 As noted, most of this is driven by
10 vegetation uptake. Although soil is very
11 important, too, as I'll talk about in a bit with
12 ammonia, and fortunately as long as we have the
13 empirical data to drive it, the actual inclusion
14 of deposition in a dispersion model is actually
15 very straightforward.

16 One defines what's called a deposition
17 velocity and it's actually used as a sink term in
18 the mathematical part of it. Fortunately for us
19 too, we have some of the other parameters in the
20 modeling itself that really inform and help drive
21 that.

22 For instance, land use and season,

1 vegetation parameters such as vegetation type and
2 leaf area index, as well as some of the
3 atmospheric boundary layer properties, which are
4 important and which I'll talk about in a bit.

5 Now the real problem with this and why
6 we can't just open up a guide book or a series of
7 papers and pull the values out and put them in
8 the model is they don't really exist. This
9 surface reactivity is not well-characterized,
10 even for major commodities. We've looked a lot
11 at the research in chlorine and ammonia and
12 often, you know, the values are anecdotal or
13 especially in a lot of the early research, people
14 focused on things such as deposition velocity
15 itself, which is problematic because it also has
16 an atmospheric component built into that.

17 So there's, you know, there's a
18 disconnect in the literature that was out there.
19 So what we try to do was build, you know, was
20 design a series of experiments that would tend to
21 give us more fundamental parameters of this.

22 Another key issue we have with the ERG

1 is that we're dealing with, you know, 150 to 170
2 separate chemicals that we would need data for.
3 Fortunately, the vast majority of incidents as I
4 mentioned are really limited to six or eight
5 materials.

6 But the guide book by necessity has to
7 list distances for every TIH material that has a
8 U.N. number, whether it's transported in any
9 quantity or not.

10 Really, if you look at the 150,
11 there's probably only a few dozen that are in
12 transportation, maybe 40, and a lot of those are
13 very small amounts. So the basis for our
14 experiments is to really calculate a deposition
15 of velocity in a chamber test, where we release
16 the material into a chamber, the chemical into a
17 chamber, measure its concentration as a function
18 of time when exposed to certain vegetation types.

19 Using that, we can isolate in on this
20 surface depletion resistance. There's three
21 resistances up here. This is a common
22 formulation in the literature. I'm sorry to have

1 to put an equation in here. One is the
2 atmospheric resistance, which just tells us how
3 easy is it for that material to get from the
4 atmosphere down to the surface or within the
5 vegetation.

6 RB is a surface boundary layer
7 resistance. Basically boundary layer is in the
8 leaves and stuff. That's fairly easy to
9 estimate. It's atmospheric resistance can be a
10 little trickier, but we have it in a model
11 already. Then RC, which is the surface depletion
12 resistance, which is a parameter that we are
13 aiming to measure in the experiments.

14 And since we use a vessel that's well-
15 mixed, we could pretty much, you know, we
16 minimize the effect of basically this RA and RB.
17 So looking at how the concentration varies as a
18 function of time and how much leaf area is in
19 this chamber, we can estimate directly this
20 deposition velocity and then the inverse of that
21 is this resistance.

22 That's all I'll talk about now here.

1 So the experimental apparatus we used is shown
2 here. Basically, we have ten liter chambers. We
3 have vegetation that we either grow in the lab or
4 get on site, that we've been very careful to
5 estimate the area of. The folks we have doing
6 this came up with some very novel ways to scan
7 the materials in and get areas from them.

8 We put the material in the vessels,
9 again expose it to the chemical of interest and
10 look at the concentrations as a function of time.
11 So this is a series of data for clover and clover
12 is something if you look in the literature,
13 everyone seems to start with clover. So that's
14 what we did, just to see if we can get
15 comparative values.

16 Typically we do this many, many times
17 to try to get a, you know, some idea of the
18 statistical variability. What you see at the top
19 is a series of lines that show, you know, loss of
20 the empty container itself. Some of that might
21 be photolysis.

22 We did find especially with chlorine

1 we needed to condition the containers first,
2 because the container would actually absorb some
3 of it. But then that settled out and then we
4 could look at the actual loss due to vegetation.

5 So here, if you put that into a
6 spreadsheet, you can calculate a deposition
7 velocity of about 8/10ths or 8/100ths of a
8 centimeter a second, which translates to an RC
9 value of 650 seconds per meter, which lines up
10 fairly well with some of the other data in the
11 literature. So we felt pretty confident about
12 this.

13 So racking and stacking everything for
14 chlorine and then we looked at sulfur dioxide,
15 hydrogen chloride and ammonia, and then mapping
16 the vegetations we use and we use clover,
17 shamrock, grass, just a normal lawn type grass,
18 as well as a conifer which is the spruce, we were
19 able to map into some of the -- or the vegetation
20 types that are very common in land surface
21 models.

22 We also looked at a variety of soils,

1 just bare soils and also at a variety of
2 different moisture levels from completely dry to
3 about ten percent moisture. So when we ran our
4 data and ran the statistics on them, here's the
5 RC values we got for them as we map into the
6 vegetation classes we used within our model. So
7 this is what went into the emergency response
8 guidebook analysis in 2016.

9 So what are the next steps in this?

10 Well, we want to continue these tests and we
11 actually have a proposal in to do just that. A
12 couple of analysis options here is we can expand
13 to a new set of chemicals, you know, a few
14 chemicals that are of interest and are also in
15 transportation, things like hydrogen sulfide,
16 methyl mercaptan, carbon dioxide, phos, things
17 like that.

18 And/or we can conduct additional
19 experiments on chlorine and ammonia. Chlorine
20 and ammonia account for about 90 percent alone of
21 all TIH transportation. So you know, we'd like
22 to have a very good idea of what happens with

1 those materials.

2 We are going to be coordinating very
3 closely with Shannon's group, who are also
4 looking at doing a similar series of tests
5 actually in the field, where they can expose
6 these to much higher concentrations.

7 We're a little bit limited to what we
8 can do in the lab just for safety reasons for
9 that. So you know in the field, you know, you
10 might be able to go up to 1,000 PPM, whereas we,
11 you know, we can't -- for something like
12 chlorine, which we can't do anything quite like
13 that.

14 So that's it and you want to talk --
15 and we'll do questions or not?

16 MR. BHARATH: Yeah, sure. Questions,
17 yeah. Really fast, so long as the questions
18 don't get out of line.

19 MR. RAJ: In the tests that you just
20 showed, was the vessel closed?

21 MR. BROWN: Oh yeah, yeah. Closed and
22 sealed.

1 (Simultaneous speaking.)

2 MR. RAJ: Was the pressure changing
3 continuously? The concentration of chlorine was
4 changing?

5 MR. BROWN: Yes, within the vessel
6 continuously right, and the vessel was completely
7 closed, right.

8 MR. RAJ: So how does that translate
9 to the real world outside, where it's diluting
10 and concentration is changing?

11 MR. BROWN: Well because we don't --
12 we're not losing -- I mean first of all, we're
13 not introducing additional chlorine. The
14 chlorine that was in there originally is getting
15 depleted by the vegetation. So we did test, of
16 course this isn't going to be working for me now.

17 Notice when I had that graph up, we
18 did test with a chamber, and maybe I didn't
19 explain that right, without any vegetation. So
20 it's an empty chamber, nothing in it. We
21 introduced the chlorine and see how that varies
22 as a function of time.

1 Then we introduced the vegetation and
2 we see how that varies as a function of time, and
3 then we take the end, you know, and then we use
4 it -- use basically a difference approach. One
5 thing I forgot to point out in that last slide is
6 for ammonia, if you noticed this surface
7 resistance value is very high for vegetation but
8 very low for soil.

9 So there wasn't a lot of reaction of
10 ammonia with the vegetation. There's a lot of
11 reaction with the soil, especially the wet soil.
12 Just sucked it right up.

13 MS. HILTON: I know that DHS has done
14 a lot of testing in this area, and if you haven't
15 talked you guys probably should talk.

16 MR. BROWN: Yeah. We've been --
17 Shannon and I have been collaborating on this.
18 Actually Shannon came out to the lab when we were
19 doing this.

20 MR. BOYLE: They go back to
21 Jackrabbit 1.

22 MR. BROWN: Yeah. Well before that.

1 MR. BOYLE: We didn't know it was
2 Jackrabbit 1.

3 MR. BROWN: Right, exactly. It was a
4 jackrabbit then, right.

5 MR. BOYLE: It was two.

6 (Off mic comments.)

7 MR. FOX: Yeah thanks Dave. I'm
8 Shannon Fox with DHS CSAC, and we are doing this
9 fall a second round of large-scale chlorine
10 release testing from 10 to 20 tons outdoors, and
11 we will be trying to coordinate our experiments
12 with reactivity with what you've done Dave, to
13 explore the high end up to 100,000 parts per
14 million, with a realistic release.

15 We want to include vegetation similar
16 to what you did. I wanted to know how you
17 determined the surface area for the different
18 vegetation, given that it will be variable
19 between each sample that's put in there.

20 MR. BROWN: Right, right. And so what
21 we did is for instance like on what was shown
22 there, the clover. So we would use typically

1 four clover leafs and we did very careful
2 measurements of several sets of those, got an
3 average basically of what a chlorine -- or of
4 what a clover leaf was.

5 So there would be -- the guy that was
6 doing this, Bill Haney who you met, would
7 actually scan. He had a piece of software that
8 would basically tell, you know, exactly what that
9 area was and it turned out it was pretty --
10 it was pretty, you know, as long as he picked
11 leafs that were all around the same size, you
12 know, visually when he scanned them they were all
13 very close.

14 So you know, we tried to, you know, we
15 tried to standardize that as much as possible.
16 The most difficult, as you might imagine, was the
17 conifer, because it's a triangular leaf and he
18 had to make a guess of that. The grass was also
19 very difficult. So but that, you know, when you
20 talk about shamrock and clover, that was easy.

21 (Applause.)

22 MR. BOYLE: I do laugh Shannon.

1 Every time they talk about that one, I see Dave's
2 small lab setup and he can count clover and
3 measure. I said what do you do out at Dugway,
4 where you're bring in a truckload of fir trees
5 and work with that. Maybe you can count clover
6 for them out at Dugway and get paid huge amounts
7 of money to say that's ten leaves or 20.

8 So it was entertaining when I first
9 heard that we counted clovers and measured them
10 in the lab, and I did think of you. I'm going to
11 do three things really quick, because Veda has a
12 mean hook. He will kick me right off. He
13 doesn't care.

14 First thing I'm going to do is a
15 little bit of an update. I'm just going to tell
16 you how we stand with the 2016 ERG. The next
17 thing I'm going to do is I'm going to beg you to
18 participate in our discussion group tomorrow,
19 because we need to know do you want to take the
20 ERG.

21 We want to do it more online. You've
22 seen a lot of discussion as to what can do

1 online, what resources can we make available, how
2 can we improve our product? Not everything has
3 to be in a book form. So I'm going to beg you to
4 participate in our discussion group tomorrow
5 morning, to say what direction should we go.
6 What we're saying the interactive, the online
7 ERG.

8 I'm going to beg you to participate in
9 that, and then I'm going to close with telling
10 you a little bit of how tomorrow's going to work,
11 and that's primarily for the people that are
12 streaming in and want to participate. We're not
13 going to have six or seven cameras at each table
14 and stream, and you pick a group. It's not going
15 to work that way.

16 It's going to be like teleconference.
17 So I just want to explain how we're going to --
18 how tomorrow's going to work and I should still
19 be done before Veda gets upset with me.

20 There we go. That's what the 2016 ERG
21 is going to look like, and since he's not here,
22 Tom Kiddy's out in Louisville is the printing

1 company. I asked him, because they've already
2 reviewed the proofs. I said can I have one of
3 the proofs so I can pretend to have a 2016 ERG?

4 He said no, that wouldn't be fair.
5 You don't get the first one. So I don't get it.
6 That's what it's going to look like. That's what
7 the proof looks like. You'll see it's got a top
8 band on it. They are printing them now. They
9 should be delivered and there was somebody from
10 the fire chief.

11 The distribution list is put together
12 by our training and outreach people. They've
13 gone state to state. So they'll know where
14 they're going in the state.

15 If you have a question as to where are
16 they going in your state or who gets them and how
17 do you get access to them, please submit a
18 comment card or email to us and I can get back to
19 you. I don't have all 50 states and all the
20 coordinators.

21 They're also they're going to be in
22 Spanish, French and English. They'll go to

1 Canada. We're always interested in how they're
2 going to get into Mexico. They seem to be stuck
3 at the Mexican border all the time. We're
4 promised they'll flow into Mexico seamlessly.

5 As we've done in the past, we don't
6 release our data files until our book is out.
7 That means we get to hit the street first. So
8 that means if we distribute the books in April,
9 the data files will be available in April. It
10 will lag a week or two. We tend to let Tom Kiddy
11 who does it, who's in our Outreach and Training
12 Group, we tend to let him come back. He gets to
13 spend two weeks printing the book.

14 We give him a week to relax and
15 everything, and then we say you've got to start
16 working on the data files, to make sure they're
17 released. So they won't lag too much longer. I
18 don't see Bob Richard here anymore from
19 LabelMaster and the other groups that always want
20 the data files as soon as possible. But they
21 will come out.

22 Print edition updates. I can read

1 them to you. What we're going to do is we did it
2 at the beginning. Instead of verbally telling
3 you how to use the book, we gave you a flow chart
4 on how to use the book. The table of placards is
5 bigger.

6 One of the comments is the rail car
7 and the road trailer identification charts are
8 always so small, and it's really hard to tell the
9 difference between which one was which.

10 So we made that section a little bit
11 bigger. We used better drawings. We cleaned
12 them up more. So we hope you'll see better
13 things there. Bob Fonczak is still here. If you
14 take all of the work that Dave Brown did, and the
15 reactivity work, we filled all that back into the
16 CASRAM model. So you'll see the protective
17 action guides being very different, particularly
18 the Table 3 models.

19 Because of the reactivity data, we
20 were able to put in. So please take a look at
21 those. Our Pipeline Group, remember we're PHMSA,
22 which is pipeline and hazardous material, they

1 updated their section and that's included. This
2 -- I don't know if it's the first time.

3 First time for me. We put the GHS
4 markings in and that's going to be a topic
5 tomorrow. Where should we go with that? How
6 much farther should we put? Should we do more
7 with the GHS system in the ERG, how should we
8 work with that, what's really going to happen?
9 So I'll put that out as a discussion.

10 Again, we have to always update the
11 U.N. ID numbers and the proper shipping names.
12 They will be up to date with the 19th edition of
13 the U.N. Orange Book. Same here, we always have
14 the ten year rule.

15 If the name has been used in any
16 regulation, Canadian or U.S. or U.N., if it's
17 been used within the last ten years it stays in
18 the ERG. It doesn't come out just because it's
19 not in the 19th edition or in 41 C.F.R. We'll
20 leave it in there for time in case something's
21 been prepared for transit and then transported.

22 And then for Canada, we have an

1 expanded emergency response assistance plan.

2 There's additional data that's Canadian. We
3 don't have a Canadian edition and a U.S. edition,
4 so you'll see it all put in the same one.

5 Now we also have the electronic
6 edition, which is for Android, Apple, Windows and
7 it's also going out on the iPad this year. We've
8 put those out. I'm not as up to speed on that
9 because we contract that out. That gets sent out
10 to a different company to take that and put the
11 data together.

12 This is what we're begging you to
13 participate tomorrow and say what direction
14 should we go with this. A complaint, if you
15 will, not too big a complaint is in a sense if
16 you don't put it on a iPhone or an Android, just
17 having PDFs and having it be the exact same as
18 the book. It's useful, but in a sense you can do
19 better.

20 We said well, what do you want to do
21 better, because we don't want to make the site or
22 the app so complicated that it can't be used

1 anymore, that there's so many things on it, or
2 the dropdown screen is so complicated, it's not
3 really meeting the intention of the 15 minutes'
4 initial response.

5 So what we said is should we put more
6 in that site? Should we develop a separate site?
7 What should we do? So that's what we're looking
8 at as to what would be a good improvement, but
9 still be useful for the first responder, and then
10 should we develop a second app or a second
11 website to say this is where we could put in more
12 training information, more response information,
13 outreach information for us. How much more could
14 we do, either in a separate site or just do it
15 through our own website?

16 So that's going to be a lot of the
17 discussion tomorrow if you're setting at the
18 table. I think it's the first, the opening
19 session, one of the opening sessions. We're
20 going to talk about hazard communication. Mark
21 will be there with -- he's facilitating it, so
22 he'll certainly be there for the hazard

1 communication note papers.

2 So we'll be looking at that. So when
3 you get to the 2020 look-ahead, we're certainly
4 -- we're not going to give away too many secrets.
5 We may not fund everything that Dave wants, but
6 we're certainly going to fund farther reactivity
7 work. We found the first group who was very
8 productive as we went through the, we will say
9 the top six.

10 So we'd like to see the rest of the
11 table with the justification on it. The Orange
12 guides, I've only been involved in the last two
13 ERGs. But we haven't really had a lot of
14 expertise or we had very little expertise in true
15 emergency response. So we'd like to verify those
16 guides. Things certainly do change, so we'd like
17 to see those verified better and make sure all
18 the distances are correct and the responses are
19 correct.

20 We'd like to verify the Orange guides,
21 and again, this is tied into my plea to
22 participate tomorrow. What should our electronic

1 edition be? Should it be web-based? Should it
2 be an app? Should we have one system that's
3 really for the first responder and then a second
4 system that gives more response information when
5 you have more time?

6 Should there be something for
7 inspectors? How should we work it, what should
8 we do? And again, that's should we incorporate
9 additional training? We've developed a new
10 electronics Code of Federal Regulations. That's
11 in PHH-10, where it's going to be a one-site-
12 fits-all.

13 You're going to go in. We're linked
14 to the e-gov where you can pull down 49 C.F.R.
15 But what you'll be able to see is all the special
16 permits we have, any interpretations we've had.
17 What we've been questioned is could we tie the
18 ERG back into the table in 172? Could we tie all
19 the ERG information back into that?

20 We're going to have to look at it. We
21 don't know. As you know, that table of materials
22 is very large. Could we tie it all back in?

1 We're going to look at that, and then again,
2 whatever we come up with today and tomorrow we
3 want to put into how do we improve it for 2020.

4 So my last slide will be thanking you,
5 but what I want to do is tell you how tomorrow
6 will work. What we're going to do is the room
7 will be set up in tables tomorrow, instead of in
8 a theater seating, and we've picked the topics
9 lineup with our strategic plan topics.

10 Then we have facilitated discussions
11 on what are the opening topics for those areas.
12 If you want to go further, if you want to discuss
13 something else, all that is okay. We're going to
14 have a lot of what we're calling research needs
15 statements, which are problem statements. Where
16 are the gaps? We're going to have those
17 available to the groups.

18 The goal is for the groups to create
19 as many of those as we can. What we'll do is
20 then flush those out and then those will go back
21 into that hopper at the top where we're saying
22 this is research that needs to be done.

1 Again, since we want to have people
2 that you don't have to be here to participate, if
3 you're listening in, streaming in, phoning in,
4 please send an -- and you want to participate
5 tomorrow, send us your phone number, in which
6 groups you want to participate in to hazmat
7 research@dot.gov. That's hazmatresearch@dot.gov.

8 What we're going to do is set up
9 conference calls. So we'll all just dial into
10 the same number and whoever wants to participate
11 in that, we'll have -- it will probably be just
12 on the iPhone or our cell phone.

13 But we'll be calling in on a speaker
14 phone and then people that want to come in or
15 people who want to participate from outside will
16 just call in, and we'll try to set the tables far
17 enough apart. It should only be six or seven
18 tables, so that's how it will work.

19 So if you're listening in and you want
20 to participate, or if you're just going back to
21 your office and say I'd rather do it by phone,
22 give us your name and phone number and what group

1 you want to be in, and we will contact you with
2 what phone number you should call in for.

3 We'll probably also post the list and
4 say here are all the call-in numbers for the
5 groups. But it's going to be a lot easier for us
6 if -- for you and us if you tell us you want to
7 participate so we can push the number to you. I
8 think Veda is getting nervous, so I must be done.

9 As we get into the, I don't want to
10 steal Veda's thunder, we do have three emerging
11 risks presentations to go. So it's not the end
12 of the day. We have three. I think Cynthia
13 Hilton's going to give us something with
14 Energetic Material, and then Britain Bruner has
15 some Natural Gas, and then Troy from SMS has a
16 follow up to his presentation last year. So I'll
17 turn it back to Veda.

18 MS. HILTON: You don't want a
19 question?

20 MR. BOYLE: I love questions. Sit
21 down, we're having questions.

22 MS. HILTON: I am so sorry. I've got

1 to say this. You know there has been some
2 criticism, not that, you know, not from me
3 necessarily, but on the guide, and whether or not
4 it's to serve incidents in transportation or a
5 wider universe of locations.

6 Like first responders may use it when
7 they go to fixed facilities. I'm sure you've
8 heard this. So the only reason I tee this
9 question up that way is that you have the GHS
10 stuff in there, and there's a wide group of
11 industry that is concerned about duplicative
12 hazard, hazcom in transportation.

13 So I don't know who suggested that.
14 I don't know how it showed up in there, but at
15 some level if the ERG is supposed to be for
16 transportation incidents, this is a concerning
17 thing, because we want to communicate hazard, but
18 we don't want to have duplicative communications
19 out there and we're all for not confusing things.

20 So I'm just -- I'm making that as a
21 statement. I'm just making it.

22 MR. BOYLE: I think you're -- to me,

1 I think you're absolutely right and we're not
2 going to go backwards through my slides. But if
3 you look, if you remember the 2016 is going to
4 have a black bar at the top, and the bar says
5 "This is for transportation incidents only." So
6 we're trying. That wasn't --

7 PARTICIPANT: We don't mean ERG.

8 PARTICIPANT: Yeah, GHS.

9 MS. HILTON: Or GHS, I'm sorry. GHS,
10 and we have got a position which I will submit
11 for the record.

12 MR. BOYLE: We'd be happy to take that
13 in. We did introduce it, because we did think
14 people are seeing these. So we wanted to provide
15 the information. If we've acted in error, 2020
16 will have great hindsight. Our vision will be
17 clearer, and we can make the corrections.

18 We did put it in. We thought it was
19 valuable, but we certainly agree. I think we
20 struggled that the same point, that we said we
21 don't intend this book to be for facility
22 response, but we know people do respond, use it

1 for facility response because they don't have
2 anything.

3 So we had to say where do we draw the
4 line and cut that off and we struggle with it.
5 So if you have help or suggestions or comments,
6 we'd love that, because we don't really know what
7 to do with it. We're struggling with it
8 ourselves.

9 MR. WILLAUER: David Willauer. Just
10 to follow up, I think for planning purposes, it
11 serves a great -- it's a great tool, because we
12 often encourage communities to identify the
13 primary hazards transported through their
14 communities and identify those risks.

15 If you can understand what your
16 protective actions are going to be within a
17 certain distance of that particular route, then
18 you can identify sensitive populations within
19 those buffers, if you will. If it's a poison
20 inhalation hazard, the buffer is going to be
21 wider.

22 If it's a fuel, the buffer's going to

1 be very small for example, and those types of
2 planning tools, additional tools for first
3 responders are essential to know where to provide
4 protection actions.

5 So not just for facilities, who often
6 have -- which often have to put together risk
7 management plans anyway. The distance, the
8 corridors along with those chemicals and fuels
9 are transported are just as important to study
10 for their residents as well. How these chemicals
11 get from A to B.

12 So that's another use of the ERG that
13 we found to be really helpful. Thank you.

14 MR. BOYLE: Thank you. Possibly your
15 response, Cynthia, to your question or comment,
16 maybe that's why we need to split into two sites
17 or two books and say here's the big bag,
18 everything that we can think of and here's the
19 emergency response portion. So we're open to
20 whatever ideas come forward, and that will be
21 tomorrow, I believe, at nine o'clock. One more
22 question please?

1 MR. KRATOCHVIL: Joe Kratochvil from
2 International Fire Chiefs. I don't want to
3 believe this, but as a responder, it's not my
4 first choice to use that book. But the way I
5 look at it is that it's chlorine leaking from a
6 tank car, is chlorine, the same chlorine leaking
7 out of a building. So that's the way I use it as
8 a responder, okay.

9 MR. BOYLE: Thanks. We know that,
10 but I think what happens as Cynthia points out or
11 anybody else could point out, we can't cover all
12 types of facilities, and we have struggled with
13 when we say is something better than nothing? We
14 don't know, we don't know. It certainly doesn't
15 work in ammonium nitrate plants. It's not a good
16 idea. But thank you Veda for the extra time.

17 MR. BHARATH: No problems.

18 (Applause.)

19 MR. BHARATH: All right. Plenty to
20 talk about tomorrow. All right. First up,
21 Cynthia, Cynthia Hilton from IME, going to give
22 us some feedback on some ideas related to

1 emission technology. Hi Cynthia.

2 MS. HILTON: I am -- I thought there
3 would be an empty room here except for the people
4 who had DOT at the end of their emails. So I
5 appreciate you. I understand that like I'm
6 between you and the subway home. I don't have
7 any video, but I have a lot of visual aids here
8 and Veda, if I'm still here ten minutes from now,
9 you need to -- I want you to -- I need to sit
10 down.

11 So I'm Cynthia Hilton. I'm the
12 executive vice president, Institute of Makers of
13 Explosives, and I'm going to figure out how to do
14 this. How do you do this?

15 (Off mic comments.)

16 MS. HILTON: That one, okay. We're
17 going to just skip over. We're, you know,
18 awesome people, you want to know all of us. But
19 I'm just going to get to up here. I think this
20 is it. Yeah, okay. So part of my visual aids
21 are you all should have memorized this, the
22 strategic plan, which is still good.

1 So I am here. We've heard, let's see,
2 what do we do. Okay. So this identifies some
3 priority issues that are not, you know, energy-
4 related and energetic materials is one of those,
5 and that's what I would like to be up here and
6 talk about, what we see as future needs.

7 Rick gave some information. You
8 understand this whole notion about the three year
9 funding and they have carryover money, and the
10 last data you gave to me is a little bit
11 different than the data you presented today. So
12 I don't know how much money is I want to say not
13 unencumbered. It looked to me like you have
14 fully committed your FY '14-'16 money. Is that
15 what I heard there? Yes.

16 So I don't know how any of these other
17 new projects, you know, may feed into this. I
18 also want to recognize for other presenters here,
19 I've heard a lot of good projects. This is
20 really good that we do this forum, and it should
21 go on the record as well that Rick and his team,
22 Lad, have really listened to what industry has

1 said about, you know, transparency,
2 accountability and, you know, Joanna, a shout out
3 to you.

4 I hope you're able to implement those
5 things. I hope when we come next year we really,
6 we see that kind of collaborative thing that you
7 were trying to put together. So having said
8 that, so there's four specific research things
9 that we're interested in for explosives and one
10 that has general applicability and -- okay.

11 So if any of you were here for the
12 forum last year, we talked about the fact that we
13 believe our IME 22 boxes, these are boxes that
14 are used to put detonators in so that you can
15 move them on vehicles with other explosives.
16 Otherwise, that's forbidden.

17 We were working with the Coast Guard
18 about 18 months ago or so on moving these boxes
19 out to oil platforms on boats that have aluminum
20 decks, and it came up about what is the fire risk
21 if you've got aluminum decks and you've got
22 explosives. The Coast Guard wanted a 60 minute

1 window there, and we were not able to say well
2 gee whiz, you've got a 60 minute window.

3 Subsequent to that, the National
4 Science Foundation has reached out. They use
5 these things to transport explosives and I don't
6 know, or they were doing research for someone who
7 uses them like in avalanche control and they want
8 to know if there's a problem, how long, you know,
9 before the fire.

10 So I'm just saying that what we asked
11 last time is allow us to do a literature search,
12 see where we are on that and bottom line we don't
13 really have a fire rating. So we would like to
14 partner with you guys. We think it's a good
15 project. We would be happy to donate, you know,
16 in kind the boxes and the material you would
17 sacrifice.

18 But we are very interested in getting
19 better grasp on what the, you know, the fire, you
20 know. Can we -- is it 30 minutes or is it 60
21 minutes and are there things we could do to the
22 existing standard -- oh I should tell everybody.

1 So this is a standard which is adopted in the
2 HMR.

3 So DOT stands behind this standard,
4 but are there things we could do to extend that
5 time, you know. Okay. So next thing is -- the
6 next thing really fast is Andrea, all right.
7 You're still here somewhere, presented on our
8 next few things, and they came out other -- they
9 were revealed we worried about them and where's
10 another handout I have?

11 Somewhere around here -- aha. A
12 little meadow that came out that was awesome on
13 February 22nd, talking about reforms that the
14 agency wants to make in classification approvals,
15 and we are supporting of all of them. Our next
16 two ideas are Andrea's. I hope we can talk
17 tomorrow to support you further in doing those,
18 so I'm not going to spend time on that.

19 The last thing -- or the next thing is
20 so, we support alignment with the U.N. model
21 regulations, and when DOT adopted those back in
22 1990, they retained a domestic provision that

1 limited the amount of explosives than can be in
2 detonators to 25 grams when they're classes as a
3 1-5.

4 This is Special Provision 103, and as
5 far as we know the U.S. is the only country in
6 the world that continues a limitation like that.
7 At the time, RSPA supported it by saying that,
8 you know, it's been in place for many years and
9 they gave a couple of hypothetical examples that
10 if they didn't retain it, gee whiz, you could
11 design things that maybe two pounds of explosive
12 material could be in a product.

13 However, we think that in the
14 intervening time and the way tests have evolved
15 and new tests have been implemented, that it's
16 hard for us to see how you could get to a
17 situation like that.

18 So we would ask the department either
19 to remove Special Provision 103, so that you're
20 consistent with the rest of the world, or devote
21 some resources to go test it and find out why the
22 rest of the world should listen to the U.S. and

1 do limitations.

2 The last one which should be something
3 that's of interest to everyone. We all love
4 data. We wouldn't be here if we didn't, and
5 data's really good. I have some examples here,
6 however, of we need denominator data. In 2012,
7 you put out this little document which is "Death
8 and Injury, Hazardous Material Sensitive."

9 So there's no denominator data in
10 here, so it limits the usefulness of this to
11 identify where there are problems. I just went
12 on your website and this is another thing that
13 should be updated. You've got accidental deaths
14 compared to hazmat stuff in the United States
15 from 1999 to 2003, and it was posted in 2004 and
16 probably should be updated because I'm sure that
17 might have changed.

18 So basically denominator data. For
19 those of you who remember, back when we used to
20 have an Office of Technology Assessment in 1986,
21 they had denominator data. Then that was updated
22 by PHMSA in 1998, and there hasn't been something

1 since then because we're told that they use the
2 U.S. Economic Census that has commodity flow
3 data.

4 But this works and it doesn't work,
5 because if you read this and I love all the
6 people in the room who are here because of
7 flammable materials, but just reading this it's
8 like 85 percent of all hazmat is flammable
9 material. So all of the rest of us, we may need
10 to leave right?

11 Or maybe that tells us something. But
12 some of the data they have here about Class 1
13 materials are Class 1 materials. It isn't what
14 we would say. Like they say the average trip for
15 a Class 1 material is over 800 miles. Now in our
16 industry, it ain't over 800 miles for an average
17 trip.

18 So maybe Julie's here, maybe that's
19 the fireworks, you know. Maybe it's the
20 military, I don't know. But at some level it
21 doesn't get to the detail that, you know, we
22 would hope would help us to better, you know,

1 assess where we are on things.

2 So doing something on denominator data
3 would be nice and I think that's it. I
4 appreciate your attention. We're committed to
5 working with you and I did it in less than ten,
6 right? Okay. Thank you all.

7 (Applause.)

8 MR. BOYLE: I'm just going to give a
9 little comment. I didn't work this out with
10 Cynthia, but it just worked out so well. What
11 she put upon the screen, that's really what our
12 research needs statement is. That's what we want
13 tomorrow. You're not going to have write long
14 papers.

15 Just give us -- this has always
16 bothered me. This is a gap, a little bit of
17 explanation. We had -- I have, I'll tell David
18 and Joanna to give you a call and say what is
19 Cynthia talking about? I don't get it. I don't
20 know what an IME box is. But you figure it out,
21 or talk to Joe Nicklous and he'll put one of his
22 chemists on it, and they'll help you out.

1 But we're not looking for research
2 papers. What Cynthia put up on the screen will
3 be perfect tomorrow for us to develop a needs
4 statement, for it to feed into our management
5 information system as a project we're evaluating
6 and prioritizing. So tomorrow, that kind of
7 information or that kind of depth is all we're
8 looking for.

9 So I'm sorry, I've run into Britain's
10 time or Veda's time. But that's really what
11 we'll be doing tomorrow is things like that.

12 MR. BHARATH: All right. I'll have
13 some more about tomorrow. All right. Next up we
14 have Britain Bruner from the Sciences Branch, and
15 he's going to talk about hydrides and emerging
16 risks associated with that.

17 MR. BRUNER: Thank you Veda. Yes, my
18 name is Britain Bruner. I'm chemist in Hazmat.
19 I'm still fairly new to the team, a Ph.D. from
20 Baylor University about two years ago. For the
21 last -- last year I talked about some concepts to
22 either inert, hazard material, specifically crude

1 oil, or materials that could be incorporated into
2 rail car technologies.

3 Today, hydrates and the emerging field
4 of natural gas, what's going to actually happen
5 in the next five, ten, possibly even twenty
6 years? The reason I say that time frame because
7 this is emerging risks.

8 We've talked about a lot of the
9 different hazards of transporting dangerous goods
10 today. You've seen everything from explosives to
11 gases. Not too much on radioactive materials or
12 corrosives or oxidizers, but lithium batteries as
13 well and miscellaneous.

14 But an emerging risk is something to
15 me that is actually -- we're not actually looking
16 at right now. It's down the road, it's not
17 immediate, something that maybe we can start
18 doing the leg work now, small incremental steps
19 that can add up over the next ten years or so and
20 do something revolutionary that will prevent
21 another incident like Lac-Megantic or other more
22 recent crude oil incidents.

1 So these, to kind of metaphor or
2 harking back to your childhood, the story of the
3 princess and the pea. I'm looking at unknown,
4 ignored or unsolved problems that are so small
5 that only the crazy or the very in the know know
6 what's going on. Which am I? I'll let you
7 decide on that subject. Probably a little bit of
8 both, but that's just being healthy in my self-
9 criticism.

10 So specifically, flammable gases. My
11 interest in flammable gases is my hindsight for
12 my work with crude oil. There have been recently
13 a significant increase in proved gas reserves,
14 not just in the United States but around the
15 world, and even worrisomely, natural gas has
16 outpaced coal for an energy resource.

17 So what does that actually mean in
18 terms of transport, when we're actually having to
19 concern ourselves with transportation of this
20 commodity? Well, if you know anything about
21 American consumerism, the more we make, the more
22 we consume and it just adds and adds and adds and

1 adds and it continues to expand.

2 We have all the resources that we need
3 to meet our energy demands. Energy security's
4 not a problem that I'm up here to talk about.
5 It's the actual infrastructure for natural gas
6 transportation.

7 So if you've been following the EIA
8 and some of the different bloggers and
9 journalists and academics out there, you can see
10 our current consumption to production rate, and
11 we're actually on track to be a net exporter,
12 just because of the recent allowance of exporting
13 natural gas.

14 Exportation of natural gas is supposed
15 to far outpace our imports by 2017, and it's
16 primarily LNG, liquefied natural gas. Over the
17 next 20 years, you can see here -- does this
18 section show up on the screen? No. Some of the
19 different models predicting the changes in these
20 imports and exports.

21 Dry production, we had a record this
22 year for natural gas, 73.5 billion cubic feet per

1 day. That's being produced. That's not even
2 what's in transport yet. That's what's going to
3 a facility to then be processed and then sent out
4 for transportation.

5 I mentioned it earlier, the rate of
6 proven reserves is continually increasing.
7 Technologies are rapidly advancing and things
8 that were remote, stranded or unconventional have
9 been realized in the last five-ten years, and
10 they are new technologies that are pressing even
11 more stranded or more unconventional, if you
12 could actually put that to a degree in terms of
13 what natural gas is out there.

14 The EIG has a predicted energy rise
15 from natural gas or a contribution from natural
16 gas from about four to eight percent. That's
17 going from about 30 to 34 percent overall with
18 their conservative estimates. I believe that's
19 actually too conservative with some of the
20 technology I'm going to get to here in a little
21 bit.

22 But you can see the different ratios

1 and the trends in energy consumption, the
2 quadrillion BTUs and the energy production in
3 trillion of kilowatt hours, and you can see from
4 their estimates and their modeling, I'm talking
5 about the EIA, how the trend's going to go.

6 Now that takes into account current
7 proven reserves. There's not much when you
8 actually go through their annual economic or
9 annual energy reports. The rate of proving new
10 reserves. So it's a little, it's a little under,
11 which is why I say it's an emerging risk.

12 So currently there are infrastructure
13 demands that no one's talking about from my
14 research. There's a pipeline issue in
15 California. You might have heard it as a duck
16 curve. That's getting gas from the plants that
17 are producing energy into the homes for heat and
18 electricity.

19 The technology that's actually going
20 to ramp this up is hydrates. Here's a map. Over
21 here on the right, you can see an intensity plot
22 of the amount of methane and natural gas that's

1 actually trapped in a hydrate formation. Not too
2 many people are familiar with hydrate formations.
3 You might have seen a lot of the environmental
4 concerns about -- I'm blanking on the term, but
5 it was an equivalent of the massive environmental
6 changes where all of these methane reserves would
7 be spontaneously released.

8 That's again not a concern, and that's
9 actually been disproven. But these are resources
10 that we can use in the meantime to go towards a
11 lower pollution rate, lower CO2 emissions as we
12 build a green infrastructure and still meet all
13 of the needs that we need for daily activity in
14 the United States and around the world.

15 So yes, to reiterate or to repeat, I'm
16 a little behind on my points, the hydrate volume,
17 the tons of cubic feet versus a shale, which is
18 recently is what has increased the EIA's
19 prediction, is about 100, let's see. Yes, it's
20 100,000 trillion cubic feet versus the 7,000
21 trillion cubic feet. That's hydrate methane to
22 shale methane.

1 That's a massive increase of natural
2 gas that is available and can easily be inundated
3 or can easily over-inundate an infrastructure for
4 transportation. We're going to use it; the
5 question is when and how. I mean we're not going
6 to stop using energy. We're going to keep
7 drilling and expanding. It's going to be all
8 kinds of wonderful inventions. Life's going to
9 be great. Agriculture's going to be good. We've
10 got to figure out how to use it some way.

11 So this picture here is actually a
12 picture of a Japanese company collecting methane
13 hydrate from hydrate formation off the coast of
14 Japan, and actually producing natural gas.
15 They're able to transport it offshore to shore
16 and then collect it, and ship it out by
17 compression or liquefaction.

18 So it's already being done, and
19 they're discovering more and more methane hydrate
20 formations that are easily accessible, that were
21 previously unaccounted for.

22 So hindsight, we saw what happened

1 with crude oil as shale oil or unconventional oil
2 became mass produced. Everybody wanted more oil.
3 We wanted to have more output. We wanted to grow
4 and grow and grow.

5 While we couldn't use the pipeline
6 systems and we didn't have the trucks available,
7 so we went to rail shipments, and all saw what
8 happened with rail shipments. We absolutely
9 inundated an infrastructure that worked for a
10 while, and then as the volume went up, because of
11 the insane success rate, you're going to actually
12 see these really small events more frequently.

13 I think it was 99.94 percent of all
14 barrels of oil by truck are delivered safely.
15 But how many people remember what happened at
16 Galena, West Virginia. These are really
17 statistically insignificant occurrences, but
18 massive events that burns an image that nobody in
19 any of the generations present will ever forget.
20 So it's always going to deter them away from
21 crude by rail.

22 So what's going to happen with the

1 natural gas going into the infrastructure that we
2 have, the roads, the pipelines, the vessels? How
3 is that going to impact our situation? What
4 sorts of unrealized emerging risks are there,
5 maybe not in five years, maybe not in ten years,
6 but down the line when we're actually peaking
7 with this natural gas consumption?

8 Simply we do not want to repeat what
9 happened with crude oil. So what I would like to
10 do while I am with PHMSA, and again these are
11 small incremental steps, is kind of go back and
12 identify some of the industry's and other
13 government agencies' interest and how they plan
14 to handle this, and actually have it not allow
15 not the squeaky wheel of all the problems going
16 on, but constantly moving forward and making
17 progress towards understanding what we can do and
18 what we should be doing.

19 For example, identifying technologies
20 for midstream safety. Liquefaction is a
21 wonderful way to transport massive amounts of
22 natural gas safely. There's a huge economic

1 burden that leaves a lot of individuals, as
2 companies go, out of the market. CNG is ideal
3 for most small production facilities, but it has
4 its hazards as well.

5 Liquefaction has its -- we've hammered
6 today; I don't really want to beat a dead horse
7 with another stick. But project massive
8 expansion ratios, violent rapid phase
9 transitions, those are all things to be concerned
10 about when you have a massive amount of natural
11 gas in a system.

12 Compressed natural gas, you have
13 really high pressures. Those are violent events
14 when they go. So what can you do to maybe
15 prevent those or what other technologies can you
16 use? Personally from my research, what I've been
17 doing the last year, clathrate hydrates seem to
18 be a wonderful resource for midstream.

19 There are companies in Japan,
20 Indonesia, Korea, China and Australia that are
21 looking at using this -- what is actually what
22 we're finding at the bottom of the ocean as a

1 man-made product at the surface, that you can
2 actually transport in a reefer car. Minus 20
3 degrees Celsius and one atmosphere.

4 You can ship solidified natural gas,
5 and I emphasize solidified because that was my
6 whole pitch last year with crude oil was
7 solidified crude oil, which has some still
8 development going on with our statements of work.

9 It's actually quite controversial as
10 well. To me it seems really sensible, but this
11 might be the crazy or this might be I'm the only
12 one in the know. I'll let you decide. There
13 have been numerous economic studies, let's see if
14 I've got it on the slide, yes, that show the
15 economic payoff between compressed natural gas,
16 clathrate hydrate gas shipments and liquefied
17 natural gas shipments.

18 Up to a certain distance, I apologize
19 for how small this is, I can't even read it, so
20 it's liquefied natural gas on the left, natural
21 gas hydrates in the middle and compressed natural
22 gas on the right, and when you set up the comp

1 spaces for the natural gas hydrates, what you can
2 see is that I believe this was taken at a
3 distance less than 4,000 nautical miles and
4 greater than a thousand.

5 So it's in the 1,000 to 4,000 nautical
6 miles, because they were looking at vessels in
7 this study, that the natural gas hydrate is the
8 most economical form of transportation. Now
9 where does that actually occur?

10 Well, there's an opportunity, if
11 anyone's been following some of the natural gas
12 production deals going on all around the world,
13 Japan wants to buy a lot of natural gas,
14 liquefied from Alaska, but Alaska is having
15 trouble trying to foot the bill. They're a
16 little upset by the cost of operation, depending
17 on which newspaper you read and who's spending it
18 which way.

19 That's right at 4,000 miles. So the
20 technology is there to have a cost-effective way
21 to safely ship massive amounts of natural gas. I
22 didn't mention it, but the actual energy density

1 storage for natural gas is the same as compressed
2 gas. So that's why you see here, you've got your
3 CNG vessel fleet, your natural gas vessel fleet
4 and your natural gas hydrate.

5 It takes the same amount of
6 infrastructure to transport in terms of volume
7 the natural gas hydrate, but it's low pressure
8 and it's compared to the liquefied natural gas
9 relatively high temperature. And so here you can
10 see kind of the payoff line for natural gas
11 hydrate.

12 Transportation distance versus the
13 total supply chain and the capital expenditures.
14 This technology fits right in the middle. Is
15 this something that agencies and industries need
16 to be paying attention to, maybe incentivize by
17 establishing the regulations that would inhibit
18 transportation, that are currently inhibiting
19 transportation.

20 Why isn't it that anyone's looking at
21 this? That's all I really want to know and ask
22 with this emerging risk idea. There's a lot of

1 wonderful science and technology out there that
2 just kind of seems to only ring with a few
3 industries, a few countries, and it could be that
4 it is highly specific to their needs.

5 But in either case, there is a large
6 amount of natural gas that's going to be coming
7 into our system, and it's something that we need
8 to keep paying attention. Not just how is the
9 LNG transported in the vessel; how can we handle
10 going from -- I think one report had it projected
11 from 42 vessels with LNG to 1,800 vessels with
12 LNG.

13 That's a Coast Guard problem. What do
14 we -- what can we do to facilitate that
15 understanding and that issue? If there is actual
16 talk about shipping liquefied natural gas or CNG
17 by rail up and down the East Coast, what can we
18 do to actually facilitate that or prevent any
19 incidents from occurring that we've seen in the
20 past with crude oil?

21 So in the interest of time, I think
22 there is one more person that has to -- or has

1 some comments to say. Leave the questions for
2 afterwards Veda? Or I'll take some questions
3 now.

4 MR. BHARATH: Yes, take a couple of
5 quick questions.

6 MR. BRUNER: Or tomorrow. I have a
7 stack of research about this. I have all kinds
8 of wonderful papers and graphs to talk about
9 more, and some of the things I've learned over
10 the last year.

11 MR. BHARATH: Any questions for
12 Britain?

13 PARTICIPANT: Tomorrow.

14 MR. BHARATH: Tomorrow.

15 MR. BRUNER: Tomorrow, okay.

16 PARTICIPANT: Yes, tomorrow.

17 MR. BRUNER: That's ominous.

18 MR. BHARATH: Tomorrow, when we're not
19 recorded. Thank you.

20 (Applause.)

21 MR. BHARATH: All right. Next up,
22 Troy Gardner from SMS. He's going to take us

1 home.

2 MR. GARDNER: All right. So I'm Troy
3 Gardner with SMS and SMS is one of PHMSA's
4 approved test laboratories, explosive test
5 laboratories. So the topics that we would like
6 for the R&D Forum to consider as potential
7 projects, we have four new areas for
8 consideration and one repeat area from last
9 year's discussion.

10 And so for the first item, there is a
11 U.S. flash composition test and HSL flash
12 composition test, and the HSL flash composition
13 test is one of the approved tests in the U.N.
14 Manual of Testing Criteria, and it's for
15 classification of flash powders.

16 The U.S. has a version of it, the U.S.
17 Flash Composition Test. The HSL one uses half of
18 a gram, 0.5 grams of the flash powder. The U.S.
19 version uses 25 grams. So one is used in the
20 time pressure apparatus; the HSL version is in
21 the time pressure apparatus that we've heard
22 about today. The U.S. version is in a tube setup

1 and takes a lot greater quantity and so there's
2 higher exposure to the test personnel.

3 But some ideas for improvement on that
4 is currently, you measure -- the criteria is when
5 you're looking at that witness plate, as it's
6 bowed, you take a measurement at the greatest, at
7 the peak of that indentation. So an idea was
8 floated out of instead of just taking one point,
9 one discrete point, why not have more of a model,
10 something like a three model photo or something
11 like that, that helps people understand what
12 acceptable -- what a pass versus a fail criteria
13 would be.

14 The Conan test, also in the U.N.
15 manual, uses this same type of an approach. It
16 shows diagrams, it shows examples of what
17 acceptable pass and fail results are. So that
18 was one idea there. The other idea was to change
19 the witness plate. If we have a different type
20 of witness plate or different thickness, maybe
21 we'll have a different response.

22 Instead of -- instead of just it

1 bowing out the specific amount, maybe we'll reach
2 a point at where we're perforating it through it
3 so it will become more clear as to what the
4 results are. So that's another additional idea
5 for that one. Then the other, the other item is
6 for both the HSL and the U.S. flash composition
7 tests.

8 We've been talking about black powder
9 today, black powder substitutes, equivalents,
10 substitutes for black powder. Black powder in
11 the HSL and in the U.S. Flash Composition Tests
12 failed, and so -- but black powder is not
13 considered a flash powder. So we're failing the
14 flash powder test, but it's not a flash powder.

15 So the question comes up are we really
16 measuring the correct things in this -- in this
17 HSL and in the U.S. Flash Composition tests? So
18 that's an idea for looking at.

19 The next one is for the 1.4S transport
20 by air for aircraft. There's -- currently we run
21 a U.N. Series 6D unconfined package test, and
22 that unconfined package test is currently

1 restricted to eight U.N. numbers for the United
2 Nations. It's only applicable to eight different
3 U.N. numbers.

4 Now Canada was the -- they started
5 using the unconfined package test, and they
6 currently require it for all, all parts -- all
7 1.4S classifications that are going by aircraft.
8 It's a required test for them.

9 So that was the next question, is does
10 this -- these eight U.N. numbers that we
11 currently restrict this to and that the United
12 Nations restricts it to, does this need to be
13 expanded, just like Canada has expanded theirs?

14 The next item is a primed cambric
15 replacement consideration for the U.N. Series 1
16 or 2 C-1, which is the time pressure test, which
17 we've been discussing. The time pressure test
18 calls out primed cambric.

19 In the 2015 Annual Explosives Testing
20 Users Group, in that meeting Canada came to that
21 meeting and had a presentation. I've provided
22 that over to the R&D Forum and it will be made

1 available, a PDF of that presentation. They went
2 through and described what primed cambric is,
3 what the source was.

4 They showed some photographic examples
5 of it, and then had some suggestions of
6 alternative things to possibly consider in the
7 future, since primed cambric is not readily
8 available.

9 One final item, one final new
10 consideration is in the new U.N. Manual of
11 Testing Criteria, they've added in a new section.
12 It's part five, and part five of the new U.N.
13 Manual of Testing Criteria deals with the GHS.
14 It's the hazards classification of material in
15 use, versus just a hazard classification for
16 transport.

17 Currently, the only one in part five
18 is a fire test for desensitized explosives, and
19 the question we want to flow out there is are
20 there other things that need to start being
21 considered, new additional tests that need to be
22 considered on the GHS side for products that are

1 in use, such as moisture studies over time.

2 As things are being used, exposure to
3 moisture. Aging studies, vibration studies, et
4 cetera, things like that that should be
5 incorporated for various explosive products.

6 The final one there, the fireworks
7 noise levels, that was talked about last year and
8 it was just mentioned that that's still on the
9 radar, that that's still something to consider
10 getting that instrumented and also to limit the
11 variability, take out the parameters such as
12 weather, distance, to remove those variables and
13 then to be able to use sensors instead of
14 operators for distinguishing noise levels
15 associated with those tests.

16 The rest are the 2015 ideas. So those
17 are still valid. So and I'm sure some of these
18 Andrea mentioned about -- encouraged about having
19 a minimum quantity of risk and approval for small
20 quantities of explosives. So we'll take that
21 offline for tomorrow as part of our discussion.

22 MR. BHARATH: Any questions for Troy?

1 (No response.)

2 MR. BHARATH: Everybody wants to go
3 home. All right, I appreciate Troy. Thank you.

4 (Applause.)

5 MR. BHARATH: Anybody else who wants
6 to mention anything? This is the last platform
7 for the day to mention anything, particularly
8 related to the Emerging Risks? Going once. All
9 right. Well, I want to just thank all the
10 speakers and all the attendees, particularly the
11 speakers from near and far and the technical
12 media center for hosting the meeting.

13 I know we had problems with the
14 videos, but if you were to leave it up to me, it
15 would have been worse. So that's good. Rick.

16 MR. BOYLE: Okay, that's good.

17 MR. BHARATH: All right.

18 MR. BOYLE: We'll start at nine
19 o'clock tomorrow morning. We'll be in table
20 setup. I'll put tents on so you know where to
21 sit. Thank you for your patience today. It
22 hasn't been perfect. Some of us like maybe

1 talked too long, but have a great evening and
2 we'll see you tomorrow morning.

3 MR. BHARATH: Tomorrow, nine o'clock.

4 (Whereupon, the above-entitled matter
5 went off the record at 4:56 p.m.)
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