

* * * * *

Stakeholders' Meeting on
Refuge Alternatives for
Underground Coal Mines
at
National Mine Health & Safety Academy
Beaver, West Virginia

Taken
on
October 19, 2015

* * * * *

BAY AREA REPORTING, INC.
BRET M. MATICS, C.C.R.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

APPEARANCES:

MODERATOR:

Sheila McConnell

PANEL MEMBERS:

Joseph A. Main, Assistant Secretary
Rodney Adamson
Wesley Shumaker
Steve Turow

SPEAKERS:

Randall Harris
Braden Lusk
Todd Moore
Dennis O'Dell
Mike Parris
Kyle Perry

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

2 MS. McCONNELL: We'll go ahead and begin
3 this public meeting.

4 My name is Sheila McConnell. I am the
5 acting director of the Office of Standards, Regulations,
6 and Variances at the Mine Safety and Health
7 Administration.

8 I will be the moderator for this
9 stakeholder meeting on refuge alternatives for
10 underground mines, which is part of the ongoing record
11 for MSHA's request for information on this important
12 subject.

13 On behalf of Assistant Secretary of Labor
14 for MSHA, Joseph A. Main, I am pleased to welcome you
15 here today and thank you for your attendance and
16 participation.

17 First, I'd like to introduce our MSHA
18 panel. We have Rodney Adamson from MSHA's Coal Mine
19 Safety and Health, Wes Shumaker from Approval and
20 Certification Center, Technical Support, Steve Turow
21 from our Office of Solicitors.

22 We are also pleased to welcome our
23 colleagues from the National Institute for Occupational
24 Safety and Health, NIOSH. We thank NIOSH and its

1 researchers for their ongoing efforts to provide
2 research into the technology, engineering, and
3 application of refuge alternatives.

4 This is the only meeting of its kind, in
5 part because MSHA has already received comments through
6 the publication of the Agency's request for information
7 in the Federal Register, which held the comment period
8 open from August 8th, 2013 to April 2nd, 2015,
9 approximately 20 months.

10 The comments received today will be
11 collected as part of the record, and MSHA will hold the
12 comment period open until November 16th, 2015 to allow
13 participants to submit additional information,
14 comments, and materials. You can review the RFI
15 comments on the Agency's website on MSHA.gov or on
16 regulations.gov.

17 The refuge alternative rule became
18 effective on March 2nd, 2009. Over the past six years,
19 stakeholders have gained experience and research that
20 has led to technological advancements and innovations.
21 There are several types of MSHA-approved refuge
22 alternatives now in use.

23 To benefit from stakeholders' experience
24 and research, MSHA published a request for information

1 in the Federal Register asking for data, comments, and
2 information on options that may present even more
3 effective solutions for miners' survival during
4 underground coal mine emergencies than the projections
5 provided by the existing refuge alternative rule.

6 First, I want to underscore an important
7 mine emergency principle, embodied by both MSHA and the
8 mining community. It is a longstanding principle that,
9 in the event of a mine emergency underground, the first
10 line of defense is for the miner to try to escape.

11 Only if escape is impossible should the
12 refuge alternative be used. If that situation does
13 occur, a refuge alternative must provide a protected,
14 secure space with an isolated atmosphere that creates a
15 life-sustaining environment to protect miners until
16 rescue or until they can escape.

17 Today, we are asking coal mine operators,
18 miners, equipment manufacturers, academia and the
19 members of the public to provide us information on two
20 critical issues on refuge alternatives.

21 First, MSHA is seeking solutions for
22 providing a clean air supply and sufficient air
23 pressure into a built-in-place shelter when a borehole
24 directly into the refuge is unavailable. We are

1 seeking solutions for piping air safely through a mine
2 to a built-in-place shelter.

3 If air is piped through a mine over
4 several miles, protection of that piping from routine
5 mining activities can become an impediment to use for a
6 built-in-place shelter.

7 Second, miners' ability to communicate
8 with each other is critical during mine emergencies.
9 Miners must remove the mouthpiece of a self-contained
10 self-rescue device to speak or remove the full-face
11 respirator mask of a self-contained breathing apparatus
12 to clearly communicate.

13 These actions expose miners to deadly gas
14 in the mine and atmosphere. We are seeking solutions
15 that would allow two-way communication between miners
16 wearing breathing apparatus.

17 In addition, in the notice of this
18 meeting, MSHA also requested information on impediments
19 and solutions related to the use of built-in-place
20 shelters, the advantages and disadvantages of using
21 self-contained breathing apparatus with refill stations
22 as an escape strategy, and the scope and status of new
23 technology for recent research related to the
24 installation and use of built-in-place refuge.

1 In its report "Facilitating the Use of
2 Built-In-Place Refuge Alternatives in Mines," NIOSH made
3 recommendations on the use of built-in-place shelters
4 as a type of refuge with a superior environment when
5 compared to tent and steel fabricated structures.

6 NIOSH's recommendations included allowing
7 built-in-place shelters meeting certain conditions to
8 be placed farther away from the working face than under
9 current regulations which require a refuge alternative
10 within one thousand feet of the face.

11 MSHA encourages all stakeholders to
12 review NIOSH's report and recommendations and to
13 comment on the advantages and disadvantages of NIOSH's
14 recommended approach,

15 the feasibility of installing built-in-
16 place shelters in different mine conditions and the use
17 of surface-supplied air and other concerns with built-
18 in-place shelters.

19 MSHA also requests discussion on the
20 advantages and disadvantages of using a self-contained
21 breathing apparatus with refill stations, as compared
22 to a self-contained self-rescue device with caches in
23 escapeways and how it will improve escape plans using
24 enhanced respirator technologies.

1 Finally, on the topic of new technology
2 and research, MSHA requests stakeholders discuss and
3 describe new and improved technology for built-in-place
4 refuge designs, including the impact of these designs on
5 the economic and technological feasibility of using
6 built-in-place shelters.

7 This stakeholder meeting will be
8 conducted in an informal manner. The panel may ask
9 questions of the participants, and the participants may
10 ask questions of the panel. MSHA is making a
11 transcript of this stakeholder meeting and will post it
12 on the Agency's website within two weeks.

13 If you wish to present written
14 statements, questions, or information today, please
15 clearly identify your material and give it to the court
16 reporter. You may also submit comments following the
17 hearing by any of the methods identified in the Addresses
18 section in the stakeholder meeting notice.

19 Those of you that have notified MSHA in
20 advance of your intent to speak will make your
21 presentations first, followed by those who signed up to
22 speak today. After all of the scheduled speakers have
23 finished, others can request to speak.

24 If you have a hard copy or an electronic

1 version of your presentation, we would appreciate that
2 you give a copy of that to the court reporter as well.
3 I hope everyone has signed the attendance sheet.

4 Before we begin our discussion today and
5 hear from you, I would like to introduce Joseph A.
6 Main, Assistant Secretary of Labor for Mine Safety and
7 Health.

8 Mr. Main?

9 MR. MAIN: Thanks, Sheila, and thanks for
10 the work that you folks did to put today's session
11 together. We have folks with us from - as Sheila
12 mentioned - from Tech Support, SOL, and folks that's
13 been working on the refuge alternative issue for quite
14 some time.

15 So why are we holding this public meeting
16 today? If you look at the one point that Sheila had
17 raised, is that we have six years' experience now with
18 the refuge alternative systems that went into effect
19 post-Sago, and we've learned a lot from those, as we
20 have deployment in the mines.

21 The good news is that, you know, we
22 really haven't had one they had to use for survival,
23 although there's a few cases that we wish that we have,
24 in terms of the impact of the mining accidents.

1 If you look historically at mine rescue
2 work, it tells us that in a number of these
3 circumstances when we have a mine emergency, we don't
4 get there really quick, and I just used in the
5 benchmarks UBB from Monday to Saturday, Jim Walters,
6 six weeks to locate the last miner.

7 Wilberg was one of the longest of modern
8 history, took us more than a year to locate - or right
9 at one year - to locate the last victim.

10 So there's reasons why we encourage a
11 system to be in place that has the first action of the
12 miners to escape the section. A second action is for
13 the miners to escape.

14 The third action is for the miner to
15 escape when all else fails, look at the alternatives
16 that we have, because in some of these, we're not quick
17 to rescue and that's for all the obvious reasons.

18 We spent a lot of money and time over the
19 last four to five years to go over all our mine
20 emergency response capabilities, and we have probably
21 the best we've ever had in mine emergency history.

22 We've developed the technologies to have
23 direct communication between the advancing team and the
24 command center, and Todd Moore, who is here, we had a

1 chance to spend about a week this spring up at the
2 Harvey Complex to work with all of the CONSOL teams
3 and to test out the equipment and to look at the bugs
4 we have and to build a better mousetrap.

5 You know, that's going to be a major
6 change in how we do mine rescuing for the first time
7 and to have actual direct communications between the
8 command center and rescue teams. That's going to give
9 us the opportunity to do things quicker and safer.

10 We've also redesigned our mapping
11 process, and so that the waiting for the handheld map
12 to come out, maybe hours later, and just to verify,
13 "Oh, that's not what we thought."

14 We're gonna do mapping at the command
15 center and sending it back to the fresh air face, which
16 is gonna speed up the process of knowing what we know,
17 so to speak.

18 But, you know, with all of those and all
19 of the other improvements, we still have this dilemma
20 about how we can get the miner out of the mine as quick
21 as we can and to set up a strategy to give the miners
22 every opportunity for survival as they do that, and
23 that's the reason we have the two issues that's front
24 and center.

1 We looked at the information that came
2 back through the request for information that we put
3 out, and we extended that four times since we've began
4 in an effort to just keep getting more information in,
5 but I think to fix the problem of that in a refuge
6 area, we've got to figure out an engineering solution
7 to how we manage supplying air to those facilities for
8 both breathable air and for both pressurizing a refuge
9 area to keep the contaminants out, and that's one of
10 the reasons we'd really like to hear from folks about
11 how we can do that.

12 And if you look at some of the mining
13 set-ups we have today and think about some of these
14 super-longwall gate roads that are 20,000 feet long and
15 what you think about decisions that miners have to make
16 to run back to that face to get out of here, "Where do
17 I get out?"

18 And building some systems like I saw at
19 the Billiton Mine out in New Mexico where they went to
20 a safe haven area as part of their concept,
21 essentially, I think we really need to take a look at
22 how can we design a system that lets miners have an
23 advantage as to get out of the mine to have a place to
24 go to, as opposed to, you know, heading back in to get

1 out, which, you know, there has been folks that have
2 questioned that, a lot of people, and I think
3 rightfully so.

4 So we're looking for all of the input we
5 can get on how we can -- to have, in the future, some
6 refuge alternative concepts that would include safe
7 havens, and I asked folks quite a bit, "Do you like the
8 US model or the Chilean model," and that gets to this
9 concept of having a wider area to be able to manage.

10 We've never faced a situation where you
11 may have an event where miners are injured or in masks
12 and locked into a refuge alternative and what happens
13 psychologically as people spend time there, laying
14 beside each other with whatever, you know, and how long
15 do they stay there before we make a decision after they
16 made a decision to go, to stay there.

17 And there's a lot of things that I think
18 we have to think about, and we have an opportunity to
19 take a pause here and figure out what is it we could do
20 to build a better mousetrap for escape and
21 opportunities and safe haven opportunities and refuge
22 opportunities for miners, and how does that work within
23 the confines of the systems we already have in place
24 that a lot of mines are gonna be running probably for

1 quite some time.

2 We have a deadline coming up on December
3 of 2018 when all of these refuge alternatives have to
4 be certified.

5 Our folks are working on getting guidance
6 together - and that will be coming out in the next few
7 months - to make sure that we have everybody on board
8 and understanding what that certification requirement
9 is gonna be.

10 And it's my hope that we don't do what we
11 did last time, 'cause last time the certification, we
12 were running to the wire to get ourselves there, but to
13 have a plan of action that gets those certifications in
14 place, whatever they may be, in time to reach those.

15 But the primary purpose today is really
16 to talk about the engineering things we need to develop
17 and understand to get us to a better refuge alternative
18 system for the miners.

19 The second issue, this is the one I've
20 been on a number of mine emergencies in my life, and I
21 could tell you, I have this real clear, that with all
22 that we're doing, we're not giving our miners the kind
23 of opportunity that we need to give.

24 About two weeks ago, a week ago, whatever

1 it was, I was at the Cumberland Mine in Pennsylvania,
2 and we had the opportunity to go through the smoke
3 trailer, which many folks who have not been through smoke
4 won't understand what that means, and I had the chief
5 of staff for the Department of Labor with us and the
6 lady who just became our new deputy with MSHA, and
7 I had to tell them about what we was holding this
8 meeting for.

9 So when we get the opportunity to go into
10 the smoke trailer, and we're tethered together, and the
11 chief of staff, or Secretary Perez was, like, two or
12 three feet behind me, and the person right ahead of me
13 was the one who was trying to, like, tell us, 'cause we
14 had a little more twists and turns, and in the smoke,
15 you can't see.

16 You know, you see clear at the fog light,
17 and when everybody come out of there, they understood
18 exactly what I was talking about. The fellow that was
19 ahead of me, two back, goes, "What was he saying? What
20 was" --

21 I said, "Yeah, just picture yourself in a
22 mine, you've got a mile to go, and you're caught in
23 smoke, and what are you gonna do with that mouthpiece?"

24 I mean, it's -- so I would like to focus

1 our attention on trying to figure out how we can build
2 communications into the mouthpiece, into the circuit,
3 into the system, where miners can actually communicate
4 without breaking that closed circuit breathing system
5 that we now have.

6 So those are two things I think are
7 really critical as we move forward. We really would
8 like to get some feedback from folks on how do we fix
9 those and what is the real opportunity here, because I
10 think just putting money into a system to say that we
11 have a system that meets a certain standard is not good
12 enough.

13 I think we have to take a step back, what
14 do the miners really need in this country and what do
15 we really need to do to get those systems in place so
16 they really work for miners if they have to have them.

17 That's the challenge, that's what we're
18 trying to get back into us so that we can make some
19 good decisions about how we move forward.

20 And with that, Sheila, I will turn the
21 pulpit back over to you.

22 But we really need input from the public,
23 from the folks who are at this hearing, folks in the
24 mining community, and the manufacturers to help us find

1 some answers. Thank you.

2 MS. MCCONNELL: Thank you, Mr. Main. We
3 have a few speakers who have signed up. Our first
4 speaker today is Mike Parris.

5 Mr. Parris, if you will say your name to
6 the court reporter and spell it.

7 MR. PARRIS: Mike Parris, P-A-R-R-I-S.

8 I'd like to thank MSHA for reopening the
9 record and holding today's meeting.

10 While I hope to submit comments that
11 address particularly the questions raised by MSHA
12 today, I want to make some general comments, and I've
13 worked with some of the people here in the room in an
14 official capacity and perhaps as an adversarial
15 capacity.

16 And the comments I'm making today, I'm
17 making in an individual capacity, in that I don't
18 presume to be speaking for the operator to whom I work
19 today, although I hope in working with my employer,
20 that we may provide comments on the record. The
21 comments I make today are my own as an individual.

22 First, I recommend that MSHA extend the
23 December 31st, 2018 deadline for parts and structure
24 approvals for operators who are willing to partner with

1 the Agency and work on a practical game plan in their
2 mines to address the integration of these new emerging
3 technologies in their emergency response plans that is
4 related to the December 31st, 2018 deadline.

5 This consideration is provided in that
6 manner. Those operators may continue to use their
7 currently deployed refuge alternatives and not be
8 forced into adopting a compliant solution far enough in
9 advance so that everything is in place on that
10 deadline.

11 I think that the effect will be -- well,
12 one of the things that I personally don't want to see
13 is any of the technologies that are discussed in the
14 request for information fail to be adopted because of
15 problems in the approval process that lead to a delayed
16 adoption by operators.

17 That I believe if we work together in a
18 real -- in a meaningful way as operators with the
19 Agency, with NIOSH, and with manufacturers, we can work
20 out how these systems actually will apply and work
21 together in time so that they could be deployed
22 widespread in our mines.

23 And on the other hand, operators who
24 choose to continue to invest exclusively in portable

1 refuge alternatives will not necessarily need to be
2 really involved in the December 31st, 2018 approval
3 deadline.

4 My expectation is that there will be any
5 number of options available to those operators, where
6 they will be able to achieve or comply to some solution
7 easily by December the 31st, 2018. So I do not believe
8 that the Agency need unilaterally waive the upcoming
9 deadline.

10 I believe that there can be good reasons
11 to do so in specific instances that are advantageous to
12 everybody, but I would not want to encourage a system
13 that allowed dilatory action on the part of some
14 operators to become even more delayed.

15 Second, even though I share NIOSH's hope
16 for the widespread adoption of built-in-place refuge
17 alternatives, we need to closely examine their proposal
18 that built-in-place refuge alternatives be allotted
19 distances as great as 5,000 feet from the face.

20 As part of NIOSH's early work on refuge
21 alternatives, a NIOSH contractor performed an extensive
22 study of several mine disasters and evaluated whether a
23 refuge alternative of 1,000 feet, 2,000 feet, or
24 further outby would have facilitated survival.

1 Notably, the NIOSH contractor
2 concluded that a refuge alternative at either 1,000 or
3 2,000 feet from the face would've benefited the miners
4 at Sago, and they concluded that an outby refuge may
5 not have done so.

6 The location of the built-in-place refuge
7 alternative should be supported by a careful review of
8 a mine's emergency response plan. However, I believe
9 that these and other potential issues can be addressed
10 fairly simply.

11 MSHA should allow mines that deploy
12 built-in-place refuge alternatives to continue to
13 deploy their existing portable refuge alternatives as
14 disabled miner emergency stations within a thousand
15 feet of the face, provided that they can accommodate
16 five miners under the part 7 structural
17 requirements.

18 History has shown, time and again, on the
19 devotion that miners have for each other and their
20 heroism, a disabled miner may not be physically capable
21 of traveling 5,000 feet to a built-in-place refuge
22 alternative.

23 If operators are allowed to continue
24 using their existing portable refuge alternatives as

1 disabled miner emergency stations, we can achieve the
2 greatest degree of safety for all of our miners while
3 also working to improve escape.

4 I really believe that it is vital that we
5 contemplate refuge alternatives within the context of
6 the miners who are most likely to require refuge, and
7 those are the miners who are least likely to be able to
8 escape, disabled miners.

9 So we need to work together to make sure
10 that the emergency response plans that we've put
11 together that integrate the current technology and this
12 emerging technology appropriately factor in disabled
13 miners and also to make sure that we don't end up with
14 a solution that wouldn't have been deployed at Sago,
15 and that, I think, is something that we need to
16 consider closely.

17 Thank you.

18 MS. MCCONNELL: Thank you, Mr. Parris. I
19 have one question, and then I'll turn it to the panel
20 to see if they have any others.

21 As you began, you recommended extending
22 the 2018 deadline to integrate some -- and consider new
23 technologies. Could you discuss some of the new
24 technologies you have seen that MSHA should consider?

1 MR. PARRIS: Oh, definitely. I think
2 the --

3 MS. MCCONNELL: Could you provide some
4 examples?

5 MR. PARRIS: Sure. The refillable self-
6 rescuers and the self-rescuer technology that uses
7 liquid air and have the full-face mask, these are very
8 potentially life-saving technologies, that if they are
9 developed, approved, marketed, and deployed should
10 eliminate the need for miners to need to go into the
11 refuge alternative.

12 The thing that we want to work toward is,
13 we don't want to end up eliminating those technologies
14 because of their relative point in development.

15 Some of these technologies are barely off
16 the drawing board into the prototype stage, much less
17 reaching the point where they are mature enough to be
18 submitted to the Agency for various approvals, and then
19 once -- and then once those approvals are in line, are
20 mature enough to be mass-produced and marketed to
21 operate.

22 So rather than -- well, in order to
23 encourage operators to explore these technologies,
24 rather than simply go and get a portable refuge

1 alternative design that is very mature and likely to
2 receive its approval years in advance of the deadline.

3 I mean, that's the easiest way to achieve
4 compliance, is going to be to do exactly that. There
5 has to be some incentive for operators to go that extra
6 mile with you, and I think that that's one way that we
7 could do it.

8 MS. MCCONNELL: Okay, thank you.

9 Mr. Main, do you have --

10 MR. MAIN: That was one of my questions.
11 What are the options? What are all the alternatives
12 that we should be looking at, in terms of the overall
13 escape strategy and, you know, how would we work at it.

14 I think what I hear you saying is that
15 the fillable air with the face mask that has a
16 communication system in it helps facilitate escape,
17 there's a lesser need for refuge alternatives,
18 something like that.

19 MR. PARRIS: Oh, yes. Exactly. Also,
20 there -- the means for providing breathable air to
21 built-in-place refuge alternatives are interesting, as
22 far as the borehole delivery plans and the potential
23 use of cryogenic air supply systems.

24 These are systems that -- well,

1 especially the cryogenic air supply systems that were
2 developed for portable refuge alternatives, I think
3 actually have a superior possibility for deployment in
4 built-in-place refuge alternatives.

5 But these technologies may not be
6 developed sufficiently to be deployed prior to December
7 31st, 2018, and we need to be in a position to actually
8 put together a plan that contemplates their use in
9 regard to the self-rescuers, the breathable air
10 supplies, and everything else.

11 The -- again, for example, the compressed
12 air systems that are contemplated, the questions about
13 running compressed air lines through mines to either
14 portable refuge alternatives or built-in-place refuge
15 alternatives eventually will mature to a point where
16 what we're contemplating is a breathable air system
17 that has to be integrated into a stopping for a
18 built-in-place refuge.

19 So that there will be, eventually, where
20 not only would the MSHA district manager approving
21 stopping walls, but also with Tech Support in approving
22 the way that delivery system is plumbed into the --
23 through the wall into the built-in-place refuge
24 alternative.

1 And this -- these things we've seen take
2 time, and it's an easier trip to take. You're taking
3 an operator that is willing to partner with you, rather
4 than allow time to progress to the point where it
5 becomes an adversarial relationship.

6 MR. MAIN: And, again, I think on that
7 point as well, I mean, we do have the options now, the
8 current standards, for built-in-place shelters, and we
9 are encouraging folks to help the miners inside on that
10 in a way that helps develop some kind of engineering
11 style that can be innovated.

12 Do you know what I'm saying?

13 MR. PARRIS: No, I do.

14 MR. MAIN: You know, that doesn't, you
15 know, require a lot of extra assessments.

16 MR. PARRIS: No, I agree.

17 I think that -- what's difficult for me
18 to anticipate from the Agency is how the Agency will
19 contend with the part 7 structural approvals
20 for the existing and contemplated January 1st, 2019
21 portable designs, while at the same time providing the
22 support necessary to develop the regulatory framework
23 to have these other technologies introduced.

24 I don't know how you guys are going to do

1 that without help from operators and also from NIOSH.
2 I think that we're going to have to work together.

3 MR. MAIN: And I think that's part of
4 what this whole exercise is about, to learn and figure
5 out what options are out there.

6 MS. MCCONNELL: Exactly.

7 Wes, do you have anything?

8 MR. SHUMAKER: No.

9 MS. MCCONNELL: Anyone?

10 Mr. Parris, thank you very much for your
11 testimony today.

12 MR. PARRIS: Thank you.

13 MS. MCCONNELL: We appreciate you coming
14 forward.

15 I'd like to introduce our next speaker,
16 Kyle Perry.

17 MR. PERRY: Good afternoon.

18 MS. MCCONNELL: Mr. Perry, could you
19 state your name and spell it for the court reporter and
20 your organization.

21 MR. PERRY: Sure. My name is Kyle Perry,
22 K-Y-L-E, P-E-R-R-Y.

23 I'm an assistant professor at the
24 University of Kentucky in mining engineering, and

1 today, I'm going to kind of talk hopefully about the
2 academic side and the research side, as far as the
3 structural components for these refuge alternative
4 built-in-place.

5 So about four years ago, we started
6 looking at how can we come up with a structural wall to
7 aid in built-in-place.

8 Kentucky funded myself and Doctor Lusk on
9 a research project looking at polycarbonate safe haven
10 walls, and the idea behind that was putting a wall in
11 -- across that somewhere, and the polycarbonate, we've
12 dealt with a lot for window systems, for glass
13 resistance, for bunkers and things like that.

14 So we thought this is a newer technology,
15 I guess, than brick and mortar, and it's even more so.
16 The advantages of polycarbonate is that it's clear.

17 So, Mr. Main, you were talking about
18 getting those guys out as quick as we can and the mine
19 rescue teams going in. Having it clear, they'd be able
20 to go in, look into this room, if nobody's in there,
21 they can keep moving.

22 They don't have to waste their time
23 opening a door that may have possibly been damaged or
24 not functioning anymore.

1 So we came up with a polycarbonate wall
2 system that worked out pretty well, and we installed it
3 in a mine, and it gained the attention of an operator
4 who already has components in place and approved for
5 breathable air systems.

6 It caught their attention, they wanted to
7 further the development of this and come up with what
8 we've got now, which is an expandable polycarbonate
9 wall, and it can be made out of polycarbonate or steel,
10 we can interchange sections, with either, basically, a
11 windowpane or a steel plate.

12 It can range from 41 inches tall up to --
13 43 inches tall up to 71 inches tall, and, currently,
14 we've got the application in to MSHA, we will receive
15 the first comments back and just put in our revisions.

16 A couple things we saw, the Safety Factor
17 2 was applied to the design load of 15 PSI.

18 One question is why, with a safety factor
19 of 2, is there a reason I know the 15 PSI was the 0-15
20 PSI over 100 milliseconds and back down from the --
21 from the data recorded, I think and I believe, but is
22 -- why -- we don't understand kind of the arbitrary,
23 "Why Safety Factor 2," whenever we don't know the last
24 -- there's only gonna be a 15 PSI or not.

1 A couple things. The door itself within
2 this wall is a circular door also made out of
3 polycarbonate. All -- basically, instead of having a
4 steel panel on there, you can put on the door. We just
5 bolt it to a frame. It's basically a steel frame with
6 interchangeable panels.

7 The door - we can also bolt in - is a
8 30-inch-diameter door sealed with -- there's a grouted
9 area in the -- in the plate or backing, and that door
10 has a rubber sealing on it enclosed with a simple
11 latch.

12 With that, it may sound weak. We've
13 tested that actually in an explosive chamber up beyond
14 30 PSI dynamic pressure, which I think's more than
15 enough to sustain 15 or 30 PSI.

16 One of the comments we got back was the
17 anchorage into the roof and floor and the coal ribs
18 themselves, and as a practicing professional engineer,
19 some of the comments that are made may not make
20 engineering sense to the designers, but it seems like
21 sometimes we overkill these things a little bit, we're
22 putting a safety factor of two on it, and we're putting
23 in supports that aren't gonna make a difference.

24 And I just want to -- I know Mr. Main

1 said something about you guys are gonna be finding
2 guidance here pretty soon in a couple months, the
3 process of getting these things approved, and I just
4 want to make sure you guys are thorough and have a
5 pretty good list of what we're gonna need to do to get
6 these things approved, so I think that's it.

7 So thank you very much.

8 MS. MCCONNELL: Well, thank you.

9 MR. PERRY: Any questions for me, guys?

10 MS. MCCONNELL: Do you have anything
11 else?

12 MR. SHUMAKER: The review of your
13 structure, now, that procedure really isn't part of the
14 2018 structural requirement --

15 MR. PERRY: Okay.

16 MR. SHUMAKER: -- because that is a 15
17 PSI stopping that is really approved through the
18 district --

19 MR. PERRY: Uh-huh.

20 MR. SHUMAKER: -- by the district
21 manager. However, that's normally sent to our
22 Pittsburgh Technology Center.

23 MR. PERRY: Right.

24 MR. SHUMAKER: Again, that's where our

1 structural guys are --

2 MR. PERRY: Uh-huh.

3 MR. SHUMAKER: -- and that's who's doing
4 the review of your design right now.

5 MR. PERRY: Uh-huh.

6 MR. SHUMAKER: And I know you have some
7 specific questions on your design, and I might have to
8 talk to the engineer doing the review to see exactly.

9 MR. PERRY: Okay.

10 MR. SHUMAKER: I'm just -- I'm not
11 familiar enough with --

12 MR. PERRY: Okay.

13 MR. SHUMAKER: -- your design package to
14 be able to answer those questions right now.

15 MR. PERRY: Okay, no problem.

16 MS. MCCONNELL: I just have just a couple
17 of questions. I'm vaguely familiar with your design,
18 and not specifics, but it seems like this is a portable
19 type of wall; is that correct?

20 MR. PERRY: Basically, we designed it to
21 be expandable for certain designs up to about 12
22 inches.

23 So if a mine says, "Oh, we're mining 48
24 inches," you know it's not gonna be 48 everywhere. So

1 we can design one to be the average of 48 and can be
2 installed, expanded, or shrunk down.

3 But, yes, we can put it in, we can
4 uninstall it, move it, and reinstall it --

5 MS. MCCONNELL: So it can move --

6 MR. PERRY: -- all in under six hours.

7 MS. MCCONNELL: Okay. So it can move as
8 the face advances.

9 MR. PERRY: If you want to, yeah.

10 MS. MCCONNELL: Okay. What would be the
11 air supply going into the --

12 MR. PERRY: Breathable air system from
13 the surface.

14 MS. MCCONNELL: And so this would be,
15 like, a -- like a borehole that you would --

16 MR. PERRY: Either a borehole or piped-in
17 air from the surface throughout the mine, yes.

18 MS. MCCONNELL: And thinking about some
19 of the other NIOSH criteria, in terms of positive
20 pressure, that's also part of it as well.

21 MR. PERRY: Yeah.

22 MS. MCCONNELL: Okay.

23 MR. MAIN: In terms of the pipeable air
24 that was on that -- the distance that you've looked at

1 that you've been able to engineer all of the air in,
2 the -- have you handled condensation and those kind of
3 things?

4 MR. PERRY: I think the next presenter
5 has a -- is gonna be talking a whole lot about the --
6 the distances and those kind of issues. I'm not
7 familiar on the air side of it; I'm more on the
8 structural part of it.

9 MR. MAIN: Yeah, and I think it would be
10 helpful, too, with the issues you raised about the
11 anchoring, where there's maybe some requirements that's
12 being added that doesn't have any significant thing to
13 do with --

14 MR. PERRY: With structural integrity of
15 the wall.

16 MR. MAIN: And it would be interesting to
17 see what those are --

18 MR. PERRY: Sure.

19 MR. MAIN: -- so we can take a look at
20 them.

21 MR. PERRY: And I've got -- I can provide
22 -- I'm not sure about the online submittal for written
23 comments, if you can put in pictures or anything like
24 that.

1 MS. MCCONNELL: Yes, you can put -- you
2 can put videos --

3 MR. PERRY: I'll be happy to go back and
4 provide a lot of those things in there and talk about
5 the anchorage as well.

6 MR. MAIN: That would be good.

7 MR. PERRY: Okay.

8 MS. MCCONNELL: Thank you very much.

9 MR. PERRY: Okay. Thank you.

10 MS. MCCONNELL: Mr. Braden Lusk?

11 Please state your name and spell it for
12 the court reporter and your --

13 MR. LUSK: Braden Lusk.

14 MS. MCCONNELL: -- and your organization.

15 MR. LUSK: Okay. Braden Lusk,
16 B-R-A-D-E-N, L-U-S-K, and I'm also with the University
17 of Kentucky. I'm a professor of mining engineering.

18 So what I would like to address with you
19 guys today is some research that we've been performing
20 on the protection of compressed air lines for
21 breathable air into built-in-place refuge alternatives.

22 I think one of the things that has been
23 mentioned a few times today is with regards to the 2018
24 approval for refuge alternatives and the deadline

1 that's looming on that.

2 I think the guidelines that you guys
3 would produce are gonna be very, very important for
4 successful implementation of engineering solutions.

5 One of the issues that you brought up
6 about the differences in approval processes between 15
7 PSI walls and refuge alternative boxes is one of the
8 major sticking points for a lot of these engineering
9 solutions, in my opinion.

10 I think if you look at the level of
11 investment that's going to be required to come up with
12 an engineering solution for a built-in-place chamber,
13 you really need to have some guidance as to how those
14 approval processes are different and how each one of
15 those needs to be addressed, whether you're looking at
16 completing a plan with refuge boxes or if you're going
17 with built-in-place refuge alternatives.

18 That's gonna allow the operators to make
19 the decisions for their specific mine plans and make
20 solutions that are, indeed, engineered solutions for
21 each individual situation.

22 There's a large amount of current
23 research that is going on right now with regards to
24 built-in-place refuge alternatives at NIOSH. We're

1 doing projects on protecting compressed air lines.

2 I think there's other people that are
3 also working on wall solutions for 15 PSI stoppings.
4 So I think there are a fair amount of people that are
5 involved with trying to provide solutions for this
6 problem.

7 One of the things that I would suggest is
8 looking at this as an engineering problem. In order to
9 do that, we need to understand what we're trying to do
10 with a refuge alternative, and if you look specifically
11 at a built-in-place refuge alternative, the question
12 is: What are we trying to protect from?

13 And I think if you look at the solution,
14 maybe not in total, but I can name four specific things
15 that we need to address, and those would include
16 typical mine wear and corrosion.

17 So once you install these, you have
18 operations going on in the mine where things would bump
19 into them, equipment, just typical wear-and-tear
20 equipment that would be in a mine.

21 You also have the blast pressure from an
22 event that you're trying to protect these people from,
23 if there is an explosion.

24 You have potential for debris impact in

1 one of those events, and then you also have protection
2 following a disaster, whether there's fire or heat
3 involved that could impair the ability of these
4 solutions to provide their life-sustaining mission.

5 In order for us to come to a design
6 that's appropriate to meet or exceed these standards,
7 we need to develop some type of design basis for that,
8 and what I mean by that is, what you -- what you guys
9 -- you typically have as guidelines.

10 A design basis threat. We're looking at
11 a 15 PSI. Is that, indeed, a 15 PSI threat that we're
12 designing for, or is it a 15 PSI threat with a safety
13 factor of two? What does the shape look like?

14 A lot of those things are currently in
15 the regulations as it stands, but we also need to look
16 at the other components as well, what type of wear and
17 corrosion we're looking at, what type of impact are we
18 trying to sustain, and these -- I think these can be
19 developed through calculations and through research
20 that is ongoing right now within NIOSH and other
21 agencies.

22 Specifically, to speak to some of the
23 tests that we're doing on protecting compressed air
24 lines, some of the things that we're working on

1 specifically are varying types and grades of pipe
2 exposed to blast pressures.

3 We're also looking at how they are
4 exposed to different, varying levels of impact and
5 calculating what energies we would suspect from a
6 typical explosion and what loading would occur
7 following that, and what type of protection is required
8 to ensure the integrity of these lines.

9 The research is ongoing, and hopefully
10 we're gonna have some concrete conclusions in the near
11 future with that, but I think the point is, there's a
12 lot of work going on in this area, and I think moving
13 forwards towards 2018, my fear is that the research
14 will not get completed in time for built-in-place
15 alternatives to be a viable solution for compliance,
16 and, thus, drive us to possibly an erroneous decision
17 for some specific applications.

18 Now, I'm not saying that I know that
19 built-in-place is the only alternative for all
20 situations, but I think there is some combination, and
21 I think that really needs to be investigated.

22 Thank you.

23 MS. MCCONNELL: Mr. Main?

24 MR. MAIN: In terms of, you know, the

1 basic question with supplying air, what particular
2 research led you to believe that, and is that supported
3 as far as the distance and to control condensation and
4 those kind of things?

5 MR. LUSK: Yeah, I think there's
6 definitely a lot -- there's a lot to look at there, and
7 we are looking at some of that.

8 What I will say is, I think the
9 individual solutions for compressed breathable air are
10 as diverse as the mine plans that they'll be exposed
11 to.

12 But it is an engineering design problem,
13 and I think we can develop systems, whether it be the
14 sizing of pipe or the storage of supplemental
15 compressed air so that you're not basically emptying
16 out the pipelines and not able to generate enough
17 pressure to hold. All of these things can be designed.

18 We've actually run tests on pressure drop
19 and flow drop. We've gone out to 10, 12 thousand feet,
20 and we've seen calculations for doing 20, 25 thousand
21 feet.

22 What you're looking at is what type of
23 pipe, what type of resistances and flow that you need
24 there, and those are the -- some of the types of things

1 that we're working on, supplemental to the, I guess,
2 more direct impact things in our research right now.

3 And I'd be willing to share -- I've got
4 just a little bit of information here. It's not really
5 concrete conclusions, but it shows a little bit of the
6 direction of the research that we're looking at.

7 MS. MCCONNELL: If you could provide that
8 to the court reporter, we would appreciate that.

9 MR. LUSK: I will. And I will also --

10 MS. MCCONNELL: Submit it through the
11 records at regulations.gov or --

12 MR. LUSK: Yeah, I'll try to submit some
13 written comments and kind of detail what we're actually
14 looking at in that respect.

15 MS. MCCONNELL: Okay, excellent.

16 MR. TUROW: When we talk about -- when we
17 look at the December 2018 deadline, we're still talking
18 about 26 months out.

19 I'm just interested in some of the
20 hurdles that are in place that would make that date a
21 hard deadline to reach, in terms of the research that
22 you're doing, and then a sense for how long it would
23 take to finish the kind of research you think is
24 necessary to develop input necessary to figure out the

1 supply of air in built-in-place refuges.

2 MR. LUSK: Well, I think as far as the
3 design of a system that you can put in place, as far as
4 sizing pipe, what length you need, what size of
5 compressor flow requirements, that's a relatively --
6 that's a relatively quick calculation that you can do.

7 The question is: What types of
8 preparation will you have to do in order for that
9 system to be approved to be installed? Will it need to
10 be buried? Will there need to be a trench? Do you
11 have to go across different crosscuts in a different,
12 varying manner?

13 What type of elbows would be able to use,
14 the actual interface between the built-in-place or
15 refuge chamber and that breathable air? Does it have
16 to come out of the trench and then into that at a
17 90-degree angle? Does it go underneath it?

18 There are a lot of things that, as
19 engineers, we can design solutions for, but those
20 solutions are really meaningless if they're not
21 approved.

22 And that's not to say that they aren't
23 good solutions, but sometimes, there are other
24 information that's available to Tech Support that they

1 may not approve of those systems.

2 And it's -- it's a very long and arduous
3 process to actually get those systems approved, not to
4 mention the fact that there's research that will
5 potentially be coming out in the next maybe 12 to 18
6 months where the reports are coming out basically less
7 than a year before this approval needs to happen.

8 And it's -- it's really just hard to turn
9 those research results into commercialized products in
10 less than a year.

11 MS. MCCONNELL: I just have one -- this
12 conversation provoked a question.

13 MR. LUSK: Sure.

14 MS. MCCONNELL: And excuse my naivete,
15 but how would your -- your compressed air solution, as
16 you discussed it, seemed somewhat permanent and labor-
17 intensive and costly.

18 I mean, would that integrate -- would you
19 be able to use your compressed air system with the
20 previous discussion on the movable wall? Would that be
21 something that could go hand in hand? And if you were
22 having this movable wall, how easy would it be to
23 extend those lines into that next built-in-place?

24 MR. LUSK: Yeah, that's a very good

1 question. Actually, I work very closely with those
2 people, and that is actually the plan for this.

3 We would like to provide a complete
4 solution for some mines to use our movable wall, the
5 compressed breathable air system, and be able to move
6 that up at the face as necessary.

7 So basically what you would have is a
8 system where the pipe comes into the built-in-place
9 refuge alternative, you have it manifolded so that you
10 can introduce the flow into that area and provide
11 breathable air.

12 When it's time to move that forward,
13 because it's beyond a thousand feet, you can take the
14 wall down, advance the pipe forward, build that built-
15 in-place refuge alternative again. That's the plan for
16 a complete solution.

17 MS. MCCONNELL: Okay.

18 MR. LUSK: Thank you.

19 MS. MCCONNELL: Thank you.

20 Okay. Mr. Lusk was our last signed-up
21 speaker, but that doesn't prevent anyone from coming
22 down and sharing some information with us on some of the
23 issues we highlighted in our opening statement and in
24 Mr. Main's remarks.

1 Is there anyone there who could speak to
2 us about two-way communication in terms of when a miner
3 has a SCSR or any solutions to that versus an SCBA?

4 Is there anyone that could speak to the
5 use of built-in-place at their own mines or the refuge
6 alternatives that are currently used in their mines?
7 Recommendations for changes?

8 It's only really through your input that
9 we can learn from your experience.

10 Come on down, Dennis.

11 MR. O'DELL: Good afternoon. My name is
12 Dennis O'Dell, D-E-N-N-I-S, O'Dell, O, apostrophe,
13 capital D-E-L-L. I am currently the administrator of
14 Occupational Health and Safety for the United Mine
15 Workers.

16 As I said this morning, I have 40 years
17 experience in the mining industry, 20 as an underground
18 coal miner, ten as a field representative for Mine
19 Workers, and ten years in currently the administrator
20 of Occupational Health and Safety.

21 So I really wasn't prepared to say
22 anything this afternoon, and I promise you I won't be
23 as long this afternoon as I was this morning, but when
24 you opened this up, you said we were just going to have

1 kind of a general discussion about everything, and not
2 necessarily on a technical end, but let's just talk
3 about some general things that coal miners can identify
4 with.

5 So one of the things that the Mine
6 Workers believe at this time is that, No. 1, shelters
7 as we have today, the chambers, we should still leave
8 one on the section. We can't go back to the days of
9 brattice cloth and post. We have to deal with the
10 facts as what we know.

11 Nobody can speculate or guess what
12 happened at Sago. We have to deal with the facts as we
13 know them.

14 Miners throughout the world are taught
15 escape first, then if you can't escape, barricade, and
16 so since MSHA's taught that, since I've known that for
17 40 years, it would be my guess that those miners were
18 taught the same thing at Sago.

19 Whatever reason, they felt they couldn't
20 escape, so they had to turn around and barricade.
21 That's the facts. That's what we have to deal with.
22 Had there been shelters or chambers in place as we have
23 today, we know now that those miners would be alive,
24 without question.

1 And why do we know that? We know that
2 because the units have been tested, there were a less
3 number of miners that would've been in that facility as
4 what we have them ready for today.

5 The other thing we know is that the
6 explosion force was nothing like it was at Upper Big
7 Branch, and when we tested units at Upper Big Branch,
8 and with that massive force of explosion there, those
9 shelters/chambers were fine.

10 People -- we know now that people
11 would've survived had they have been barricaded in
12 those. That's the facts. So we have to deal with the
13 facts and the facts only. With saying that, I believe
14 that we can also do better than what we're doing today.

15 As just a general discussion, it's my
16 personal belief - if I may - that if I'm still working
17 in the mines today, I'm gonna do everything in my power
18 to escape, but knowing that I have a shelter or a
19 chamber on the section gives me some satisfaction in
20 knowing if I can't escape, I have an alternative.

21 So I believe those should be left where
22 they are today, regardless of where we go moving
23 forward. The other thing I believe is, can we go to
24 hardened rooms or hardened shelters? I believe the

1 answer to that is yes as well, because I think it
2 serves a great purpose.

3 It doesn't really serve a purpose for
4 escape. Let's say -- let's take a situation, again, at
5 UBB.

6 Had those miners have had the hardened
7 rooms in place or the hardened shelters, they would've
8 been able to go to that, regroup, change out the self-
9 rescuers that they had, communicate with each other,
10 and see what their next plan is.

11 So it's a place where miners can go and
12 gather themselves, figure out what the next move is,
13 communications are provided, they can communicate with
14 the surface and find out what's ahead of them.

15 If air is provided, they can change out
16 their SCSRs or replenish their units without being in
17 contaminated air. So I believe that's an important
18 step forward.

19 The other purpose, I think, that it would
20 serve would be for miner rescue teams. In the event
21 somebody were stuck on a section in a chamber, the mine
22 rescue teams could utilize those hardened rooms or
23 shelters or whatever you want to call them as preset
24 fresh air bases.

1 They can use those to go in, they can
2 replenish their units to where they could expand
3 further on their search, they could communicate better
4 with the outside.

5 If their communications aren't working --
6 and we know we're doing a lot better, Joe, with the
7 communication systems that you have now today, but it's
8 always good to have a backup plan, right? I mean, the
9 best plans don't always work out, so it's always good
10 to have Plan B.

11 So I think there's a lot that we can do,
12 as far as utilizing built-in-place refuge chambers as
13 well, for escape and for miner rescue.

14 Where applicable, I think that those
15 places could be provided with a borehole from the
16 surface to provide fresh air and communications, and we
17 know that there are some mines that can do that without
18 any problems, accessible.

19 There's also mines where that's a
20 challenge, in the mountains or whether it be a problem
21 with a landowner who doesn't necessarily want you to
22 come on his property or you can't access it or it may
23 take too long to access it, too.

24 Then we ought to consider the use of

1 compressed air lines. There's a lot of mines today
2 that utilize compressed air lines. It's part of their
3 everyday business. They're there.

4 So if they can't utilize a borehole from
5 the surface, then utilize the compressed air lines that
6 they already have in the mine, but just be smarter
7 about the placement of it.

8 That's all it's -- I -- my manager told
9 me one time, "The key to success is the six Ps: Prior
10 Proper Planning Prevents Poor Performance."

11 And I think if smart mine managers would
12 utilize that in the event of using compressed air
13 lines, because I've heard that they can pretty well
14 withstand a 15 PSI; it's just the flying objects that
15 you have to protect them from, that they're not in the
16 line of debris that may damage the lines.

17 So let's get smart about either burying
18 them or putting them closer to the roof or whatever,
19 but look at the different ways that those lines can be
20 protected for use. Communications. It's always been a
21 problem underground, communicating.

22 Anybody that's worked in a coal mine
23 knows if I'm on one side of a piece of equipment, if
24 somebody's on the other side, they're screaming,

1 they're yelling, you have earmuffs on, the machine's
2 running, you can barely hear each other.

3 I mean, it's a difficult -- under normal
4 circumstances, it's a difficult situation to where you
5 can communicate with each other.

6 I think that there is room for full-face
7 apparatus like they use in mine rescue, but I think it
8 can be less complicated than those units that mine
9 rescue people or firefighters use.

10 Anybody that lives in the area where
11 I live and has to deal with Congress, they got this
12 neat, little thing under their seats, it's a pullover
13 hood.

14 Any member of Congress or Senate, under
15 the seats that they sit on in the chambers, has this
16 little -- you pull it out, and it's got a hood that you
17 put over your head in the event they have to evacuate,
18 and they have fresh air. I mean, have you seen this?
19 It's there.

20 So if these Senators and Congressmen can
21 use that and have access to that, why can't we as coal
22 miners?

23 MS. MCCONNELL: How long is --

24 MR. O'DELL: Because --

1 MS. MCCONNELL: How long is the oxygen
2 supply for that?

3 MR. O'DELL: I'm not -- that's a good
4 question for you to find out. I'm not sure, but it
5 alleviates another problem for coal miners. A lot of
6 coal miners have facial hair, and so we don't go to work
7 every day planning on fighting a fire or having to
8 evacuate under self-contained self-rescuers.

9 We go to work to mine coal. That's our
10 job on a day-to-day basis. But we have to be prepared
11 in the event of an emergency, unlike a firefighter or a
12 mine rescue team member who has to be clean-shaven
13 because that's what they do.

14 Coal miners, I think it's a bit too much
15 to ask coal miners to be clean-shaven every day,
16 because it's not a daily part of their routine to fight
17 a fire or to escape.

18 So this hood-type thing helps alleviate
19 the problem of fit test, and I think there's been some
20 pretty good success on most of the testing on those,
21 and I think the communications can be implemented in
22 those units to where miners can talk back and forth
23 with each other and understand what the -- what's being
24 said.

1 That's pretty much what I just wanted to
2 throw out there, as far as just some common sense
3 things to think about.

4 I appreciate the time that you've given
5 me to speak on those things, and I appreciate the work
6 that everybody's done, not just you guys but everybody
7 in the industry, as far as those that are being
8 proactive to move us in a better place than where we
9 are today.

10 MS. MCCONNELL: Thank you.

11 Mr. Main?

12 MR. MAIN: Yeah, just a couple things.
13 In terms of -- if you look at the super-longwall or
14 super gate roads we have in some of these mines, that
15 distance between that face and the outby, it can be a
16 life-challenging experience, and I think the -- you
17 know, if you look at it from a practical standpoint,
18 looking at it for the current refuge alternatives, from
19 the face outby, there is going to -- probably would be
20 a bit costly, as the saying goes, and I'm trying to
21 figure out some remedies for -- particularly for
22 situations like that, as you described, in the hardened
23 room areas, which would you see those to being the same
24 15 PSI standard to be protected from the explosive --

1 MR. O'DELL: The hardened rooms?

2 MR. MAIN: In the hardened rooms, yes.

3 MR. O'DELL: Yeah, I heard some
4 conversation out in the lunchroom before we came in
5 here today, and some of the hardened rooms, they talk
6 about can withstand that type of pressure, but the
7 other thing that some of the folks have done is pretty
8 ingenious.

9 When they built these -- and you guys
10 have probably seen them, and I haven't had the
11 privilege of seeing them, but they actually build them
12 so the access to them is not in line with where the
13 explosion would travel.

14 So I think if you -- if you're a little
15 bit smart on how you build these and you build them
16 with a little offset to where they're not in line with
17 where the explosion pattern would go, I think that
18 increases the chance that it's gonna more than meet
19 that standard, that PSI standard, to where it may take
20 some damage, because you're putting it in a place where
21 it's even more protected, just because of the natural
22 settings and the way you build the unit on it.

23 I think the other thing that I failed to
24 mention is, we have to look at it as far as distance-

1 wise between place to place for the miners to travel.

2 If we wear the self-contained self-
3 rescuers that we use today, which are supposed to be 60
4 minutes, there's already been a formula established to
5 what the distance is between caches.

6 I think we have to apply that same
7 rationale if we go to hardened rooms, as far as those
8 distances for changing out or replenishing the units
9 that we would be using.

10 I think the other thing that could be
11 done on that is a mine-by-mine approval-type approach
12 on -- based on the fact that all mines have different
13 conditions, different heights, different, you know, air
14 and those kind of things. So I hope -- I don't know if
15 I answered it, but I think I did.

16 MR. MAIN: Okay, that was helpful. I
17 just -- and I think the -- you know, looking at it, if
18 we look at where is most at risk, the gap to the next
19 location, it would be more on those long gate roads
20 than it would be a short section or the --

21 MR. O'DELL: That's a definite challenge,
22 but I think the areas where you put your self-rescuers
23 has to be located strategically to at least you know
24 that you can get to a hardened room or a shelter if

1 need be.

2 Because I don't know that you'd, on a
3 longwall face, you could put a -- obviously you can't,
4 you know, put a shelter or a hardened room, but you can
5 locate the self-rescuers strategically to where if you
6 need to get from that place to where you can get to --

7 MR. MAIN: Planning your escape route
8 out.

9 MR. O'DELL: Right.

10 MS. MCCONNELL: Wes, do you have
11 anything?

12 Thank you, Dennis.

13 MR. O'DELL: Thank you.

14 MS. MCCONNELL: Anyone else that could
15 speak to the topics of this session?

16 Thank you, sir. State your name and
17 spell it.

18 MR. MOORE: Once again, I didn't come
19 here to make a presentation, but I -- since you
20 described the thing the way you did, that it's more of
21 an open forum --

22 MS. MCCONNELL: Yes, it is.

23 MR. MOORE: -- I will address the group
24 again. Once again, it's Todd Moore, T-O-D-D,

1 M-O-O-R-E, and I'm with Consol Energy.

2 The first thing that, you know, we've
3 been talking about, putting these compressed air lines
4 in, okay? That all sounds well and good, but there's
5 lots of things that go along with compressed air lines
6 that the group needs to think about.

7 One is, you know, that some of the
8 bottoms in these coal mines are tremendously hard,
9 okay? The coal seam is one thing to mine; the bottom
10 is another thing to mine.

11 The second thing is that a lot of the
12 mines that we've owned and operated have bottom hooving
13 of two to three feet, okay? So if you bury it and then
14 the bottom hooves, what's gonna happen to your line?
15 It's gonna separate, it's gonna -- there's lots of
16 different things that happen there.

17 Any compressed air I've ever dealt with,
18 you have to have drops, you have to have places that
19 you can bleed off the -- the water and the
20 condensation, those kind of things. Any of those
21 places are gonna be vulnerable places, you know, for a
22 fire, for an explosion to disrupt the system.

23 And trust me, if I knew where my next
24 fire or explosion was gonna be, I wouldn't have my next

1 fire or explosion. So you can't always engineer for
2 that. You can't always think where that's gonna be.
3 You can't always work your way around that. That's why
4 I don't think compressed air lines are feasible.

5 The line from the surface, if you can put
6 a borehole down, you know, that's all well and good,
7 and that would be a Cadillac outby shelter, but those
8 locations are limited as well, you know, due to
9 landowner difficulties, due to the terrain, due to
10 those kind of things. It's not always possible.

11 I think if you go to RAs, there has to be
12 multiple, different ways that the people can provide
13 the air, one maybe being boreholes, they can, but maybe
14 it's cached air.

15 Maybe it's air that's in a, you know, in
16 compressed caches that you would move and you would
17 have behind the RA wall that you have so that you could
18 move it from place to place. But I think that's the
19 only way that's feasible.

20 You talk about the face pieces, and I
21 want to talk about what Dennis talked about there.
22 What he says about the Senate and the Congress, I have
23 one of those units. I think it's a five-minute unit.
24 It's in a bag.

1 I think I've showed it to you, Joe. It's
2 in a bag, it's green. You tear it apart, put a hood
3 down over your head, there's a little canister that
4 goes right along your neck.

5 Like I said, I think it's only a five-
6 minute unit, but it does help with a lot of the
7 problems that we keep talking about, with this face-fit
8 test, okay?

9 I can't be worrying about what size
10 people I have on my section every day. You know, I got
11 four with big heads like mine, and I got two with
12 little heads like yours today. Before, I got four
13 little heads like yours and two big heads like mine.
14 So that doesn't work.

15 So you have to have one size fits all.
16 This hood that comes around your head and cinches in,
17 okay, that allows communication, it keeps the smoke out
18 of your eyes. There's lots of good things that come
19 along with that.

20 MS. MCCONNELL: But the option is only
21 five minutes. So how --

22 MR. MOORE: That's -- true. That has
23 nothing to do with the hood; that just has --

24 MS. MCCONNELL: Right.

1 MR. MOORE: -- to do with the oxygen
2 supply.

3 MS. MCCONNELL: So is there any product
4 out there that provides you more than five minutes or
5 up to 30 minutes or --

6 MR. MOORE: In my opinion -- you can ask
7 the professionals here in the room that know better
8 than I, but I believe that that hood could be utilized
9 with some other type of supply device.

10 MS. MCCONNELL: Okay.

11 MR. MOORE: Okay? Currently, it's only,
12 I think it's five, it might be ten minutes, but it's
13 just a small unit. But I think that's something that
14 certainly needs to be looked at.

15 And the final thing I want to say is, no
16 matter what you guys decide on RAs, outby, inby,
17 whatever, without Through-the-Earth communications,
18 we're still just spinning our wheels here.

19 We're ten years after Sago, okay? Those
20 poor guys beat on the roof down there 'til they
21 couldn't stand it any longer, okay? And we never heard
22 them. We didn't know that they were, okay? That was
23 our -- I still wear my helmet, a sticker that tells me
24 to beat on the roof, and people come and save me.

1 That's what's in my helmet right today.
2 Ten years later, we're not much closer than we were ten
3 years ago, although technology does exist, and I think
4 without Through-the-Earth communications, I think we're
5 not doing the miners the justice that they deserve
6 being able to get in these shelters.

7 That's all I have.

8 MS. MCCONNELL: Thank you very much. Oh,
9 hold on.

10 Mr. Main?

11 MR. MAIN: Yeah, Todd, and there was -- I
12 think there is -- one of the manufacturers that worked
13 with your folks, which is --

14 MR. MOORE: Lockheed?

15 MR. MAIN: -- Lockheed, and I think
16 they're in China now.

17 MR. MOORE: I think so.

18 MR. MAIN: And there's another firm out
19 of Canada that I just saw, we have an approval at -- do
20 you know which one that is, Wes?

21 MR. SHUMAKER: The Rescue Dog.

22 MR. MAIN: The -- through the
23 communications and stuff.

24 MR. SHUMAKER: Yeah, I believe they're

1 called the Rescue Dog at E-Spectrum.

2 MR. MAIN: I didn't know -- I know they
3 had been working with that technology. I just saw this
4 actually recently. I was --

5 MR. MOORE: I believe there are four or
6 five different companies right now that say that they
7 have Through-the-Earth communications. I've not tested
8 all of them, but I do know that it does exist. It's
9 not pie-in-the-sky stuff.

10 MR. MAIN: Yeah, I would agree to that.
11 That's something on the list that we need to figure out
12 how to move forward.

13 MS. MCCONNELL: Thank you, sir.

14 MR. MOORE: Thank you.

15 MS. MCCONNELL: Is there anyone else who
16 would like to come down and share some information?

17 MR. HARRIS: I guess since my other two
18 buddies got up and gabbed, I need to, too.

19 Hi, I'm Randall Harris, R-A-N-D-A-L-L,
20 H-A-R-R-I-S. I'm a tech support for the State of West
21 Virginia, Mine Safety Office.

22 I also said I wasn't going to talk,
23 because I've said everything I'm gonna say many times,
24 but, you know, it's interesting that you guys date

1 yourself as working on this for six years. As Todd
2 pointed out, we've been working on this for ten years,
3 and Todd was here.

4 Dennis wasn't in the room, but Dennis'
5 people were. We spent a lot of time trying to figure
6 out what solutions were after Sago, and in many ways,
7 we're responsible for the craziness that's here now,
8 'cause then Congress picked it all up and voted in the
9 MINER Act.

10 One thing that Dennis started off with is
11 absolutely right. We did not set off to build
12 shelters.

13 We set off to figure out how we get
14 people the heck out of the mines, and the whole concept
15 of shelters came in because while we were doing this,
16 in Canada, they had an accident in an underground
17 metal/nonmetal mine, and a diesel engine, as I recall,
18 caught on fire, and there was diesel smoke, and
19 everybody went into a shelter.

20 Well, the media picked it all up and
21 said, "Ah, shelters are it." We were in the middle of
22 our deliberations, and so our chief executive says,
23 "Shelters are not a bad thing, let's talk about
24 shelters."

1 But when I talked to the Canadians, their
2 biggest fear was if you put a shelter in there and it
3 looks like a dining room, people are gonna go there
4 first. They're not gonna give out. And sooner or
5 later, they're gonna go in that room, and then we're
6 not gonna be able to get them out.

7 So their recommendation to us - which I
8 heard also from the folks in Poland and the folks in
9 Australia - was build something that works, but make it
10 so goddamn ugly that nobody will get into it unless
11 they absolutely have to and provide them everything
12 they need to get out, so that if -- the option to get
13 out is more attractive than the option to get in.

14 And that's basically how we got to where
15 we are today. The concept of outby places to stop and
16 change rescuers and all that stuff was all debated.

17 The underground, whether you put air --
18 compressed air in, we debated all of that, too, and a
19 lot of the reasons Todd talked about have not been
20 overcome.

21 The mines that have compressed air
22 systems now or any industry that has compressed air
23 systems has trouble maintaining pressure over
24 maintenance periods, and even in factories that don't

1 move. And as Todd pointed out, our mines move. The
2 tops move, bottoms move, ribs move.

3 So it makes it even more complicated.
4 The communication systems we have underground now are
5 not perfect.

6 The issue with Through-the-Earth works
7 really well if you're on the Enterprise, but when you
8 get into the practical issues of moving an
9 electromagnetic field through - in some cases -
10 thousands of feet of rock, you've got a lot more
11 issues, and that's why the Lockheed Martin system is as
12 expensive and extravagant as it is, because it's not
13 easy.

14 When you're trying to move a signal
15 through, it's not like communicating through the air.
16 The density of the air, the ability of the air to
17 conduct signal is fairly constant.

18 When you're going through strata, you've
19 got different layers of rocks and different
20 compositions, you've got pools of water sitting in
21 there, so you get all of these lensing effects, and
22 it's just not easy.

23 So Through-the-Earth communications is
24 something that is worth exploring, but it's not

1 something that you're -- that's gonna have an everyday
2 solution. It's just very difficult.

3 Joe, your question about talking, we
4 actually came across that while we were working through
5 our stuff, and I've worked on it on and off for the
6 last ten years. There are throat mics right now that
7 you can wear with the current brand of SCSRs we have
8 out there.

9 The problem is, that we basically have
10 two major communication systems that accept them, the
11 Motorola and the Kenwood. Motorola has them approved
12 actually, but it costs more than a radio, and it comes
13 in a pouch about the size of an SCSR.

14 Kenwood no longer offers theirs, because
15 it was too difficult to get it approved and the market
16 was too small, so they don't offer a throat mic for
17 that, and the way our approval is, you can't plug
18 somebody else's throat mic into a Kenwood radio, even
19 though there might be a plug for it.

20 I found a company in Illinois that makes
21 them for the military. They use them in tanks and in
22 helicopters, throat mics. They were willing to do it.
23 The problem is, we ran into even if I got them to do
24 it, they could make one small enough to fit in a pouch

1 next to your SCSR and it would plug into your unit.

2 We couldn't get it approved, because they
3 were gonna make a throat mic that would be universal to
4 everybody. There's no mechanism, meaning electrical
5 approval codes, to be able to do that, which kind of
6 gets back in another issue that was brought up a couple
7 of times, is the reality of 2018.

8 The reason we made 2016 was we happened
9 to find a flaw that we had to fix, and we told
10 everybody, "You've gotta fix the flaw." We fixed the
11 flaw in time to make 2016. That was our first set of
12 deadlines, right? Was it 2016?

13 MR. SHUMAKER: 2013. 2013.

14 MR. HARRIS: 2013. If we hadn't found
15 that flaw, we would've had this crisis in 2013.
16 Because there was an imminent danger, we got everybody
17 to fix everything in time, and everybody got their
18 approvals in place, and we made the 2013 date.

19 There is nothing driving people to get
20 everything done in time to make 2018. I don't know how
21 that's gonna happen. There's -- unless a crisis comes
22 up or we get some real creative or motivated
23 manufacturers to go out there and go do their thing in
24 time.

1 I haven't kept up with Wes in the last
2 several months, so I'm not sure where we are in this
3 process, but it's probably not much improved. The
4 problem you've got is, there's a lot of manufacturers
5 sitting out here, too.

6 That's the guys that are gonna have to
7 figure out how to make the things in time, for the
8 other guys out here mining coal to pay for them and get
9 them installed by the end of 2018. You can't just go
10 out and start building something and be able to ship
11 it.

12 The logistics of going through this cycle
13 the last time - when we had to go back and repurpose
14 some of these shelters - was enormous. The logistics
15 was more complicated than -- by far than anything
16 associated with the approval process or design process.

17 How do you move thousands of these
18 devices? And a lot of these things weigh eight, nine
19 tons. How do you move thousands of these things around
20 to be able to do what you got to do in the time you've
21 gotta do? How do you get them manufactured?

22 To manufacture them, you've gotta just
23 order the parts. To order the parts, you've gotta do
24 the design. To do the design, you've gotta get the

1 approval. To get the approval, you've gotta do the
2 testing.

3 So you gotta work backwards from 2018,
4 and I personally believe that you've already missed the
5 deadline for 2018.

6 Unless somebody, a manufacturer of the
7 portable shelters, unless one of them has their
8 structural approval in place now, I don't know how,
9 with all those steps in place, they're gonna be able to
10 get everything moving, if they have to do any
11 modifications, to be able to hit 2018 and get them out
12 in the market that, quite honestly, is economically
13 stressed and -- especially for capital expenditures.

14 The other issue that's come up a couple
15 times from the other folks talking is this whole
16 concept that this is a very situational-specific
17 solution that you need, and you're driving towards some
18 universal standard. It ain't gonna work.

19 I mean, we got thousands of different
20 mines. Coal mines, you've got metal -- your
21 metal/nonmetal mines that, eventually, you're gonna get
22 into -- some of them have already adopted things like
23 this, but you've got thousands of these things out
24 there. Every one of them is different.

1 As Todd says, some of them got floors
2 that are very, very hard. Some of them got floors that
3 turn into mud. Some of them got floors that go up and
4 down. There's not gonna be a single solution.

5 Braden and his folks are talking about
6 the -- their walls. The problem with the walls,
7 whether it's made out of their stuff, which is pretty
8 cool, or whether it's made out of blocks or steel or
9 whatever is the same thing we were just talking about,
10 the walls go up and down over time.

11 The issue about where is the next
12 explosion gonna come for, that was a real interesting
13 thing, Joe, because when we went through -- we actually
14 went through the process of, "Tell us what you're gonna
15 do and why you're gonna do it."

16 The problem we ran into was, from a
17 regulatory point of view, if a mine operator points
18 out to you that there is a risk of an explosion at this
19 point, what are you gonna do about that as a regulator,
20 'cause they've now pointed out a hazard or a risk, at
21 least.

22 And now, we're in a position -- we know
23 where a risk is, and then something eventually happens
24 and we didn't do nothing about it, or where the

1 solution we adopted wasn't adequate, I mean, we've got
2 a real -- there's a chicken and egg thing here that I'm
3 not sure what the answer is.

4 The Australians went down this road a
5 couple decades ago, and that's how they ended up at
6 this whole concept of, "You tell us what you're gonna
7 do, and we'll tell you whether it's adequate, then
8 you're gonna have to follow it," rather than setting a
9 standard.

10 They set some standards, but it's mostly
11 at the mine level. You gotta tell us your duty of
12 care, I think they call it. This is just a very
13 complicated issue, and I'll be quite honest, you guys
14 are way behind the curve on this. It's gonna be tough.

15 This built-in-place shelter thing, I know
16 me and the NIOSH guys, we've had long debates about
17 this. I agree that there's a place in this that
18 several other folks have said we need a whole bucket
19 full of solutions. We don't need a solution. There's
20 not a solution.

21 The hoods that Todd's talking about,
22 besides that little one, which originally, I think,
23 only has a carbon monoxide filter in it, but besides
24 that, there are hoods like that. I've used them.

1 I used to be in the nuclear weapons
2 program. I was on the NES team, which is our inversion
3 of nuclear -- or the mine and rescue teams, nuclear
4 emergency support team. If the nuclear weapons went
5 off or something happened, we were the guys that
6 bundled up our stuff and went out.

7 There are hoods like that. We have them,
8 I mean, DOE has them, the military has them. And most
9 of them got like -- it's got an airpack on them, but
10 you can put air in there from anything.

11 The irony is, I was telling Ed earlier,
12 we were going -- we were all talking about, we all got
13 old mining stuff sitting around, we all collect junk,
14 we all do. I can -- look at you smile.

15 I found in one of my stashes a MSA self-
16 rescuer that was built in 1950 that had exchangeable --
17 there's a solid state one that had -- it's changeable
18 cartridges, so it had a whole cartridge with the
19 OxyChem in it and CO2 absorber, and it came with a
20 hood, it came with a regulator, and it came with three
21 packs that you could plug into it.

22 We have spent -- since Sago, we have
23 probably spent 7 or 8 million dollars on R&D that we've
24 developed something that was developed in the '50s, and

1 they couldn't sell enough of them, and MSA quit making
2 them.

3 You know, there are solutions out here.
4 They're -- they're gonna be difficult to find, and as
5 the gentleman from --

6 Parris? I don't know who you're with.

7 But as Mr. Parris was saying, it's gonna
8 take everybody working together, especially now that
9 we're up against this time crunch.

10 And I know from your point of view, Joe,
11 sooner or later, you're gonna go off to the next -- the
12 next thing you're gonna do, and we're running out of
13 time on this, this momentum. If we're gonna get
14 something done before you go off to your next job,
15 we're gonna have to get it done now.

16 I have no idea what's gonna happen next;
17 I just have been through too many administration
18 changes as a federal employee to know that things --
19 that -- to know that things will change one way or
20 another, and the things that -- the momentum and stuff
21 that has happened over the last period of time, since
22 you've been here, Joe, is going to be interrupted, if
23 nothing else, by just a change of all of the managers.

24 'Cause people are gonna be shuffled

1 around, you're not gonna have the same momentum, you're
2 gonna lose a year, 18 months, figuring out exactly what
3 the heck the next person's gonna do before you even
4 start doing anything.

5 And you and I had a conversation, you've
6 been here for almost six years, and you still haven't
7 figured out how to make things work yet.

8 MR. MAIN: Still haven't.

9 MR. RANDALL: Yeah, you still haven't,
10 you know, but, I mean, I've been through it at the
11 Department of Energy. I can't imagine the Department
12 of Labor is any different.

13 So that's my two cents' worth. I've said
14 all of this before at multiple meetings, and I told Ed
15 that I probably wouldn't even say it again, but,
16 fortunately, the court reporter has got it all written
17 down this time.

18 MR. MAIN: A lot of things to think
19 about, and, you know, that's what this is -- I think
20 Dennis talked about it, it's sort of an open
21 conversation, kind of a public meeting we wanted to
22 have, because we do have to come to terms with all of
23 this.

24 And I think we've been with the -- the

1 current model about six years now, and we have -- with
2 the experience we had, we've had a few that did, as you
3 noted, bring all of this equipment out and find out how
4 to do it the painful way, but I think, you know, just
5 sort of, like, putting everything in perspective.

6 We do have a short period of time, if not
7 driven by a December 2018 certification regulation, we
8 probably think we're a little bit more ahead of the
9 curve than what you may, but time's gonna tell on that
10 one.

11 We plan to have, as short as we can, the
12 guidance out for what 2018 certifications mean, but,
13 you know, it's -- I think we just need to take a quick
14 step back and look at the overall mine emergency
15 response system structures we're putting in place and
16 use this short period of time as an opportunity to try
17 to plot where we go from here.

18 And that's the purpose of this exercise,
19 because we do have a communications issue, we do have
20 some of these long gate roads that have a great
21 distance from where you leave that refuge alternative
22 to the next area, which we have to go through, things
23 like that, that, you know, we really need to have input
24 on and information back.

1 MR. RANDALL: I contend that you're never
2 gonna get enough input to make those decisions, and
3 that, you know, you're gonna have to find a solution
4 that is flexible enough to allow people to do what they
5 need to do with whatever the latest technology is, and
6 an approval process that is flexible enough to allow
7 the technologies to bear in the appropriate locations.

8 The whole issue is how do you encourage
9 -- how do you encourage innovation, technological
10 innovation in any field, whether it's new coal-mining
11 methods or safety methods, when you have rigid approval
12 processes that are difficult to modify, and it's not
13 just an issue for MSHA; it's an issue for any regulator
14 at any level in the system.

15 How do you -- how do you, on one hand,
16 encourage innovation, at the same time maintain some
17 minimal standards and remain, you know, credible as a
18 regulator?

19 MR. TUROW: I guess the only point I'd
20 like to make is that I think that's a good -- a good
21 statement. I just do want everyone to recognize that
22 the existing standards, I'm talking about 30 CFR 7.510
23 does allow for the approval of new technology.

24 So there is that flexibility that is at

1 least built into the regulatory structure that would
2 allow new technology to be approved if it provides the
3 same level of protection, and I just -- not commenting
4 one way or another, but just want more people to be
5 aware of that option.

6 MR. RANDALL: Steve, as a ten-year
7 observer of the process, that flexibility is very
8 difficult to actually execute, and I don't -- you know,
9 having been on both sides now, you know, I'd spent the
10 first 20 years of my life sitting in federal agencies
11 regulating folks like you did, and now I've been on
12 this side, and it's not easy.

13 I mean, there's no easy way to do this,
14 but I just know that unless you get about -- a process
15 in place to -- or something to drive to whatever
16 deadline you're gonna get, you're gonna have difficulty
17 getting there, because you will become -- overcome by
18 events that we have not even anticipated yet.

19 I mean, I love your six Ps things.
20 That's absolutely right.

21 All right.

22 MS. MCCONNELL: Thank you.

23 MR. SHUMAKER: Thank you.

24 MR. MAIN: Thank you.

1 MR. RANDALL: Thank you.

2 MS. MCCONNELL: Thank you.

3 Anyone else like to come down and share a
4 few thoughts? We're learning a lot from your
5 testimony. I know I am. So if you have some ideas or
6 suggestions, please come down.

7 MR. MAIN: How long is the record open on
8 this one? October --

9 MS. MCCONNELL: Another month from now.

10 MR. MAIN: Okay.

11 MS. MCCONNELL: November 16th.

12 MR. MAIN: So this is an extension of
13 four extensions of the record --

14 MS. MCCONNELL: Right.

15 MR. MAIN: -- and an extension of the
16 comment period. So, you know, any ideas, good thoughts
17 that you have, we'd like to sort of get them out,
18 because we do need to move forward doing something, and
19 the input would be very helpful, and guidance.

20 MS. MCCONNELL: Okay. If there is --
21 this is the last call. If no one else wishes to make a
22 presentation, I will conclude this meeting, and I want
23 to thank everyone who has made a presentation, as those
24 who did not present, for your attendance here today,

1 and your interest in this rulemaking.

2 I want to emphasize that all comments
3 must be received by November 16th, and we will take
4 your comments and concerns into consideration as the
5 agency determines what, if any, action is needed.

6 Thank you so much, and have a good
7 evening.

8 (The meeting concluded.)

9

10 ----oOo----

11

12

13

14

15

16

17

18

19

20

21

22

23

24

1 STATE OF WEST VIRGINIA,
2 COUNTY OF RALEIGH, to wit:

3

4 I, Bret M. Matics, C.C.R., do hereby
5 certify that the foregoing proceedings were duly taken
6 by means of voice writing and transcribed by me to the
7 best of my skill and ability by means of computer-aided
8 transcription and that all information contained
9 therein will be held absolutely confidential.

10 Given under my hand this 26th day of
11 October, 2015.

12

13

14 BRET M. MATICS

15

16

17

18

19

20

21

22

23

24

A	35:15	7:17 11:15	7:2 10:15 14:3	37:6 75:7
ability 6:7 37:3	Addresses 8:17	12:7,8 22:7	18:7 19:1,17	appropriately
64:16 79:7	adequate 70:1,7	23:15,20,23	19:18,21 20:12	21:12
able 13:9 19:6	administration	24:1,9,12,13	20:13,24 21:5	approval 3:19
21:7 27:19	3:7 72:17	24:16 28:5	23:11,17,21	18:15 19:2
31:14 33:1	administrator	32:11,12,17,23	24:2,4,14,15	23:2 34:24
39:16 41:13	44:13,19	33:1,7 34:20	34:21,24 35:17	35:6,14 42:7
42:19 43:5	adopted 18:14	34:21 36:1	35:24 38:15	60:19 65:17
47:8 60:6 63:6	68:22 70:1	37:23 39:1,9	44:6 52:18	66:5 67:16
66:5 67:10,20	adopting 18:8	39:15 41:1,15	amount 35:22	68:1,1,8 75:6
68:9,11	adoption 18:16	42:15,19 43:5	36:4	75:11,23
absolutely 62:11	19:16	43:11 47:15,17	anchorage 29:17	approval-type
63:11 76:20	advance 8:20	47:24 48:16	34:5	54:11
79:9	18:9 23:2	49:1,2,5,12	anchoring 33:11	approvals 17:24
absorber 71:19	43:14	50:18 54:13	angle 41:17	22:18,19 25:19
academia 5:18	advancements	56:3,5,17 57:4	answer 31:14	66:18
academic 27:2	4:20	57:13,14,15	47:1 70:3	approve 42:1
Academy 1:9	advances 32:8	63:17,18,21,22	answered 54:15	approved 22:9
accept 65:10	advancing 10:23	64:15,16,16	answers 17:1	28:4 30:3,6,17
access 48:22,23	advantage 12:23	71:10	anticipate 25:18	41:9,21 42:3
50:21 53:12	advantageous	airpack 71:9	anticipated	65:11,15 66:2
accessible 48:18	19:11	alive 45:23	76:18	76:2
accident 62:16	advantages 6:20	alleviate 51:18	Anybody 49:22	approving 24:20
accidents 9:24	7:13,20 27:16	alleviates 51:5	50:10	24:21
accommodate	adversarial	allotted 19:18	anymore 27:24	approximately
20:15	17:14 25:5	allow 4:12 6:15	apart 58:2	4:9
achieve 19:6	afternoon 26:17	20:11 25:4	apostrophe	April 4:8
21:1 23:3	44:11,22,23	35:18 75:4,6	44:12	arbitrary 28:22
Act 62:9	agencies 37:21	75:23 76:2	apparatus 6:11	arduous 42:2
acting 3:5	76:10	allowed 19:13	6:16,21 7:21	area 1:22 12:6,9
action 10:11,12	agency 18:1,19	20:23	50:7	12:20 13:9
10:14 14:13	19:8 22:18	allowing 7:6	APPEARAN...	29:9 38:12
19:13 78:5	25:18,18 78:5	allows 58:17	2:1	43:10 50:10
actions 6:13	Agency's 4:6,15	alternative 4:17	applicable 48:14	74:22
activities 6:5	8:12	5:5,12,13 7:9	application 4:3	areas 52:23
actual 11:7	ago 14:24,24	9:13,18 13:6	28:14	54:22
41:14	27:5 60:3 70:5	13:12 14:17	applications	asked 13:7
Adamson 2:7	agree 25:16	19:23 20:2,7	38:17	asking 5:1,17
3:18	61:10 70:17	20:22 22:11	applied 28:17	assessments
added 33:12	Ah 62:21	23:1 24:24	apply 18:20 54:6	25:15
addition 6:17	ahead 3:2 15:12	27:3 35:7	appreciate 9:1	assistant 2:6
additional 4:13	15:19 47:14	36:10,11 38:19	26:13 40:8	3:13 9:6 26:23
address 17:11	74:8	43:9,15 46:20	52:4,5	associated 67:16
18:2 34:18	aid 27:7	74:21	approach 7:14	atmosphere
36:15 55:23	ain't 68:18	alternatives 1:6	54:11	5:14 6:14
addressed 20:9	air 5:22,22 6:1,3	3:9 4:3,22 5:20	appropriate	attendance 3:15

9:3 77:24 attention 16:1 28:3,6 attractive 63:13 August 4:8 Australia 63:9 Australians 70:4 available 19:5 41:24 average 32:1 aware 76:5	beat 59:20,24 Beaver 1:10 began 12:3 21:21 behalf 3:13 belief 46:16 believe 18:17 19:7,10 20:8 21:4 28:21 39:2 45:6 46:13,21,23,24 47:17 59:8 60:24 61:5 68:4 benchmarks 10:5 benefit 4:23 benefited 20:3 best 10:21 48:9 79:7 better 11:4 13:20 14:17 46:14 48:3,6 52:8 59:7 beyond 29:13 43:13 big 46:6,7 58:11 58:13 biggest 63:2 Billiton 12:19 bit 13:7 29:21 40:4,5 51:14 52:20 53:15 74:8 blast 36:21 38:2 bleed 56:19 blocks 69:8 board 14:7 22:16 bolt 29:5,7 borehole 5:23 23:22 32:15,16 48:15 49:4 57:6 boreholes 57:13 bottom 56:9,12	56:14 bottoms 56:8 64:2 boxes 35:7,16 Braden 2:11 34:10,13,15 69:5 Branch 46:7,7 brand 65:7 brattice 45:9 breaking 16:4 breathable 12:8 23:20 24:9,16 28:5 32:12 34:21 39:9 41:15 43:5,11 breathing 6:11 6:16,21 7:21 16:4 Bret 1:22 79:4 79:14 brick 27:15 bring 74:3 brought 35:5 66:6 bucket 70:18 buddies 61:18 bugs 11:3 build 11:4 13:20 16:1 43:14 53:11,15,15,22 62:11 63:9 building 12:18 67:10 built 53:9 71:16 76:1 built- 7:17 43:14 built-in- 7:15 built-in-place 5:23 6:2,6,19 6:24 7:2,3,7 8:3,6 19:16,18 20:6,12,21 23:21 24:4,14 24:18,23 25:8 27:4,7 34:21	35:12,17,24 36:11 38:14,19 41:1,14 42:23 43:8 44:5 48:12 70:15 bump 36:18 bundled 71:6 bunkers 27:13 buried 41:10 bury 56:13 burying 49:17 business 49:3	cause 14:11 15:13 62:8 69:20 72:24 center 3:20 10:24 11:8,15 11:24 30:22 cents' 73:13 certain 7:7 16:11 31:21 certainly 59:14 certification 3:20 14:8,11 74:7 certifications 14:13 74:12 certified 14:4 certify 79:5 CFR 75:22 challenge 16:17 48:20 54:21 chamber 29:13 35:12 41:15 46:19 47:21 chambers 45:7 45:22 48:12 50:15 chance 11:1 53:18 change 11:6 47:8,15 63:16 72:19,23 changeable 71:17 changes 44:7 72:18 changing 54:8 chicken 70:2 chief 15:4,11 62:22 Chilean 13:8 China 60:16 choose 18:24 cinches 58:16 circuit 16:2,4 circular 29:2 circumstances
<hr/> B <hr/> B 48:10 B-R-A-D-E-N 34:16 back 11:15 12:2 12:16,24 15:19 16:13,18,21 28:15,20 29:16 34:3 45:8 51:22 66:6 67:13 74:14,24 backing 29:9 backup 48:8 backwards 68:3 bad 62:23 bag 57:24 58:2 barely 22:15 50:2 barricade 45:15 45:20 barricaded 46:11 based 54:12 bases 47:24 basic 39:1 basically 28:10 29:3,5 31:20 39:15 42:6 43:7 63:14 65:9 basis 37:7,10 51:10 BAY 1:22 bear 75:7			<hr/> C <hr/> C 3:1 C.C.R 1:22 79:4 cached 57:14 caches 7:22 54:5 57:16 Cadillac 57:7 calculating 38:5 calculation 41:6 calculations 37:19 39:20 call 47:23 70:12 77:21 called 61:1 Canada 60:19 62:16 Canadians 63:1 canister 58:3 capabilities 10:20 capable 20:20 capacity 17:14 17:15,17 capital 44:13 68:13 carbon 70:23 care 70:12 careful 20:7 cartridge 71:18 cartridges 71:18 cases 9:23 64:9 caught 15:22 28:6 62:18	

10:3 50:4 clean 5:22 clean-shaven 51:12,15 clear 14:21 15:16 27:16,19 clearly 6:12 8:15 closed 16:4 closely 19:17 21:16 43:1 closer 49:18 60:2 cloth 45:9 CO2 71:19 coal 1:7 3:18 5:4 5:17 29:17 44:18 45:3 49:22 50:21 51:5,6,9,14,15 56:8,9 67:8 68:20 coal-mining 75:10 codes 66:5 colleagues 3:23 collect 71:13 collected 4:11 combination 38:20 come 11:12 15:17 27:6 28:7 35:11 37:5 41:16 44:10 48:22 55:18 58:18 59:24 61:16 68:14 69:12 73:22 77:3,6 comes 43:8 58:16 65:12 66:21 coming 14:2,6 26:13 42:5,6 43:21 command 10:24 11:8,14	comment 4:7,12 7:13 77:16 commenting 76:3 comments 4:5 4:10,14,15 5:1 8:16 17:10,12 17:16,20,21 28:15 29:16,19 33:23 40:13 78:2,4 commercialized 42:9 common 52:2 communicate 6:7,12 16:3 47:9,13 48:3 50:5 communicating 49:21 64:15 communication 6:15 10:23 23:16 44:2 48:7 58:17 64:4 65:10 communicatio... 11:7 16:2 47:13 48:5,16 49:20 51:21 59:17 60:4,23 61:7 64:23 74:19 community 5:8 16:24 companies 61:6 company 65:20 compared 7:5 7:21 complete 43:3 43:16 completed 38:14 completing 35:16 Complex 11:2 compliance 23:4 38:15	compliant 18:8 complicated 50:8 64:3 67:15 70:13 comply 19:6 components 27:3 28:4 37:16 compositions 64:20 compressed 24:11,13 34:20 36:1 37:23 39:9,15 42:15 42:19 43:5 49:1,2,5,12 56:3,5,17 57:4 57:16 63:18,21 63:22 compressor 41:5 computer-aided 79:7 concept 12:20 13:9 62:14 63:15 68:16 70:6 concepts 13:6 concerns 7:17 78:4 conclude 77:22 concluded 20:2 20:4 78:8 conclusions 38:10 40:5 concrete 38:10 40:5 condensation 33:2 39:3 56:20 conditions 7:7 7:16 54:13 conduct 64:17 conducted 8:8 confidential 79:9 confines 13:23	Congress 50:11 50:14 57:22 62:8 Congressmen 50:20 consider 21:16 21:22,24 48:24 consideration 18:5 78:4 Consol 11:2 56:1 constant 64:17 contained 79:8 contaminants 12:9 contaminated 47:17 contemplate 21:5 contemplated 24:12 25:20 contemplates 24:8 contemplating 24:16 contend 25:19 75:1 context 21:5 continue 18:6,24 20:12,23 contractor 19:21 20:1 control 39:3 conversation 42:12 53:4 73:5,21 cool 69:8 copy 8:24 9:2 correct 31:19 corrosion 36:16 37:17 costly 42:17 52:20 costs 65:12 country 16:14 COUNTY 79:2	couple 28:16 29:1 30:2 31:16 52:12 66:6 68:14 70:5 court 8:15 9:2 17:6 26:19 34:12 40:8 73:16 craziness 62:7 creates 5:14 creative 66:22 credible 75:17 crisis 66:15,21 criteria 32:19 critical 5:20 6:8 16:7 crosscuts 41:11 crunch 72:9 cryogenic 23:23 24:1 Cumberland 15:1 current 7:9 21:11 25:8 35:22 52:18 65:7 74:1 currently 18:7 28:13 37:14 44:6,13,19 59:11 curve 70:14 74:9 cycle 67:12
D				
D 3:1 D-E-L-L 44:13 D-E-N-N-I-S 44:12 daily 51:16 damage 49:16 53:20 damaged 27:23 danger 66:16 data 5:1 28:21 date 40:20 61:24				

66:18	44:10,12 55:12	differences 35:6	Doctor 27:8	effort 12:4
day 51:7,15	57:21 62:4,10	different 7:16	DOE 71:8	efforts 4:1
58:10 79:10	73:20	35:14 38:4	Dog 60:21 61:1	egg 70:2
day-to-day	Dennis' 62:4	41:11,11 49:19	doing 14:22 31:3	eight 67:18
51:10	density 64:16	54:12,13,13	31:8 36:1	either 20:2
days 45:8	Department	56:16 57:12	37:23 39:20	24:13 28:10
deadline 14:2	15:5 73:11,11	61:6 64:19,19	40:22 46:14	32:16 49:17
17:23 18:4,10	deploy 20:11,13	68:19,24 73:12	48:6 60:5	elbows 41:13
19:3,9 21:22	deployed 18:7	difficult 25:17	62:15 73:4	electrical 66:4
23:2 34:24	18:21 21:14	50:3,4 65:2,15	77:18	electromagnetic
40:17,21 68:5	22:9 24:6	72:4 75:12	dollars 71:23	64:9
76:16	deployment	76:8	door 27:23 29:1	electronic 8:24
deadlines 66:12	9:20 24:3	difficulties 57:9	29:2,4,7,8,9	eliminate 22:10
deadly 6:13	deputy 15:6	difficulty 76:16	drawing 22:16	eliminating
deal 45:9,12,21	describe 8:3	dilatory 19:13	drive 38:16	22:13
46:12 50:11	described 52:22	dilemma 11:19	76:15	else's 65:18
dealt 27:12	55:20	dining 63:3	driven 74:7	embodied 5:7
56:17	deserve 60:5	direct 10:23	driving 66:19	emergencies 5:4
debated 63:16	design 12:22	11:7 40:2	68:17	6:8 14:20
63:18	23:1 28:17	direction 40:6	drop 39:18,19	emergency 5:7,9
debates 70:16	31:4,7,13,17	directly 5:24	drops 56:18	10:3,20,21
debris 36:24	32:1 37:5,7,10	director 3:5	due 57:8,9,9	18:3 20:8,14
49:16	39:12 41:3,19	disabled 20:14	duly 79:5	21:1,10 51:11
decades 70:5	67:16,24,24	20:20 21:1,8	duty 70:11	71:4 74:14
December 14:2	designed 31:20	21:12	dynamic 29:14	emerging 18:2
17:23 18:4	39:17	disadvantages		21:12
19:2,7 24:6	designers 29:20	6:20 7:13,20	E	emphasize 78:2
40:17 74:7	designing 37:12	disaster 37:2	E-Spectrum	employee 72:18
decide 59:16	designs 8:4,4	disasters 19:22	61:1	employer 17:19
decision 13:15	25:21 31:21	discuss 8:2	earlier 71:11	emptying 39:15
13:16 38:16	detail 40:13	21:23	early 19:20	enclosed 29:10
decisions 12:15	determines 78:5	discussed 18:13	early 19:20	encourage 10:10
16:19 35:19	develop 14:16	42:16	earmuffs 50:1	19:12 22:23
75:2	25:10,22 37:7	discussion 7:19	easier 25:2	75:8,9,16
defense 5:10	39:13 40:24	9:4 42:20 45:1	easiest 23:3	encourages 7:11
definite 54:21	developed 10:22	46:15	easily 19:7	encouraging
definitely 22:1	22:9 24:2,6	disrupt 56:22	easy 42:22 64:13	25:9
39:6	37:19 71:24,24	distance 32:24	64:22 76:12,13	ended 70:5
degree 21:2	development	39:3 52:15	economic 8:5	energies 38:5
delayed 18:15	22:14 28:7	54:5 74:21	economically	Energy 56:1
19:14	device 6:10 7:22	distance- 53:24	68:12	73:11
deliberations	59:9	distances 19:19	Ed 71:11 73:14	engine 62:17
62:22	devices 67:18	33:6 54:8	effect 9:18 18:11	engineer 29:18
delivery 23:22	devotion 20:19	district 24:20	effective 4:18	31:8 33:1 57:1
24:22	diesel 62:17,18	30:18,20	5:3	engineered
Dennis 2:12	difference 29:23	diverse 39:10	effects 64:21	35:20

engineering 4:2 12:6 14:16 25:10 26:24 29:20 34:17 35:4,8,12 36:8 39:12	52:6 62:19 66:4,10,16,17 72:8	69:12,18	fair 36:4	fine 46:9
engineers 41:19	everybody's 52:6	explosive 29:13 52:24	fairly 20:10 64:17	finish 40:23
enhanced 7:24	everyday 49:3 65:1	expose 6:13	familiar 31:11 31:17 33:7	finished 8:23
enormous 67:14	exactly 15:18 23:4,19 26:6	exposed 38:2,4 39:10	far 18:8 23:22 27:2 39:3 41:2	fire 37:2 51:7,17 56:22,24 57:1 62:18
ensure 38:8	31:8 73:2	extend 17:22 42:23	41:3 48:12	firefighter 51:11
Enterprise 64:7	examine 19:17	extended 12:3	52:2,7 53:24	firefighters 50:9
environment 5:15 7:4	example 24:11	extending 21:21	54:7 67:15	firm 60:18
equipment 5:18 11:3 36:19,20 49:23 74:3	examples 22:4	extension 77:12 77:15	farther 7:8	first 3:17 5:6,9 5:21 8:21 10:11 11:6 17:3,22 28:15 45:15 56:2 63:4 66:11 76:10
erroneous 38:16	exceed 37:6	extensions 77:13	fear 38:13 63:2	fit 51:19 65:24
escape 5:10,11 5:16 6:22 7:23 10:12,13,15 13:20 21:3,8 23:13,16 45:15 45:15,20 46:18 46:20 47:4 48:13 51:17 55:7	exchangeable 71:16	extensive 19:21	feasibility 7:15 8:5	fits 58:15
escapeways 7:23	exclusively 18:24	extra 23:5 25:15	feasible 57:4,19	five 10:19 20:16 58:21 59:4,12 61:6
especially 24:1 68:13 72:8	excuse 42:14	extravagant 64:12	federal 4:7 5:1 72:18 76:10	five- 58:5
essentially 12:21	execute 76:8	eyes 58:18	feedback 16:8	five-minute 57:23
established 54:4	executive 62:22	F	feet 7:10 12:14 15:12 19:19,23 19:23 20:3,15 20:21 39:19,21 43:13 56:13 64:10	fix 12:5 16:8 66:9,10,17
evacuate 50:17 51:8	exercise 26:4 74:18	fabricated 7:5	43:13 56:13	fixed 66:10
evaluated 19:22	exist 60:3 61:8	face 7:8,10 11:15 12:16 19:19 20:3,15 23:15 32:8 43:6 52:15,19 55:3 57:20	fellow 15:18	flaw 66:9,10,11 66:15
evening 78:7	existing 5:5 20:13,24 25:20 75:22	face-fit 58:7	felt 45:19	flexibility 75:24 76:7
event 5:9 13:11 36:22 47:20 49:12 50:17 51:11	expand 48:2	faced 13:10	field 44:18 64:9 75:10	flexible 75:4,6
events 37:1 76:18	expandable 28:8 31:21	facial 51:6	fight 51:16	floor 29:17
eventually 24:15 24:19 68:21 69:23	expanded 32:2	facilitate 23:16	fighting 51:7	floors 69:1,2,3
everybody 14:7 15:17 19:12	expectation 19:4	facilitated 19:24	figure 12:6 13:19 16:1 26:4 40:24 47:12 52:21 61:11 62:5,13 67:7	flow 39:19,23 41:5 43:10
	expenditures 68:13	Facilitating 7:1	67:7	flying 49:14
	expensive 64:12	facilities 12:7	figured 73:7	focus 15:24
	experience 4:19 4:23 9:17 44:9 44:17 52:16 74:2	facility 46:3	figuring 73:2	fog 15:16
	explore 22:23	fact 42:4 54:12	fillable 23:15	folks 9:10,11,12 12:10 13:1,7 14:5 15:3 16:8 16:23,23 25:9 53:7 60:13 63:8,8 68:15 69:5 70:18
	exploring 64:24	factor 21:12 28:16,18,23 29:22 37:13	filter 70:23	
	explosion 36:23 38:6 46:6,8 53:13,17 56:22 56:24 57:1	factories 63:24	final 59:15	
		facts 45:10,12 45:21 46:12,13 46:13	Finally 8:1	
		fail 18:14	find 16:24 47:14 51:4 66:9 72:4 74:3 75:3	
		failed 53:23	finding 30:1	
		fails 10:15		

76:11	game 18:1	71:12 72:22	30:2 35:13	heading 12:24
follow 70:8	gap 54:18	gonna 11:14,16	74:12 77:19	heads 58:11,12
followed 8:21	gas 6:13	13:24 14:9	guidelines 35:2	58:13,13
following 8:16	gate 12:14 52:14	15:23 28:24	37:9	Health 1:9 3:6
37:2 38:7	54:19 74:20	29:23 30:1,5	guys 25:24	3:19,24 9:7
force 46:6,8	gather 47:12	31:24 33:5	27:18 30:1,4,9	44:14,20
forced 18:8	general 17:12	35:3,18 38:10	31:1 34:19	hear 9:5 12:10
foregoing 79:5	45:1,3 46:15	46:17 53:18	35:2 37:8 52:6	23:14 50:2
formula 54:4	generate 39:16	56:14,15,15,21	53:9 59:16,20	heard 49:13
forth 51:22	gentleman 72:5	56:24 57:2	61:24 67:6,8	53:3 59:21
fortunately	getting 12:4	61:23 63:3,4,5	70:13,16 71:5	63:8
73:16	14:5 27:18	63:6 65:1 66:3		hearing 8:17
forum 55:21	30:3 76:17	66:21 67:6	H	16:23
forward 16:7,19	give 8:15 9:2	68:9,18,21	H-A-R-R-I-S	heat 37:2
26:14 43:12,14	11:8,21 14:23	69:4,12,14,15	61:20	heck 62:14 73:3
46:23 47:18	63:4	69:19 70:6,8	hair 51:6	heights 54:13
61:12 77:18	given 52:4 79:10	70:14 72:4,7	hand 18:23	held 4:7 79:9
forwards 38:13	gives 46:19	72:11,12,13,15	42:21,21 75:15	helicopters
found 65:20	giving 14:22	72:16,24 73:1	79:10	65:22
66:14 71:15	glass 27:12	73:2,3 74:9	handheld 11:11	helmet 59:23
four 10:19 12:3	go 3:2 10:19	75:2,3 76:16	handled 33:2	60:1
27:5 36:14	12:24 13:16	76:16	happen 42:7	help 16:24 25:9
58:11,12 61:5	15:2,9,22	good 9:21 16:11	56:14,16 66:21	26:1 58:6
77:13	22:10,24 23:5	16:19 19:10	72:16	helpful 33:10
frame 29:5,5	27:20 34:3	26:17 30:5	happened 45:12	54:16 77:19
framework	41:11,17 42:21	34:6 41:23	66:8 71:5	helps 23:16
25:22	45:8 46:22,23	42:24 44:11	72:21	25:10 51:18
fresh 11:15	47:8,11 48:1	48:8,9 51:3,20	happens 13:12	heroism 20:20
47:24 48:16	51:6,9 53:17	56:4 57:6	69:23	Hi 61:19
50:18	54:7 56:5	58:18 75:20,20	happy 34:3	highlighted
front 11:23	57:11 63:3,5	77:16 78:6	hard 8:24 40:21	43:23
full 70:19	66:23,23 67:9	gotta 66:10	42:8 56:8 69:2	historically 10:1
full-face 6:10	67:13 69:3,10	67:21,22,23,24	hardened 46:24	history 10:8,21
22:7 50:6	72:11,14 74:17	68:1,3 70:11	46:24 47:6,7	20:18
functioning	74:22	grades 38:1	47:22 52:22	hit 68:11
27:24	goddamn 63:10	great 19:19 47:2	53:1,2,5 54:7	hold 4:11 39:17
funded 27:8	goes 15:19 52:20	74:20	54:24 55:4	60:9
further 19:24	58:4	greatest 21:2	Harris 2:10	holding 9:15
28:7 48:3	going 11:5,8	green 58:2	61:17,19 66:14	15:7 17:9
future 13:5	23:4 25:24	group 55:23	Harvey 11:2	honest 70:13
38:11	26:2 27:1,19	56:6	haven 12:20	honestly 68:12
	32:11 35:11,16	grouted 29:8	13:21 27:9	hood 50:13,16
G	35:23 36:18	guess 27:15 40:1	havens 13:7	58:2,16,23
G 3:1	38:12 44:24	45:11,17 61:17	hazard 69:20	59:8 71:20
gabbed 61:18	52:19 61:22	75:19	head 50:17 58:3	hood-type 51:18
gained 4:19 28:3	64:18 67:12	guidance 14:5	58:16	hoods 70:21,24

71:7 hooves 56:14 hooving 56:12 hope 9:3 14:10 17:10,19 19:15 54:14 hopefully 27:1 38:9 hours 11:12 32:6 hurdles 40:20	28:13 31:22,24 include 13:6 36:15 included 7:6 including 8:4 increases 53:18 individual 17:17 17:21 35:21 39:9 industry 44:17 52:7 63:22 informal 8:8 information 3:11 4:6,13,24 5:2,19 6:18 8:14 12:1,2,4 18:14 40:4 41:24 43:22 61:16 74:24 79:8 ingenious 53:8 injured 13:11 innovated 25:11 innovation 75:9 75:10,16 innovations 4:20 input 13:4 16:22 40:24 44:8 74:23 75:2 77:19 inside 25:9 install 36:17 installation 6:24 installed 28:2 32:2 41:9 67:9 installing 7:15 instances 19:11 Institute 3:23 integrate 21:11 21:22 42:18 integrated 24:17 integration 18:2 integrity 33:14 38:8 intensive 42:17	intent 8:20 interchange 28:10 interchangeable 29:6 interest 78:1 interested 40:19 interesting 23:21 33:16 61:24 69:12 interface 41:14 interrupted 72:22 introduce 3:17 9:5 26:15 43:10 introduced 25:23 inversion 71:2 invest 18:24 investigated 38:21 investment 35:11 involved 19:2 36:5 37:3 irony 71:11 isolated 5:14 issue 9:13 14:19 64:6 66:6 68:14 69:11 70:13 74:19 75:8,13,13 issues 5:20 11:23 20:9 33:6,10 35:5 43:23 64:8,11	9:5 junk 71:13 justice 60:5	76:14 77:5,16 knowing 11:16 46:18,20 known 45:16 knows 49:23 Kyle 2:13 26:16 26:21
I idea 27:10 72:16 ideas 77:5,16 identified 8:17 identify 8:15 45:3 Illinois 65:20 imagine 73:11 imminent 66:16 impact 8:4 9:24 36:24 37:17 38:4 40:2 impair 37:3 impediment 6:5 impediments 6:18 implementation 35:4 implemented 51:21 important 3:11 5:6 35:3 47:17 impossible 5:11 improve 7:23 21:3 improved 8:3 67:3 improvements 11:19 in-place 7:18 43:15 inby 59:16 incentive 23:5 inches 28:12,13		intend 8:20 interchange 28:10 interchangeable 29:6 interest 78:1 interested 40:19 interesting 23:21 33:16 61:24 69:12 interface 41:14 interrupted 72:22 introduce 3:17 9:5 26:15 43:10 introduced 25:23 inversion 71:2 invest 18:24 investigated 38:21 investment 35:11 involved 19:2 36:5 37:3 irony 71:11 isolated 5:14 issue 9:13 14:19 64:6 66:6 68:14 69:11 70:13 74:19 75:8,13,13 issues 5:20 11:23 20:9 33:6,10 35:5 43:23 64:8,11	K K-Y-L-E 26:22 keep 12:4,9 27:21 58:7 keeps 58:17 Kentucky 26:24 27:8 34:17 Kenwood 65:11 65:14,18 kept 67:1 key 49:9 kind 4:4 14:22 25:10 27:1 28:22 33:2,6 39:4 40:13,23 45:1 54:14 56:20 57:10 66:5 73:21 knew 56:23 know 9:21 11:5 11:16,18 12:24 13:1,14 15:16 23:13 25:12,14 25:15,24 28:19 28:23 29:24 31:6,24 38:18 38:24 45:10,13 45:23 46:1,1,5 46:10 48:6,17 52:17 54:13,14 54:17,23 55:2 55:4 56:2,7,21 57:6,8,15 58:10 59:7,22 60:20 61:2,2,8 61:24 66:20 68:8 69:22 70:15 72:3,6 72:10,18,19 73:10,19 74:4 74:13,23 75:3 75:17 76:8,9	L L-U-S-K 34:16 Labor 3:13 9:6 15:5 73:12 labor- 42:16 lady 15:6 landowner 48:21 57:9 large 35:22 latch 29:11 latest 75:5 layers 64:19 laying 13:13 lead 18:15 learn 26:4 44:9 learned 9:19 learning 77:4 leave 45:7 74:21 led 4:20 39:2 left 46:21 length 41:4 lensing 64:21 lesser 23:17 let's 45:2 47:4,4 49:17 62:23 level 35:10 70:11 75:14 76:3 levels 38:4 life 14:20 76:10 life-challenging 52:16 life-saving 22:8 life-sustaining 5:15 37:4 light 15:16 limited 57:8 line 5:10 22:19
		J January 25:20 Jim 10:5 job 51:10 72:14 Joe 48:6 58:1 65:3 69:13 72:10,22 Joseph 2:6 3:14		

49:16 53:12,16 56:14 57:5 lines 24:13 34:20 36:1 37:24 38:8 42:23 49:1,2,5 49:13,16,19 56:3,5 57:4 liquid 22:7 list 30:5 61:11 little 15:14 29:21 40:4,5 50:12,16 53:14 53:16 58:3,12 58:13 70:22 74:8 live 50:11 lives 50:10 load 28:17 loading 38:6 locate 10:6,8,9 55:5 located 54:23 location 20:6 54:19 locations 57:8 75:7 locked 13:12 Lockheed 60:14 60:15 64:11 logistics 67:12 67:14 long 12:14 13:14 40:22 42:2 44:23 48:23 50:23 51:1 54:19 70:16 74:20 77:7 longer 59:21 65:14 longest 10:7 longstanding 5:8 longwall 55:3 look 9:16 10:1 10:15 11:3	12:12,21 27:20 33:19 35:10 36:10,13 37:13 37:15 39:6 40:17 49:19 52:13,17 53:24 54:18 71:14 74:14 looked 12:1 32:24 59:14 looking 13:4 23:12 27:6,9 35:15 36:8 37:10,17 38:3 39:7,22 40:6 40:14 52:18 54:17 looks 63:3 looming 35:1 lose 73:2 lot 9:19 10:18 13:2,17,24 25:15 27:12 33:5 34:4 35:8 37:14 38:12 39:6,6 41:18 48:6,11 49:1 51:5 56:11 58:6 62:5 63:19 64:10 67:4,18 73:18 77:4 lots 56:5,15 58:18 love 76:19 lunchroom 53:4 Lusk 2:11 27:8 34:10,13,13,15 34:15 39:5 40:9,12 41:2 42:13,24 43:18 43:20 <hr/> M M 1:22 79:4,14 M-O-O-R-E	56:1 machine's 50:1 Main 2:6 3:14 9:6,8,9 17:2 23:9,10 25:6 25:14 26:3 27:17 29:24 32:23 33:9,16 33:19 34:6 38:23,24 52:11 52:12 53:2 54:16 55:7 60:10,11,15,18 60:22 61:2,10 73:8,18 76:24 77:7,10,12,15 Main's 43:24 maintain 75:16 maintaining 63:23 maintenance 63:24 major 11:5 35:8 65:10 making 8:10 17:16,17 72:1 manage 12:7 13:9 manager 24:20 30:21 49:8 managers 49:11 72:23 manifolded 43:9 manner 8:8 18:6 41:12 manufacture 67:22 manufactured 67:21 manufacturer 68:6 manufacturers 5:18 16:24 18:19 60:12 66:23 67:4 map 11:11	mapping 11:10 11:14 March 4:18 market 65:15 68:12 marketed 22:9 22:20 Martin 64:11 mask 6:11 22:7 23:15 masks 13:11 mass-produced 22:20 massive 46:8 material 8:15 materials 4:14 Matics 1:22 79:4 79:14 matter 59:16 mature 22:17,20 23:1 24:15 McConnell 2:4 3:2,4 17:2 21:18 22:3 23:8 26:6,9,13 26:18 30:8,10 31:16 32:5,7 32:10,14,18,22 34:1,8,10,14 38:23 40:7,10 40:15 42:11,14 43:17,19 50:23 51:1 52:10 55:10,14,22 58:20,24 59:3 59:10 60:8 61:13,15 76:22 77:2,9,11,14 77:20 mean 15:24 23:3 25:7 37:8 42:18 48:8 50:3,18 68:19 70:1 71:8 73:10 74:12 76:13,19	meaning 66:4 meaningful 18:18 meaningless 41:20 means 15:4 23:20 79:6,7 mechanism 66:4 media 62:20 meet 37:6 53:18 meeting 1:5 3:3 3:9 4:4 6:18 7:7 8:7,11,18 9:15 15:8 17:9 73:21 77:22 78:8 meetings 73:14 meets 16:11 member 50:14 51:12 members 2:5 5:19 mention 42:4 53:24 mentioned 9:12 34:23 metal 68:20 metal/nonmetal 62:17 68:21 methods 8:17 75:11,11 Mexico 12:19 mic 65:16,18 66:3 mics 65:6,22 middle 62:21 Mike 2:12 17:4 17:7 mile 15:22 23:6 miles 6:4 military 65:21 71:8 million 71:23 milliseconds 28:20 mine 1:9 3:6,18
---	--	--	---	--

5:4,7,9,17 6:1 6:3,8,14 7:16 9:6 10:1,3,19 10:21 11:6,20 12:19,23 14:20 15:1,22 19:22 27:18 28:3 31:23 32:17 35:19 36:16,18 36:20 39:10 44:14,18 45:5 47:21 49:6,11 49:22 50:7,8 51:9,12 56:9 56:10 58:11,13 61:21 62:17 69:17 70:11 71:3 74:14 mine's 20:8 mine-by-mine 54:11 miner 5:10 10:6 10:14 11:20 20:14,20 21:1 44:2,18 47:20 48:13 62:9 miners 5:15,18 6:9,13,15 10:12,13 11:21 12:15,22 13:11 13:22 14:18,22 16:3,14,16 20:3,16,19 21:2,6,7,8,13 22:10 25:9 45:3,14,17,23 46:3 47:6,11 50:22 51:5,6 51:14,15,22 54:1 60:5 miners' 5:3 6:7 mines 1:7 3:10 7:2 9:20 13:24 18:2,22 20:11 24:13 43:4 44:5,6 46:17	48:17,19 49:1 52:14 54:12 56:8,12 62:14 63:21 64:1 68:20,20,21 minimal 75:17 mining 5:8 6:5 9:24 12:12 16:24 26:24 31:23 34:17 44:17 67:8 71:13 minute 58:6 minutes 54:4 58:21 59:4,5 59:12 missed 68:4 mission 37:4 model 13:8,8 74:1 moderator 2:3 3:8 modern 10:7 modifications 68:11 modify 75:12 momentum 72:13,20 73:1 Monday 10:5 money 10:18 16:10 monoxide 70:23 month 77:9 months 4:9 14:7 30:2 40:18 42:6 67:2 73:2 Moore 2:11 10:24 55:18,23 55:24 58:22 59:1,6,11 60:14,17 61:5 61:14 morning 44:16 44:23 mortar 27:15 motivated 66:22	Motorola 65:11 65:11 mountains 48:20 mousetrap 11:4 13:20 mouthpiece 6:9 15:23 16:2 movable 42:20 42:22 43:4 move 16:7,19 32:4,5,7 43:5 43:12 47:12 52:8 57:16,18 61:12 64:1,1,2 64:2,2,14 67:17,19 77:18 moving 27:21 38:12 46:22 64:8 68:10 MSA 71:15 72:1 MSHA 3:14,17 4:5,11,24 5:7 5:21 6:18 7:11 7:19 8:2,10,19 15:6 17:8,11 17:22 20:11 21:24 24:20 28:14 75:13 MSHA's 3:11,18 45:16 MSHA-appro... 4:21 MSHA.gov 4:15 mud 69:3 multiple 57:12 73:14	3:23 natural 53:21 near 38:10 neat 50:12 necessarily 19:1 45:2 48:21 necessary 25:22 40:24,24 43:6 neck 58:4 need 12:21 14:16,23 16:14 16:15,22 19:1 19:8,17 21:9 21:15 22:10,10 23:17 24:7 30:5 35:13 36:9,15 37:7 37:15 39:23 41:4,9,10 55:1 55:6 61:11,18 63:12 68:17 70:18,19 74:13 74:23 75:5 77:18 needed 78:5 needs 35:15 38:21 42:7 56:6 59:14 NES 71:2 never 13:10 59:21 75:1 new 6:22 8:1,3 12:19 15:6 18:2 21:22,23 75:10,23 76:2 newer 27:14 news 9:21 nine 67:18 NIOSH 3:24,24 7:2 18:19 19:21 20:1 26:1 32:19 35:24 37:20 70:16 NIOSH's 7:6,12 7:13 19:15,20	nobody's 27:20 normal 50:3 normally 30:21 Notably 20:1 noted 74:3 notice 6:17 8:18 notified 8:19 November 4:12 77:11 78:3 nuclear 71:1,3,3 71:4 number 10:2 14:20 19:5 46:3
<hr/>				
O				
<hr/>				
O 3:1 44:12				
O'Dell 2:12				
44:11,12,12				
50:24 51:3				
53:1,3 54:21				
55:9,13				
objects 49:14				
observer 76:7				
obvious 10:17				
obviously 55:3				
Occupational				
3:23 44:14,20				
occur 5:13 38:6				
October 1:16				
77:8 79:11				
offer 65:16				
offers 65:14				
Office 3:5,21				
61:21				
official 17:14				
offset 53:16				
Oh 11:13 22:1				
23:19 31:23				
60:8				
okay 23:8 30:15				
31:9,12,15				
32:7,10,22				
34:7,9,15				
40:15 43:17,20				
54:16 56:4,9				

56:13 58:8,17 59:10,11,19,21 59:22 77:10,20 old 71:13 once 22:19,19 36:17 55:18,24 ongoing 3:10 4:1 37:20 38:9 online 33:22 oOo--- 78:10 open 4:8,12 55:21 73:20 77:7 opened 44:24 opening 27:23 43:23 operate 22:21 operated 56:12 operations 36:18 operator 17:18 25:3 28:3 69:17 operators 5:17 17:24 18:6,16 18:18,23 19:5 19:14 20:23 22:23 23:5 26:1 35:18 opinion 35:9 59:6 opportunities 13:21,21,22 opportunity 11:9,22 13:18 14:23 15:2,9 16:9 74:16 opposed 12:24 option 58:20 63:12,13 76:5 options 5:2 19:5 23:11 25:7 26:5 order 22:22 36:8 37:5 41:8 67:23,23	organization 26:20 34:14 originally 70:22 ought 48:24 outby 19:24 20:4 52:15,19 57:7 59:16 63:15 outside 48:4 overall 23:12 74:14 overcome 63:20 76:17 overkill 29:21 owned 56:12 OxyChem 71:19 oxygen 51:1 59:1 <hr/> P <hr/> P 3:1 P-A-R-R-I-S 17:7 P-E-R-R-Y 26:22 package 31:13 packs 71:21 painful 74:4 panel 2:5 3:18 8:8,10 21:19 29:4 panels 29:6 Parris 2:12 17:4 17:5,7,7 21:18 22:1,5 23:19 25:13,16 26:10 26:12 72:6,7 part 3:10 4:5,11 12:20 19:13,20 20:16 25:19 26:3 30:13 32:20 33:8 49:2 51:16 participants 4:13 8:9,9 participation	3:16 particular 39:1 particularly 17:11 52:21 partner 17:24 25:3 parts 17:23 67:23,23 pattern 53:17 pause 13:19 pay 67:8 Pennsylvania 15:1 people 13:2,13 17:13 36:2,4 36:22 43:2 46:10,10 50:9 57:12 58:10 59:24 62:5,14 63:3 66:19 72:24 75:4 76:4 Perez 15:11 perfect 64:5 Performance 49:10 performed 19:21 performing 34:19 period 4:7,12 72:21 74:6,16 77:16 periods 63:24 permanent 42:16 Perry 2:13 26:16 26:17,18,21,21 30:9,15,19,23 31:2,5,9,12,15 31:20 32:6,9 32:12,16,21 33:4,14,18,21 34:3,7,9 person 15:12 person's 73:3	personal 46:16 personally 18:12 68:4 perspective 74:5 physically 20:20 picked 62:8,20 picture 15:21 pictures 33:23 pie-in-the-sky 61:9 piece 49:23 pieces 57:20 pipe 38:1 39:14 39:23 41:4 43:8,14 pipeable 32:23 piped 6:3 piped-in 32:16 pipelines 39:16 piping 6:1,4 Pittsburgh 30:22 place 7:16 10:11 12:23 13:23 14:14 16:15 18:9 28:4 40:20 41:3 45:22 47:7,11 52:8 53:20 54:1,1 55:6 57:18,18 66:18 68:8,9 70:17 74:15 76:15 placed 7:8 placement 49:7 places 48:15 56:18,21,21 63:15 plan 14:13 18:1 20:8 24:8 35:16 43:2,15 47:10 48:8,10 74:11 planning 49:10 51:7 55:7 plans 7:23 18:3	21:10 23:22 35:19 39:10 48:9 plate 28:11 29:9 please 8:14 34:11 77:6 pleased 3:14,22 plot 74:17 plug 65:17,19 66:1 71:21 plumbed 24:22 point 9:16 22:14 22:17 24:15 25:4,7 38:11 69:17,19 72:10 75:19 pointed 62:2 64:1 69:20 points 35:8 69:17 Poland 63:8 polycarbonate 27:9,11,16 28:1,8,9 29:3 pools 64:20 poor 49:10 59:20 portable 18:24 20:13,24 22:24 24:2,14 25:21 31:18 68:7 position 24:7 69:22 positive 32:19 possibility 24:3 possible 57:10 possibly 27:23 38:16 post 8:11 45:9 post-Sago 9:19 potential 20:9 23:22 36:24 potentially 22:8 42:5 pouch 65:13,24 power 46:17
---	--	---	--	--

practical 18:1 52:17 64:8	problems 18:15 48:18 58:7	48:16 57:12 63:11	28:18 36:11 39:1 41:7	12:10,21 14:15 16:7,7,14,15
practicing 29:18	procedure 30:13	provided 5:5 18:5 20:15	42:12 43:1 45:24 51:4	16:16,22 19:2 21:4 30:13,17
preparation 41:8	proceedings 79:5	47:13,15 48:15	65:3	35:13 38:21 40:4 41:20
prepared 44:21 51:10	process 11:11,16 18:15 30:3	provides 59:4 76:2	questioned 13:2 questions 8:9,10	42:8 44:8,21 47:3 64:7
present 5:2 8:13 77:24	42:3 67:3,16 67:16 69:14	providing 5:22 23:20 25:21	8:14 17:11 23:10 24:12	74:23
presentation 9:1 55:19 77:22,23	75:6 76:7,14	provoked 42:12	30:9 31:7,14 31:17	reason 11:23 28:19 45:19
presentations 8:21	processes 35:6 35:14 75:12	Ps 49:9 76:19	quick 10:4,16 11:20 27:18	66:8
presenter 33:4	produce 35:3	PSI 28:17,19,20 28:24 29:14,15	41:6 74:13	reasons 10:10 10:17 12:10
preset 47:23	product 59:3	30:17 35:7 36:3 37:11,11	quicker 11:9	19:10 63:19
pressure 5:23 29:14 32:20	products 42:9	37:12 49:14 52:24 53:19	quit 72:1	recall 62:17
36:21 39:17,18 53:6 63:23	professional 29:18	psychologically 13:13	quite 9:13 13:7 14:1 68:12	receive 23:2 28:14
pressures 38:2	professionals 59:7	public 3:3 5:19 9:15 16:22	70:13	received 4:5,10 78:3
pressurizing 12:8	professor 26:23 34:17	73:21	R	recognize 75:21
presume 17:18	program 71:2	publication 4:6	R 3:1	recommend 17:22
pretty 28:2 30:2 30:5 49:13	progress 25:4	published 4:24	R-A-N-D-A-L... 61:19	recommendati... 63:7
51:20 52:1 53:7 69:7	project 27:9	pull 50:16	R&D 71:23	recommendati... 7:3,6,12 44:7
prevent 43:21	projections 5:4	pullover 50:12	RA 57:17	recommended 7:14 21:21
Prevents 49:10	projects 36:1	pulpit 16:21	radio 65:12,18	record 3:10 4:11 17:9,20 77:7
previous 42:20	promise 44:22	purpose 14:15 47:2,3,19	raised 9:17 17:11 33:10	77:13
primary 14:15	Proper 49:10	74:18	RALEIGH 79:2	recorded 28:21
principle 5:7,8	property 48:22	put 9:10 12:2 21:10 24:8	ran 65:23 69:16	records 40:11
prior 24:6 49:9	proposal 19:17	28:15 29:4 32:3 33:23	Randall 2:10 61:19 73:9	redesigned 11:10
privilege 53:11	protect 5:15 36:12,22 49:15	34:1,2 41:3 50:17 54:22	75:1 76:6 77:1	refill 6:21 7:21
proactive 52:8	protected 5:13 49:20 52:24	55:3,4 57:5 58:2 63:2,17	range 28:12	refillable 22:5
probably 10:20 13:24 52:19	53:21	71:10	RAs 57:11 59:16	refuge 1:6 3:9 4:3,17,21 5:5
53:10 67:3 71:23 73:15	protecting 36:1 37:23	putting 16:10 27:10 29:22,22	rationale 54:7	5:12,13,20,24 6:24 7:2,4,9
74:8	protection 6:4 34:20 37:1	49:18 53:20 56:3 74:5,15	reach 14:14 40:21	8:4 9:13,18 12:5,8 13:6,12
problem 12:5 31:15 36:6,8	38:7 76:3	Q	reaching 22:17	13:21 14:3,17 18:7 19:1,16
39:12 48:20 49:21 51:5,19	prototype 22:16	question 21:19	ready 46:4	
65:9,23 67:4 69:6,16	provide 4:1 5:13 5:19 17:20		real 14:21 16:9 18:18 66:22	
	22:3 33:21		69:12 70:2	
	34:4 36:5 37:4 40:7 43:3,10		reality 66:7	
			really 9:22 10:4	

19:18,20,23 20:2,4,6,12,13 20:21,24 21:5 21:6 22:11,24 23:17,21 24:2 24:4,14,14,18 24:23 27:3 34:21,24 35:7 35:16,17,24 36:10,11 41:15 43:9,15 44:5 48:12 52:18 74:21 refuges 41:1 regard 24:9 regardless 46:22 regards 34:23 35:23 Register 4:7 5:1 regroup 47:8 regulating 76:11 regulation 74:7 regulations 3:5 7:9 37:15 regulations.gov 4:16 40:11 regulator 69:19 71:20 75:13,18 regulatory 25:22 69:17 76:1 reinstall 32:4 related 6:19,23 18:4 relationship 25:5 relative 22:14 relatively 41:5,6 remain 75:17 remarks 43:24 remedies 52:21 remove 6:9,10 reopening 17:8 replenish 47:16 48:2 replenishing	54:8 report 7:1,12 reporter 8:16 9:2 17:6 26:19 34:12 40:8 73:16 REPORTING 1:22 reports 42:6 representative 44:18 repurpose 67:13 request 3:11 4:6 4:24 8:23 12:2 18:14 requested 6:18 requests 7:19 8:2 require 7:9 21:6 25:15 required 35:11 38:7 requirement 14:8 30:14 requirements 20:17 33:11 41:5 rescue 5:16 10:1 10:17 11:8 27:19 47:20,22 48:13 50:7,9 51:12 60:21 61:1 71:3 rescuer 71:16 rescuers 22:6 47:9 54:3 63:16 rescuing 11:6 research 4:2,19 4:24 6:23 8:2 27:2,9 34:19 35:23 37:19 38:9,13 39:2 40:2,6,21,23 42:4,9 researchers 4:1	resistance 27:13 resistances 39:23 respect 40:14 respirator 6:11 7:24 response 10:20 18:3 20:8 21:10 74:15 responsible 62:7 results 42:9 review 4:14 7:12 20:7 30:12 31:4,8 revisions 28:15 RFI 4:14 ribs 29:17 64:2 right 10:8 15:12 30:23 31:4,14 35:23 37:20 40:2 48:8 55:9 58:4,24 60:1 61:6 62:11 65:6 66:12 76:20,21 77:14 rightfully 13:3 rigid 75:11 risk 54:18 69:18 69:20,23 road 70:4 roads 12:14 52:14 54:19 74:20 rock 64:10 rocks 64:19 Rodney 2:7 3:18 roof 29:17 49:18 59:20,24 room 17:13 27:20 50:6 52:23 54:24 55:4 59:7 62:4 63:3,5 rooms 46:24 47:7,22 53:1,2 53:5 54:7	route 55:7 routine 6:4 51:16 rubber 29:10 rule 4:17 5:5 rulemaking 78:1 run 12:16 39:18 running 13:24 14:12 24:13 50:2 72:12 <hr/> S <hr/> S 3:1 safe 12:20 13:6 13:21 27:9 safely 6:1 safer 11:9 safety 1:9 3:6,19 3:24 9:6 21:2 28:16,18,23 29:22 37:12 44:14,20 61:21 75:11 Sago 20:4 21:14 45:12,18 59:19 62:6 71:22 satisfaction 46:19 Saturday 10:5 save 59:24 saw 12:18 28:16 60:19 61:3 saying 15:19 23:14 25:12 38:18 46:13 52:20 72:7 says 31:23 57:22 62:22 69:1 SCBA 44:3 scheduled 8:22 scope 6:22 screaming 49:24 SCSR 44:3 65:13 66:1 SCSRs 47:16 65:7	sealed 29:8 sealing 29:10 seam 56:9 search 48:3 seats 50:12,15 second 6:7 10:12 14:19 19:15 56:11 Secretary 2:6 3:13 9:6 15:11 section 8:18 10:12 45:8 46:19 47:21 54:20 58:10 sections 28:10 secure 5:14 see 15:15,16 18:12 21:20 31:8 33:17 47:10 52:23 seeing 53:11 seeking 5:21 6:1 6:14 seen 21:24 25:1 39:20 50:18 53:10 self- 22:5 47:8 54:2 71:15 self-contained 6:9,11,21 7:20 7:22 51:8 54:2 self-rescue 6:10 7:22 self-rescuer 22:6 self-rescuers 24:9 51:8 54:22 55:5 sell 72:1 Senate 50:14 57:22 Senators 50:20 sending 11:15 sense 29:20 40:22 52:2 sent 30:21 separate 56:15
---	--	--	--	---

serve 47:3,20	side 27:2,2 33:7	solution 12:6	speed 11:16	74:14
serves 47:2	49:23,24 76:12	18:8 19:6	spell 17:6 26:19	steps 68:9
session 9:10	sides 76:9	21:14 35:12	34:11 55:17	Steve 2:8 3:20
55:15	signal 64:14,17	36:13 38:15	spend 11:1	76:6
set 11:21 62:11	signed 8:21 9:3	42:15 43:4,16	13:13	sticker 59:23
62:13 66:11	17:3	65:2 68:17	spent 10:18 62:5	sticking 35:8
70:10	signed-up 43:20	69:4 70:1,19	71:22,23 76:9	stop 63:15
set-ups 12:13	significant	70:20 75:3	spinning 59:18	stopping 24:17
setting 70:8	33:12	solutions 5:3,21	spring 11:1	24:21 30:17
settings 53:22	simple 29:10	6:1,14,19 35:4	staff 15:5,11	stopplings 36:3
shape 37:13	simply 20:10	35:9,20,20	stage 22:16	storage 39:14
share 19:15 40:3	22:24	36:3,5 37:4	stakeholder 3:9	strata 64:18
61:16 77:3	single 69:4	39:9 41:19,20	8:7,11,18	strategically
sharing 43:22	sir 55:16 61:13	41:23 44:3	stakeholders	54:23 55:5
sheet 9:3	sit 50:15	62:6 70:19	4:19 7:11 8:2	strategy 6:22
Sheila 2:4 3:4	sitting 64:20	72:3	stakeholders'	11:21 23:13
9:9,11,16	67:5 71:13	somebody 47:21	1:5 4:23	stressed 68:13
16:20	76:10	65:18 68:6	stand 59:21	structural 20:16
shelter 5:23 6:2	situation 5:12	somebody's	standard 16:11	25:19 27:3,6
6:6 46:18	13:10 35:21	49:24	52:24 53:19,19	30:14 31:1
54:24 55:4	47:4 50:4	somewhat 42:16	68:18 70:9	33:8,14 68:8
57:7 62:19	situational-sp...	soon 30:2	standards 3:5	structure 17:23
63:2 70:15	68:16	sooner 63:4	25:8 37:6	30:13 76:1
shelters 6:20 7:3	situations 38:20	72:11	70:10 75:17,22	structures 7:5
7:7,16,18 8:6	52:22	sort 73:20 74:5	standpoint	74:15
25:8 45:6,22	six 4:18 9:17	77:17	52:17	stuck 47:21
46:24 47:7,23	10:6 32:6 49:9	sound 29:12	stands 37:15	study 19:22
60:6 62:12,15	62:1 73:6 74:1	sounds 56:4	start 67:10 73:4	stuff 60:23 61:9
62:21,23,24	76:19	space 5:14	started 27:5	63:16 65:5
67:14 68:7	size 41:4 58:9,15	speak 6:10 8:20	62:10	69:7 71:6,13
shelters/cham...	65:13	8:22,23 11:17	stashes 71:15	72:20
46:9	sizing 39:14	37:22 44:1,4	state 26:19	style 25:11
ship 67:10	41:4	52:5 55:15	34:11 55:16	subject 3:12
short 54:20 74:6	skill 79:7	speaker 17:4	61:20 71:17	submit 4:13
74:11,16	small 59:13	26:15 43:21	79:1	8:16 17:10
showed 58:1	65:16,24	speakers 2:9	statement 43:23	40:10,12
shown 20:18	smart 49:11,17	8:22 17:3	75:21	submittal 33:22
shows 40:5	53:15	speaking 17:18	statements 8:14	submitted 22:18
shrunk 32:2	smarter 49:6	specific 19:11	stations 6:21	success 49:9
shuffled 72:24	smile 71:14	31:7 35:19	7:21 20:14	51:20
Shumaker 2:7	smoke 15:2,3,10	36:14 38:17	21:1	successful 35:4
3:19 26:8	15:14,23 58:17	specifically	status 6:22	sufficient 5:22
30:12,16,20,24	62:18	36:10 37:22	stay 13:15,16	sufficiently 24:6
31:3,6,10,13	SOL 9:12	38:1	steel 7:5 28:9,11	suggest 36:7
60:21,24 66:13	Solicitors 3:21	specifics 31:18	29:4,5 69:8	suggestions 77:6
76:23	solid 71:17	speculate 45:11	step 16:13 47:18	super 52:14

super-longwall 12:14 52:13	74:15 75:14	tech 9:12 24:21 41:24 61:20	26:10,12 30:7 30:8 34:8,9	28:21 30:6 33:4,9 34:22
superior 7:4 24:3	systems 9:18 12:18 13:23	technical 3:20 45:2	38:22 43:18,19 52:10 55:12,13	35:2,10 36:2,4 36:13 37:18
supplemental 39:14 40:1	16:15 18:20 23:23,24 24:1	technological 4:20 8:5 75:9	55:16 60:8 61:13,14 76:22	38:11,12,20,21 39:5,8,13
supplies 24:10	24:12 27:12 28:5 39:13	technologies 7:24 10:22	76:23,24 77:1 77:2,23 78:6	40:23 41:2 47:1,19 48:11
supply 5:22 23:23 24:1	42:1,3 48:7 63:22,23 64:4	18:3,13 21:23 21:24 22:8,13	thanks 9:9,9 theirs 65:14	48:14 49:11 50:6,7 51:14
32:11 41:1 51:2 59:2,9	65:10	22:15,23 24:5 25:23 75:7	they'd 27:19 thing 22:12	51:19,21 52:3 52:16 53:14,17
supplying 12:7 39:1	T T-O-D-D 55:24	technology 4:2 6:23 8:1,3	33:12 45:18 46:5,23 50:12	53:23 54:6,10 54:15,17,22
support 3:20 9:12 24:21	take 12:21 13:19 16:13 25:1,2	21:11,12 22:6 27:14 30:22	51:18 53:7,23 54:10 55:20	56:6 57:2,4,11 57:18,23 58:1
25:22 41:24 61:20 71:4	33:19 40:23 43:13 47:4	60:3 61:3 75:5 75:23 76:2	56:2,9,10,11 59:15 62:10,23	58:5 59:12,13 60:3,4,12,15
supported 20:7 39:2	48:23 53:19 72:8 74:13	tell 14:21 15:7 15:13 69:14	66:23 69:9,13 70:2,15 72:12	60:17 70:12,22 73:18,19,24
supports 29:23	78:3 taken 1:14 79:5	70:6,7,11 74:9 telling 71:11	things 11:9 13:17 14:16	74:4,8,13 75:20
supposed 54:3	talk 14:16 27:1 31:8 34:4	tells 10:2 59:23 ten 44:18,19	16:6 18:12 25:1 27:13	think's 29:14 thinking 32:18
sure 14:7 21:9 21:13 22:5	40:16 45:2 51:22 53:5	59:12,19 60:2 60:2 62:2 65:6	28:16 29:1,21 30:3,6 33:3	third 10:14 thorough 30:4
26:21 30:4 33:18,22 42:13	57:20,21 61:22 62:23	ten-year 76:6 tent 7:5	34:4,22 36:7 36:14,18 37:14	thought 11:13 27:14
51:4 67:2 70:3	talked 57:21 63:1,19 73:20	terms 9:24 23:12 32:19,23 38:24	37:24 39:4,17 39:24 40:2	thoughts 77:4 77:16
surface 32:13,17 47:14 48:16	talking 15:18 27:17 33:5	40:21 44:2 52:13 73:22	41:18 45:3,5 52:3,5,12	thousand 7:10 20:14 39:19,20
49:5 57:5	40:17 56:3 58:7 65:3	terrain 57:9 test 11:3 51:19	54:14 56:5,16 56:20 57:10	43:13 thousands 64:10
surface-suppli... 7:17	68:15 69:5,9 70:21 71:12	58:8 tested 29:13	58:18 67:7,18 67:19 68:22,23	67:17,19 68:19
survival 5:3 9:22 11:22	75:22 tall 28:12,13,13	46:2,7 61:7 testimony 26:11	72:18,19,20 73:7,18 74:22	68:23 threat 37:10,11
19:24	tanks 65:21 taught 45:14,16	77:5 testing 51:20	76:19 think 12:5,13,15	37:12 three 15:12
survived 46:11	45:18 team 10:23	68:2 tests 37:23 39:18	12:21 13:2,17 13:18 16:6,10	56:13 71:20 throat 65:6,16
suspect 38:5	51:12 71:2,4 teams 11:2,8	tethered 15:10 thank 3:15,24	16:13 18:11 21:15 22:1	65:18,22 66:3 Through-the-...
sustain 29:15 37:18	27:19 47:20,22 71:3	17:1,2,8 21:17 21:18 23:8	23:6,14 24:2 25:6,17 26:2,3	59:17 60:4 61:7 64:6,23
system 10:11 12:22 14:18	tear 58:2			throw 52:2
16:3,4,10,11 19:12 23:16				
24:16,22 28:2 32:12 41:3,9				
42:19 43:5,8 56:22 64:11				

time 9:14 10:18 11:6 13:13 14:1,11,11,14 18:21 20:18 25:2,4,21 27:22 38:14 43:12 45:6 49:9 52:4 62:5 66:11,17,20,24 67:7,13,20 69:10 72:9,13 72:21 73:17 74:6,16 75:16	transcribed 79:6 transcript 8:11 transcription 79:8 travel 53:13 54:1 traveling 20:21 tremendously 56:8 trench 41:10,16 trip 25:2 trouble 63:23 true 58:22 trust 56:23 try 5:10 40:12 74:16 trying 15:13 16:1,18 36:5,9 36:12,22 37:18 52:20 62:5 64:14 turn 16:20 21:19 42:8 45:20 69:3 turns 15:14 Turow 2:8 3:20 40:16 75:19 twists 15:14 two 5:19 8:12 11:23 14:24 15:11,19 16:6 29:22 37:13 56:13 58:11,13 61:17 65:10 73:13 two-way 6:15 44:2 type 7:4 31:19 37:7,16,17 38:7 39:22,23 41:13 53:6 59:9 types 4:21 38:1 39:24 41:7 typical 36:16,19 38:6	typically 37:9 <hr/> U UBB 10:5 47:5 ugly 63:10 Uh-huh 30:19 31:2,5 unavailable 5:24 underground 1:7 3:10 5:4,9 44:17 49:21 62:16 63:17 64:4 underneath 41:17 underscore 5:6 understand 14:17 15:4 28:22 36:9 51:23 understanding 14:8 understood 15:17 unilaterally 19:8 uninstall 32:4 unit 53:22 57:23 58:6 59:13 66:1 United 44:14 units 46:2,7 47:16 48:2 50:8 51:22 54:8 57:23 universal 66:3 68:18 University 26:24 34:16 upcoming 19:8 Upper 46:6,7 use 4:22 6:5,19 6:24 7:1,3,16 9:22 18:6 23:23 24:8 41:13 42:19	43:4 44:5 48:1 48:24 49:20 50:7,9,21 54:3 65:21 74:16 uses 22:6 utilize 47:22 49:2,4,5,12 utilized 59:8 utilizing 48:12 <hr/> V vaguely 31:17 Variances 3:6 various 22:18 varying 38:1,4 41:12 verify 11:12 version 9:1 versus 44:3 viable 38:15 victim 10:9 videos 34:2 view 69:17 72:10 Virginia 1:10 61:21 79:1 vital 21:4 voice 79:6 voted 62:8 vulnerable 56:21 <hr/> W waiting 11:11 waive 19:8 wall 24:23 27:6 27:10 28:1,9 29:2 31:19 33:15 36:3 42:20,22 43:4 43:14 57:17 walls 24:21 27:10 35:7 69:6,6,10 Walters 10:5 want 5:6 17:12 18:12 19:12	22:12,13 29:24 30:4 32:9 47:23 48:21 57:21 59:15 75:21 76:4 77:22 78:2 wanted 28:6 52:1 73:21 wasn't 44:21 61:22 62:4 70:1 waste 27:22 water 56:19 64:20 way 18:18 23:3 23:6 24:22 25:10 53:22 55:20 57:3,19 65:17 70:14 72:19 74:4 76:4,13 ways 49:19 57:12 62:6 we'll 3:2 70:7 we're 10:16 11:14 13:4 14:22,22 15:10 16:17 24:16 26:2 29:21,22 30:5 31:23 35:24 36:9 37:10,11,17,23 37:24 38:3,10 40:1,6,13,17 46:14 48:6 59:18,19 60:2 60:4 62:7 63:5 69:22 72:9,12 72:13,15 74:8 74:15 77:4 we've 9:19 10:21 10:22 11:10 12:3,6 13:10 21:10 25:1 27:11 28:8,14 29:12 34:19
---	---	--	---	--

39:18,19,20 56:2,12 62:2 70:1,16 71:23 73:24 74:2 weak 29:12 weapons 71:1,4 wear 36:16 37:16 54:2 59:23 65:7 wear-and-tear 36:19 wearing 6:16 website 4:15 8:12 week 11:1 14:24 weeks 8:12 10:6 14:24 weigh 67:18 welcome 3:14,22 went 9:18 12:19 62:19 69:13,14 70:4 71:4,6 Wes 3:19 26:7 55:10 60:20 67:1 Wesley 2:7 West 1:10 61:20 79:1 wheels 59:18 wider 13:9 widespread 18:22 19:16 Wilberg 10:7 willing 17:24 25:3 40:3 65:22 window 27:12 windowpane 28:11 wire 14:12 wise 54:1 wish 8:13 9:23 wishes 77:21 wit 79:2 withstand 49:14 53:6	work 9:10 10:2 11:2 13:22 16:16 17:18 18:1,17,19,20 19:20 21:9 22:12 23:13 26:2 38:12 43:1 48:9 51:6 51:9 52:5 57:3 58:14 68:3,18 73:7 worked 17:13 28:2 49:22 60:12 65:5 Workers 44:15 44:19 45:6 working 7:8 9:13 14:5 17:19 21:3 36:3 37:24 40:1 46:16 48:5 61:3 62:1 62:2 65:4 72:8 works 63:9 64:6 world 45:14 worrying 58:9 worth 64:24 73:13 would've 20:3 46:3,11 47:7 66:15 wouldn't 21:14 56:24 73:15 writing 79:6 written 8:13 33:22 40:13 73:16 X Y yeah 15:21 32:9 32:21 33:9 39:5 40:12 42:24 52:12 53:3 60:11,24 61:10 73:9	year 10:8,9 42:7 42:10 73:2 years 4:18 10:19 23:2 27:5 44:16,19 45:17 59:19 60:2,3 62:1,2 65:6 73:6 74:1 76:10 years' 9:17 yelling 50:1 Z 0 0-15 28:19 1 1 45:6 1,000 19:23 20:2 10 39:19 100 28:20 12 31:21 39:19 42:5 15 28:17,19,24 29:15 30:16 35:6 36:3 37:11,11,12 49:14 52:24 16th 4:12 77:11 78:3 18 42:5 73:2 19 1:16 1950 71:16 1st 25:20 2 2 28:17,19,23 2,000 19:23 20:3 20 4:9 39:20 44:17 76:10 20,000 12:14 2009 4:18 2013 4:8 66:13 66:13,14,15,18 2015 1:16 4:8,12 79:11	2016 66:8,11,12 2018 14:3 17:23 18:4 19:2,7 21:22 24:7 30:14 34:23 38:13 40:17 66:7,20 67:9 68:3,5,11 74:7 74:12 2019 25:20 25 39:20 26 40:18 26th 79:10 2nd 4:8,18 3 30 29:14,15 59:5 75:22 30-inch-dia... 29:8 31st 17:23 18:4 19:2,7 24:7 4 40 44:16 45:17 41 28:12 43 28:13 48 31:23,24 32:1 5 5,000 19:19 20:21 50s 71:24 6 60 54:3 7 7 20:16 25:19 71:23 7.510 75:22 71 28:13 8 8 71:23 8th 4:8 9	90-degree 41:17
--	---	--	--	------------------------