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I certify that I have read the transcript for the March 30, 2007, meeting of the Panel, and that, to the best of my knowledge, this transcript is accurate and complete.

Linda Zeiler, Designated Federal Officer

Dr. Jan M. Mutmansky, Chair

TRANSCRIPT OF PROCEEDINGS

IN THE MATTER OF:)
)
TECHNICAL STUDY PANEL ON THE)
UTILIZATION OF BELT AIR AND THE)
COMPOSITION AND FIRE RETARDANT)
PROPERTIES OF BELT MATERIALS)
IN UNDERGROUND COAL MINING)

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UNITED STATES DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

IN THE MATTER OF:)
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TECHNICAL STUDY PANEL ON THE)
UTILIZATION OF BELT AIR AND THE)
COMPOSITION AND FIRE RETARDANT)
PROPERTIES OF BELT MATERIALS)
IN UNDERGROUND COAL MINING)

Glenwood Room
Holiday Inn
Pittsburgh Airport
8256 University Blvd
Coraopolis, Pennsylvania

Friday,
March 30, 2007

The parties met, pursuant to the notice, at 9:08 a.m.

BEFORE: LINDA F. ZEILER
Designated Federal Officer

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P R O C E E D I N G S

(9:08 a.m.)

MS. ZEILER: Good morning. We are very pleased this morning to have Dr. Raj Ramani here to speak to the panel about the 1992 Belt Air Advisory Committee Report. He is a Emeritus Professor of Mining Engineering at Penn State University. Dr. Ramani.

DR. RAMANI: Thank you, Linda, and thank you members of the panel here. I see almost everybody, and some I have known for over 20 years here. The Chair and I were at a meeting a couple of weeks ago and he asked me to talk about mining. Between the two of us, we know about mining for a hundred years.

MS. ZEILER: Dr. Ramani, if you could turn on the wireless microphone.

DR. RAMANI: Yes. And so that brings me to this belt air discussion, and as I was saying, this was a meeting of the U.S. Bureau of Mines in 1968 in the Interior South Building in Washington, when there was discussions taking place on the 1969 Health and Safety Act.

And some of you may know Dr. Stefanko, who was the head of the Department of Engineering at Penn State at that time. He was one of the panel

discussing the safety issues in mining, and discussing the issue of the regulation provisions and the provisions of the trolley entry ventilation and belt entry ventilation.

And Dr. Stefanko's background comes from working in mines in Pennsylvania, where belts were always isolated.

The provision of the Pennsylvania Health and Safety Regulation with regard to ventilation is in 242(c), which basically says that belts will be isolated, and the quantity of air sent through the belt will be adequate to dilate gases and dust, and then that is the end of the provision of the law.

Subsequently, when extensible belts came in the Pennsylvania law revised it in 1971 to exclude belts from -- extensible belts from those kinds of regulations.

In any case the discussion was along those lines, and so when the first belt air panel was appointed, and I was asked to be a member of the panel, it was -- and once again going back to this familiar subject as to belt air ventilation, and ventilation provisions, and by that time I had started work on mine ventilation, and mine ventilation morals, the air flow through mines.

And the design of mines had seen the growth of longwalls, and the discussion on two, three, four entry longwalls and where belts should be placed and all that.

So the first belt air committee, when it was appointed by the Secretary of Labor, he said what do you want to do this year, and he says -- I hope it doesn't go to sleep that often.

(Laughter.)

DR. RAMANI: So, as to the belt air committee, it was appointed, and Lynn Martin, the Secretary of Labor at that time, appointed this committee and the committee was announced to be a nine member committee, and I think MSHA committees, or Department of Labor committees in those days, two Labor representatives, two industry representatives, and five representatives with no economic interests, neither affiliated with labor or industry.

The committee was constituted and at our first meeting, we found out that the UMWA withdrew their representation on the committee, and we eventually ended up with eight members on the committee.

And we met for 14 days over a six month period, and we had several sources that came and gave

us testimony. We visited Jim Walters -- I think Mine Number 3 -- in Birmingham, where they were using the belt air and they had an automatic monitoring system.

They had an atmospheric monitoring system in the mine also. So then we produced a report. The committee itself was chaired by Dr. Mary Jo Jacobs. She is a physician, and a public health person, and with a lot of experience on industrial health and safety.

Dr. Ragula Bhaskar was at that time an Associate Professor at the University of Utah. Shirley Clark was a representative of Labor, and Ms. Clark used to work for the Twentymile Mine at the time, and some of you may remember Diane Doyle, who was I believe the ventilation and dust group in the former U.S. Bureau of Mines.

Jack Holt is now the vice president for safety, and at that time, I think he was also vice president for safety at CONSOL. I represented Penn State as an academic, and Dr. Saperstein was from the University of Kentucky, head of the department there.

And Jack Stevenson was working for Jim Walters and Associates. Jack Holt and Jack Stevenson were the two industrial representatives, and because we had only one representation from the union, Jack

Stevenson was a non-voting member, and we called him an alternate member of the committee. So recommendations and awards were all on the basis of these seven persons.

And this was the committee, and this was also my first exposure to what I will call a committee meeting in open discussion, and there was no discussion and there was no writing that was done in private.

While we may write things for committee members' discussion, those writings were discussed in public. Anything that went into a report was thoroughly discussed not only among the public, and not only among the members of the panel, but also by the public, and they had an opportunity for input. So that was a very interesting process for us, and we went into that process in great detail.

Our charge was rather very simple, to review MSHA's belt air proposal, because they have a proposal at that time out on the street, and related provisions and other technical data, and we had to come up with three things; conditions under which belt air can be safely used as intake air courses to ventilate working places; minimum velocities in conveyor belt haulageways; and ventilation of escapeways.

So really the committee was given what I will call three specific topics, though the first one said review, including related provisions and other technical data.

And that's where the committee not only looked at those three, but looked at a number of other issues as well. One of the first things that the committee did, and we spent quite a bit of time on this, was the identification of key issues associated with the use of belt air on the face.

And this was done in prior communications with MSHA and the MSHA officer in charge, and I think the MSHA officer in charge at that time was Ed Miller. He was in Washington in the technical support group. I remember that Linda was associated with the work that we were doing at that time.

There was quite a bit of staff, about six or seven people who worked with us all the time, and basically by the time that we had our first meeting, we had a good idea of what the issues were, and of course the issues were presented in a meeting like this, and the public had an opportunity for input to our discussion.

But basically we identified the health and safety issues as to the use of belt in working places.

The health issues basically concerned, let's say, things like dust. The safety issues concerned fire, and productions of combustion moving down, and things of that type. So there was little bit of discussion on those.

We had coal mine fires, and safety with particular attention to belt entries, belts, firefighting plans, and these are some of the things that we thought were safety issues.

Other issues were atmospheric monitoring systems, sensors, reliability, alert/alarm levels, because the committee thought about some of the things that may be described as the use of belts, and if there were safety and health issues, and what should be monitored.

These mine ventilation systems and escapeway design, and alternate escapeways, and escapeway integrity; will the escapeway continue to be an escapeway in the event of an emergency was a question that we thought was key, and that needed to be addressed by the committee.

Education, training, and management, and looking at what is happening worldwide, in terms of, let's say, monitoring systems, and in terms of belts, and in terms of ventilation, dust control, and all of

those things, and other areas that will apply to this committee.

This was principally the issues that we developed, and that became the focus for our discussions in subsequent meetings. So our first meeting was really spent on organizing ourselves together into a group, and looking at the issues, and defining the issues, and deciding how we want to move forward as a committee.

I don't think the issues today are much different than these same issues, in the sense that often times I look at issues like -- well, they get more defined, and clearly, and probably technology advances to a point where some of the issues need not be addressed anymore, and some issues can be addressed more effectively because we have technological developments.

And finally there is always the need for research in some of these areas. So I personally think that while these issues were issues, say like 15 years ago, when this committee met in the 1991 and 1992 period, that there were issues, when say like petitions for modifications were issued. I don't know when the first petition for modification was issued, but it was something like '75 or '76, or something

like that. Same period.

And '79 was the first modification, and it was proposed by Island Creek for ventilation, for air ventilation purposes, and the adequacy of air quantity and all that.

So you can see that the issues continue to be the same way as before. The resources for the committee were very extensive. Probably the background materials, or a lot of background materials -- you know, hearings. MSHA had at that time had a belt ventilation review -- belt air ventilation review report out that MSHA had prepared, and that was a very useful report.

We went through the report, that MSHA had produced -- they had gone and produced about 12 or 15 different regulation plans that were actually in use, and they had done the surveys, and looked at the quantities of air in the belt air, and had looked at leakages from belt air into intake air, and intake air into belt air, and belt air into returns.

And they had certain conclusions and findings that were very useful, and proposed regulations and record of hearings, because there were proposed regulations and there were public hearings, and UMWA had made a lot submissions and presentations

on these records of hearings, and proposed regulations, and they were made available.

Several investigations and personnel from the U.S. Bureau of Mines and MSHA, on various topics, like ventilation, fires, dust, belt materials, the air velocities, and they were all presented to us.

Other experts from industry and government agencies, and health versus safety, and things like that; dust, escapeways, two-entry development, and three-entry development, and the escapeway provisions under very restrictive conditions, and how can they be accommodated.

In fact, Fred Kissell, Dr. Kissell, was the representative from the U.S. Bureau of Mines to the committee, and I see Chuck here, and Chuck made one of the presentations to the committee on fires, and belt materials, and smoldering.

And Lazzara and Litton, if I remember right, were the -- Litton was the partner in the crime, in terms of spacing of sensors, and transport of materials to the sensors, and all of that on which the committee had to base some very important positions as to spacing between sensors and all of that.

We had panels, and we had individual manufacturers come and talk to use, and we thought

that we should hear from five or six manufacturers of, let's say, atmospheric monitoring systems, and the AMS manufacturers, and conveyor belt manufacturers, and people like that.

And they formed a panel, about five of them, and similar we had belt manufacturers -- Goodyear, and people like that -- and they came as a group, and they talked about what the status of technology is, and where it can be going.

So you can see that there were a lot of resources for the committee, and we ended up with a lot of materials. The committee in total made about 12 recommendations, and these recommendations can be organized in terms of how they address the three charges to the committee.

Now, when I was invited to give a talk here, Dr. Mutmansky asked me what he wanted to hear from me are what are the recommendations, and how do we reach those recommendations.

Now I would very much suggest that if you take a look at the belt advisory committee's report which was put together by the committee, we go through these recommendations in great detail, and give you an issue, a rationale, and some of the discussions that took place.

It is a very faithful reflection of what happened, and how we reached our decisions, and as you can see, it was an open meeting, and there were questions that were brought up by the representatives from the audience, and the committee went into a discussion, a table discussion of that recommendation, and looked at whether it should be considered or not.

I think that you were there in some of those meetings at that time, you know, when you were discussing about longwall and escapeway ventilation. So, charge one to the committee was really conditions under which belt air can be safely used as intake air courses.

The committee just said that belt air courses can be safely used as intake air. I am going to go through each of these in detail, but this was more of a finding than a recommendation. Several conditions were specified for such use, and out of the 12 recommendations that the committee made, you can say that six or seven of them dealt with this particular recommendation.

Once the committee decided and found that belt air can be safely used in the face areas or otherwise belt haulage courses can be intake air courses, then it went into those conditions, and that

is where I think the high level of resources that was available was very useful to make some of the points.

Recommendations summary. This charge two was ventilation velocities in the belt entry, both minimum and maximum, should contain methane and dust levels in belt entries to below those specified in the standards, and prevent methane layering.

Now, the key factor there is that the first part of this is obvious. You cannot have a mine without those things being met. So one of the things that we said was in belt entries, these were not applicable, and finally with regard to methane layering, there was some question, and the last issue is sufficient to prevent methane layering.

And methane layering is a tricky issue, in the sense that the phenomena itself, while well known, the manner in which it developed, and the manner in which the layers were transferred from place to place, and what kind of velocities is unique, and very difficult.

So there was some considerable discussion on that, but we developed two recommendations, because we talked about minimum and maximum velocities, and these had to be considered in terms of the transport of combustion products, and at the same time, the

dilution of methane and dust and the prevention of methane layering.

Finally, **regulation systems**. This was with respect to escapeway design. If there was one topic which presented a lot of difficulty to the committee, this was the escapeway design.

There were a lot of issues that the committee addressed, and if you take a look at the recommendations when we come to the discussion of these recommendations in detail, you will probably find that the committee spent a tremendous amount of time saying that escapeway design is a lot more than using belt air in the face.

That is a much bigger problem in terms of mine ventilation system design. So ventilation systems should be designed and maintained to protect the integrity of the mine atmosphere in the primary intake escapeway.

That is -- and basically if you want to say what was the committee's recommendation, the committee's recommendation was what other way in which the intake escapeway is designed, and there must be someway of ensuring that the intake escapeways are designed and maintained to protect integrity of the mine atmosphere and it is preserved, and that people

will be able to when they take the escapeway walk out of the mine.

It should not be compromised, and that is at least the plan, the design, and how it is compromised, and what happens is something that is a practice, but the design itself should ensure that the integrity of that must be preserved in the event of an event happening.

And what we meant by that was a positive pressure differential should be maintained from the primary escapeway to adjacent entries to the extent feasible and practicable.

So you can very quickly see that what we are talking about here is really not the belt entry. This recommendation, while it is in the belt entry study, and because we are asked to talk about escapeways, it really talks about the design of the escapeways.

And belt entry, if it is used as an intake, may have different ramifications with belt entry not being used as intakes. That is the key difference there. It is the intake escapeway design, and that is the focus of this recommendation.

And we have two recommendations that specifically address the escapeway issues. My objective here is to go through the recommendation

summary, and then go through each recommendation in detail. And then we will open it up for questions and answers or for discussion.

Two recommendations that the committee, and which we were not asked to do, you know. This is where you get some coupons, some benefits of appointing a committee. You get what you don't want. So we recommended two recommendations to MSHA, okay? And we said we are just going to throw this in, okay?

MSHA should develop standards for testing and approval for a couple of things, and so we just pointed out that those are important things. And you put a few academics on a committee, and they can't get away from research.

So we had a few recommendations for research. We said that there are a number of areas where you have to do some research, and again I don't want to go into this in detail, but as you can see, the communications research will always continue to be there.

But this was a case of hardware and software development at that time. But what happened recently at SAGO, or what happened during some emergencies, still points out that even with the improvements in communications that you still have issues with both

the hardware and the software, and that these were areas which we recognized it 1989.

I served on about three different committees. One committee I served on was in 1979 for the National Academy of Engineering looking at the Bureau of Mines research on rescue and recovery, and our recommendation was that there was a need to double up the improved communications system.

Then in 2002, when I was doing another National Academy of Engineering study, which looked at what are the things that mining needs desperately to improve health and safety in mines, the National Academy said communication was a weak link.

Then I was the chair of the Quecreek Mine Inundation Committee for the Governor of Pennsylvania, and when we look at what happened, and when you didn't know for 72 hours whether these guys are alive or not, there should be some way of establishing communications with people who are trapped underground to let us know that they are alive.

Once water covered up that drill hole, there was no communication between the miners and the surface. So communication research, we realized, is difficult, and request for hardware to improve the reliability and availability of the system, and then

after having a good system, it is a question of software.

How do we develop systems by which people know what they are communicating is really a good communication. So this research continues to be a key compliment of mining research. Not only mining, I think, but in fact research in general. That people should understand what is being said

Belts in returns were one of the items that was mentioned, and pressurizing primary intake escapeways, and this was our major recommendation, and so there was research needed. And finally when you have diesel, and when you have fire, then how do we distinguish between, say, the background conditions and normal conditions.

A lot of these things were addressed by researchers over the years. So this basically is what the committee did, and we met, I think, six times, and we went to various places -- Lexington, Birmingham, Salt Lake City, and we were in Pittsburgh, and then we had a couple of meetings in Washington, D.C.

I think the present committee plans to visit some of these places again. These previous visits were very, very useful because the people in the community can come, the nearby mining committee can

come and give their presentations.

In Salt Lake City, we had presentations on two-entry systems, and longwalls, and issues that were not so prevalent, say, in the east. So the first issue, the charge, the committee really said before we go ahead and say what the conditions are, let's ask the question can belt entry be used as an intake aircourse.

That should be the first question that we want to answer, and then if yes, then what are the conditions that must be met, and so we went into a discussion on can belt entry be used as an intake aircourse.

And there were a number of rationales presented. You know, like the belt ventilation, and the MSHA report prepared by the committee was very useful. Looking at the data there, in the experience of the mines, they had lived with this regulation for about 20 years before we had the belt air committee, and there were petitions for modifications approved and mines were using this.

And looking at some of the systems that we looked at, a complete isolation of the belt entry itself has never been proven successful. The air has escaped from the belt into the face, or belt air has

leaked into other entries, or the air has leaked into the belt entry from other entries.

So the objective of the regulation was not being met. That was the conclusion of the committee. So a regulation on the books whose objectives cannot be met fully by everybody, maybe there are other ways to handle it, and that's why we were looking at petitions for modifications, or looking at the belt ventilation review report.

And looking at some of the mine ventilation plans, and looking at all the presentations that were made, the committee concluded that belt air can be used as an intake air course, balancing the health aspects with regard to dust, and safety aspects with regard to transport of fire combustion products, and things like that.

And the impact of anything happening on the belt entry and how it may affect other intakes, because that's really what it is. In our escapeways, we will have one of the primary escapeways as the intake escapeway, and how are we going to be affected if these intakes are connected.

Then we went into the question of what are the conditions that must be met, and that's where the committee did not assume that the belt air can be used

safely as an intake aircourse for ventilating working places. We didn't assume that.

We left the question open and that was the first question that the committee addressed. If we had said no, then there was no need to continue any further. So once that question was answered yes, then the question is what are the conditions to be met.

Now what I have done here is I have put 1/1, and it is recommendation one on issue one. Issue One is your belt entry -- conditions under which belt entry can be operated, and as you see here, belt haulage entries can be safely used as intake aircourses to ventilate working places provided additional safety and health conditions are met.

And this is a finding and current systems are inadequate to meet the goals of regulations, belt air into face, and combustion products in belt entry can enter the face, and that is one of the issues that we addressed.

We looked at the belt entry ventilation reports, review reports, and we had transcripts, and hearings, and we looked at the comments. And there was a lot of background, with the committee concluding that belt entries can be safely used as intake aircourses.

So that brings us to the conditions, okay? So this is recommendation number two on issue one. When belt entries are used to ventilate working places, one of the additional requirements is the presence within the belt haulage entry of an early warning fire detection system.

So one of the things that the committee said is one of the most important things that we are concerned about with belt entry is belt fires from statistics that were presented.

You know, they occurred rather or more frequently than other fires in mines, and belt entry can be a source of fire, and if you have a fire in the belt entry, and belt entry is used as an intake aircourse, the combustion products are going to transfer to the face.

So we need an early warning fire detection system, and that was the key purpose of this recommendation, and quickly we converted to the early warning fire detection system as an atmospheric monitoring system.

And this atmospheric monitoring system would have an automatic transmittal of the information to the surface, with alarms to the face, and things like that, and we can talk about all of those. But this

was the key -- what I will say as the key recommendation for using belt entries as intake aircourses.

Several specific guidelines were developed by the committee, and I have to say that when the committee started working, MSHA at that time, if I remember right, had something like 60 or 70 petitions for modification approved.

So there were a lot of requirements that MSHA had already put on these petitions for modification. And the committee looked at these petitions, and added some more of its own provisions, and came up with about fourteen guidelines.

The committee came up with 14 guidelines and these were basically as you can say as topics. I really don't want to go into great detail on each of these because this is all documented here, and they all tell you what these things are, and you can go and take a look at it in more detail.

Actions before the use of the belt air, and that have to petition, and as you petition, you provide what are the various things that you will need.

Capabilities of the atmospheric monitoring system, and what it can do. Minimum velocity and

location of sensors is basically what is the minimum velocity that you will have in the belt air, and what is the distance between sensors.

Section alarms. A responsible person at the surface, who should be responsible, and what are their duties, and things like that. What should the people, the miners underground, do upon alert/alarm activation once it is activated.

What should the actions of surface persons be when the alarm or alert is activated. So you can see that the committee went into great specifics as to what needs to be done. Some of these were already in the PFMs, and some the committee discussed and said we should add.

How can we minimize the nuisance alerts. What are the fire fighting and evacuation plan contents and records. Now, we don't operate in a static environment. I think that about two years ago, MSHA proposed a new fire fighting response or emergency response plans.

So when we are looking at these things, we looked at what was then present and said a few more things need to be done, and I think in 2005, if I remember right, there was a new fire fighting and evacuation plan that was proposed, with new training

requirements, and new people, and new responsibilities, and things like that, which become applicable now.

A lot of attention was spent towards the atmospheric monitoring and calibration testing, examinations, and records, and how can we minimize the malfunctions, and how do I identify it, and what should be there in the mine ventilation map, the quantities, the escapeways, the sensor locations, and things of that type.

Some discussion on smoke sensors and slippage switches on belt conveyors, and backup communication if the main communication fails. What should be the backup communication.

So you can see that we spent a lot of time on not just atmospheric monitoring systems. We said that we need one, but we want to make it more effective than before.

And the things that need to be considered for that atmospheric monitoring system of these 14 different items. Now some of the recommendations specifically address more and more of these issues.

So this is a three part recommendation, and recommendation number three, which again goes along with belt air can be safely used in the faces -- you

know, belt aircourses can be used as intakes -- was training, and this is a three part recommendation dealing with the training of mine personnel on an early warning fire protection system.

And we said that the three groups that are to be addressed in this recommendation are the miners, the people who are responsible for the installation, maintenance, and operation, and inspection of the AMS system; and the early fire warning; and finally the atmospheric monitoring system operator responsible for monitoring the system and initiating the fire and evacuation plan.

So we said that the person who we appoint as the operator; this person should be responsible for monitoring the system, and initiating the fire fighting and evacuation plan.

So you are just not an operator, but also you had the responsibility for communicating the nature of things to people everywhere. MSHA should by examination -- and there was a lot of discussion on this one -- assure the competency of the AMS operator. **Competency by examination.**

We suggested to not give a person a certificate saying that he has attended the classes, and performed satisfactorily. Have an examination and

ensure that the candidate has passed the examination, and that is a certificate of competency.

And we find a lot of certificates hanging on the wall, or attended a class, or this or that. But here we wanted an examination on a specific topic, which includes I think some of the things that we are talking about here.

There was a lot of discussion on this, a lot of discussion on competency examination of the AMS operator. When miners are underground an AMS operator must be on the surface within sight or sound of the surface control station.

So we had certain provisions with regard to education, training, and certification of personnel, who will be affected by the use of belt air in the face, which will require the installation of an AMS.

This minimum air velocity, which goes back to recommendation number four, supporting issue number one, is in mines using the AMS as a condition for using the air in the conveyor entry to ventilate working faces, the minimum velocity of air in the belt entry should be 50 feet per minute.

And basically this was based upon conditions under which a fire can start. You know, heating starts, and heating gradually, and with inadequate

ventilation, it increases the temperature, and the temperature, in-turn, increases heating; and heating, in-turn, increases temperature, and all of a sudden you have a fire.

And that kind of thing, and how long does it take from the initiation of heating to start up a fire? Going through the notes, I think that I didn't look at the original paper of Lazzara and Litton, but it was about 14-1/2 minutes if I remember right.

And then if it takes 14-1/2 minutes from the start of heating to a smoldering fire, then you also look at if you have a sensor, and these sensors are 500 feet apart.

And the fire starts somewhere say at the 499 feet or one foot from one sensor, and 499 feet from another sensor, it has to travel 499 feet before it will alert the sensor. So doing those kinds of calculations, we ended up with maybe about 30 minutes that it may take.

And sensor spacing was looked at around a thousand feet, and therefore the minimum velocity was set at 50 feet per minute. That was the rationale. If it is 50 feet per minute, and the distance is a thousand feet between sensors, and let's say the fire starts just downwind of one sensor, one foot downwind

of one sensor, it has to travel a thousand feet, and at 50 feet per minute, it will reach the other sensor in 20 minutes, and then you have the alert, and the alarm, and all that.

So that was the rationale for 50 feet per minute. We had an expert from the U.S. Department of Commerce, and we wanted some additional opinions in addition to the Bureau of Mines research, and this expert from Commerce suggested that 50 feet per minute was probably low, and it can be higher.

But the committee eventually settled on 50 feet per minute. Multiple neutral entries and their effects. In fact, a letter from the U.S. Department of Commerce's expert is in the report as one of the appendices.

Multiple neutral entries. You have multiple neutral entries, and these entries are also somehow or other connected with the belt, do we need 50 feet in all of these other entries as well was one of the questions.

Because in a typical room and pillar development, you will have more entries than you need for ventilation, which is not the case in typical continuous miner or longwall development.

You see, mines, and this is an important

thing about advancing technology. At the present time, I am teaching mining methods to my students in class, and I am amazed.

You know, when I came first to this country, I went to a mine called Valley Camp Number 3 in Triadelphia. It was 12 entry development, with pillars about 30 feet or 35 feet wide, and entries about 20 feet wide. A typical room and pillar development.

We don't have those kind of developments in large mines today. In most mines today, you will not have that kind of development. Conventional mining has come down to about 10 percent of the production, and not too many mines. So technology changes, and that was all the conditions for a change, and the requirements may change.

Multiple neutral entries may not be very common in the future, but it is one of the things that we were concerned about at that time; that if you had two or three neutral entries and they were all left open, should be the ventilation of these entries as well?

So we came back with the conclusion that it should be 50 feet per minute in all the entries that are connected. This is what we called our

recommendation to MSHA, and MSHA should move forward with the development and promulgation schedules for early warning fire detection system, including smoke sensors.

And we also suggested that the approval schedules should include performance standards and safety standards, and finally we said that it should be flexible to permit advances in technology.

Generally this is one of the problems of regulations, that unless we have some provisions for flexibility as technology advances, it becomes difficult to change, and then there is problems, and then you have to go through a petition for modification process, which again presents its own problems.

So the idea that the committee thought was that technology is advancing, and we saw a lot more developments in belts, and a lot more developments in the AMS, and more developments on mine ventilation planning, and developments in mine design, continuous miners, longwalls, and so we thought that anything that we develop, we should have flexibility built in so that any new rule that is promulgated can be easily modified.

Then we looked at the ventilation of the

belt aircourses from issue number two, rather than issue number one, and that had to deal with the health and safety effects rather than sensors. So we were not looking at the sensors anymore.

We were looking at the dust, combustion products, dilution of methane, and things of that type, as opposed to transfer of combustion products between sensors.

And that for here we said that the respirable dust should be less than one milligram per meter cubed at the section tail piece if you are going to use it as intake aircourse.

Respirable dust should be less than two milligrams per meter cubed at all other outby locations on the belt, and we wanted additional sampling to be established, at designated area sampling, so that we can ensure the ventilation system and maintain a dust control plans, and we should have identified those on those plans.

So we did not specify anything in particular, but I can tell you the spirit of the discussion. The spirit of the discussion was what should be the maximum air that can be allowed on the belt.

It is not the minimum air. We know the

minimum velocity is 50 feet per minute. We have already said that it should be 50. The question now is what should be the maximum.

And we had a lot of discussions, and a lot of discussions with members of the audience, and in fact one member said what do you want to put out for a limit. Why can't we have a thousand feet per minute.

And eventually we decided that we cannot specify a maximum, and the reason being again there are technology changes taking place, and belts were traveling at 400 feet per minute. Belts are now traveling at 750 feet per minute.

If the intake air is going to be brought into the belt, a belt traveling at 750 feet per minute, and the intake air traveling at 500 feet per minute will give you an effective velocity of 1,250 feet per minute.

So that may create a dust problem. So what you are looking at is not just the velocity of air. You are looking at belt velocity, and you are looking at the air velocity coming in, and you are looking at the conditions of the moist and coal, and you are looking at entrainment propensity of coal.

Some coals entrain a lot more than some other coals, and betting is not always as complete as

one can expect, and all these things. So basically that is why we settled that these should be the standards. Now there were established standards for dust, and there are established standards for methane. Why can't we make that these standards must be met.

In the belt entry, if the belt entry is going to be used as an intake entry, why bring in additional standards. So whatever maximum velocity can be sustained can be sustained. So this does not mean that you have an open season on velocity.

It only means that you can decide what is good for your mine in terms of velocity as long as you can meet the provisions of the law with regard to dust and methane, and methane layering.

I disagreed with this recommendation, particularly I think this recommendation that comes up here, Issue 2, Recommendation 2. The minimum air velocity in belt haulage entries in all mines, whether belt air is used to ventilate working places or not, should be established based on ability of the air current to reduce the potential for methane layering.

Frankly, I personally felt that this was a very, very ambiguous statement. The committee voted 5 to 2, and there was another member of the committee who did not agree.

The reason for that committee member not agreeing with this recommendation was we were not asked to talk about non-belt air mines. So why are we making a recommendation for all mines, because this is a scope of recommendation much broader, and the belt air goes as an intake, and we had some problems with the relationship to minimum velocity for the transport of combustion products.

That is another one which did not get a unanimous recommendation from the committee. So basically this was a recommendation that if somebody is going to put some recommendation for methane layering, it is worthwhile to study the phenomena. See what is the frequency of the phenomena of methane layering in mines.

Methane layering is not a common phenomena in all gassy mines. In gassy mines, which are very deep, and which have steep slopes, there may be some issues. So this is a research area before we can address whether there is methane layering and what should be the minimum velocity for methane layering.

As a subject there are formulas that you can use. For methane layering, what should be the minimum velocity. That has been studied, and not that it has not been studied. But that the problem exists

underground in a particular mine needs to be established.

So that was one of the reasons, but this is a recommendation that has to be kept in mind, because a lot of times, we don't realize that methane emission does not take place only in the face.

In a very highly gassy mine, about 20 to 25 percent of the methane comes out of the face. The remaining 75 percent of the methane in coal continues to be emitting all the time as the coal is being loaded, and the coal is being transported, and the coal comes to the crushing plant on the surface, and as it is being crushed, more methane is emitted.

So the methane ignition will continue to take place all along until the coal comes out. So there is the potential for methane emission. But there is also a lot more air for the dilution of that methane.

So in belt entries, one has to look at the problem of methane layering and if it is there or not, taking into account some of the issues involved.

Lifelines should be installed and maintained at all primary and alternate escapeways. Tracks and belts can be treated as acceptable lifelines provided that track switches and belt transfers exist that

provisions are made for clear designation of the escape route.

This is an important recommendation. Lifelines were generally not required. Directional lifelines had already come in, and some mines were putting it in, but it was not a common practice. But as most of you know, directional lifelines can save lives, and lifelines are extremely useful devices.

And I remember Fred Kissell presenting a paper sometime either before this meeting or after this meeting. He had a wonderful paper on what disorients people in the event of a fire. What overcomes the person first.

And it is the smoke and not being able to see that this disorients a person, and that is what his conclusion was, and that was an important conclusion.

And once you get out of that disorientation, initially if you can escape, chances of escape are much more. This was also applicable to all mines. We had a lot of discussion on whether there should be a replacement of the deflectors, or should they be there, and so that there is a redundancy that exists in the mines, and use of directional cones, that was also recommended.

This was a fairly difficult topic. I was in this working group. In fact, this is the only working group that I belonged to, and the committee was split up into four different working groups, and I was in this working group as the ventilation person on the working group.

It had a number of components. First of all, we said that the mining system considerations, if you take a look at this recommendation as it is written, and I suggest that you do, because this is one of the most difficult recommendations. It really has nothing to do with the belt air as such.

It really dealt with escapeways, and how do you escapeway integrity into place in the first instance, and ensure that it remains integral throughout the life of the mine.

Mining system considerations, because it is not just the escapeway itself. There is the haulage system, and there is the ventilation system, and there is the production system. The primary escapeway and alternate escapeway. The alternate escapeway, where should the alternate escapeway be, and what should it be. Should it be in the return or should it be in the intake.

Integrity of the atmosphere in the

escapeways, and how do you get the integrity, and positive pressure differentials between the primary escapeway and adjacent entries is the way that you try to get that integrity.

And then we said that the information for a mine ventilation plan approval on data relative to the integrity of the atmosphere in the escapeway under normal and pressurized conditions.

So what we are saying is that escapeways are part of your ventilation plan, and therefore, when you submit a ventilation plan, which is approved by the district, the district must request, or the mining company should be required to provide how are you going to preserve the integrity of your escapeways in the event of an emergency.

So you can see that the committee went through this process quite extensively, and so the recommendation basically says that you should consider the interfaces and interrelationships of the escapeways with the other aspects of the mining system.

Ventilation should be designed and maintained to protect integrity of the atmosphere in the primary intake escapeway, and evaluation of this fact should be on a mine-by-mine basis of the

following.

So while there are general escapeway provisions, the escapeways of a particular mine should be evaluated on the basis of prudent engineering to provide positive pressure differential between the primary escapeways and adjacent entries.

And planned, evaluated, and practiced use of devices to pressurize the primary escapeway in the event of an emergency. It is one thing to say that we have these things available, but if you are going to use it, and if that is one of things that you are submitting as a device by which the primary escapeways will be pressurized, then we should have some kind of proof that it will work.

Often in mining that is one of the key things, and what has not been proved can be problematical when we try to prove it the first time. So that was the first thing that we wanted to do.

So the primary escapeway, basically what we said was should be based upon pressurizing it, and preserving the integrity of it. And then we said that one way of preserving the integrity is to pressurize the primary escapeway so that any leakage that takes place is from the primary escapeway to other escapeways.

And we said that whenever we are doing that, that should be tested and proven to be workable in a mine situation. Then we said let's take a look at the alternate escapeway.

The committee thought that an alternate escapeway in the intake air would be good. This is possible if we have multiple entries, if we have multiple entries that we are not using, and if we can make that an alternate escapeway.

The only thing that the committee said was that you need not be on a totally separate and distinct split of air, but it should be physically separated from the primary escapeway.

But it did not preclude the use of a return entry. So what we tried to say was while we prefer an alternate escapeway on the intake air, really mines are using return air entry as a secondary escapeway, or not secondary, but alternate escapeway.

And therefore we do not want to preclude the use. If it is not possible, then it is not possible. But if it is possible, then it is better to go with the alternate escapeway in the intake.

We continued with how you can further submit and told of how you can evaluate. Information submitted for ventilation plan approval should include

substantiating data relative to the integrity of the mine atmosphere in the escapeways under normal and pressurized conditions.

So what we are saying is that we must have some substantive data to say that what we are proposing will actually work. Methods of evaluation of the escapeway integrity include measured data from existing system and experimental data from pressurized system, or analytical methods, including computer-oriented simulations.

If you say you can pressurize this entry under an emergency, what will happen. We have developed programs that can analyze the spread of contaminants in mine atmospheres, and we have programs that can tell you or predict concentrations in various places. Well, these are the physical phenomena that we are talking about what and why can't this be done.

This was our second recommendation to MSHA, that MSHA should proceed rapidly to develop regulations for improved fire resistant belting, including new testing and approval schedules. And when available, the improved fire resistant belting and material should be used in all underground coal mines.

So this was one of the things that the belt

manufacturers said, that they will have materials available, but they have materials available, but it is not required.

This is a key thing. The mining industry is so small that manufacturers, to invest in something new, it is going to be extremely difficult unless they can find a market. That is one of the problems of mining, finding new materials, new equipment, new systems, new developments, and new monitoring systems.

The problem is that the market is not big enough to invest funds, and so NIOSH, and in our case, the Bureau of Mines in the past, was not only the originator of the idea or supporter of the idea, but they were the people that did the fundamental research for all the mining requirements, and they were the people who led to the development.

They were the people who produced the prototype. They were the people who produced the initial applications, and finally when it is working, you have the idea of proposing a rule, and this may take as much as 20 years.

And this is one of the problems, and the manufacturers basically were saying that we can have improved fire resistant material, but we can't do it unless it is required. And I don't think that MSHA is

going to require something that is not there.

So which came first, the egg or the chicken, or the chicken and the egg, and you play this game, and it is not exact, and in some cases it is not very good, and in some other cases, it can be problematical.

Now I think over a period of 15 years that there must be improved belt materials from what was there in '92, and this may be better materials than there were before. We don't know, but what I am saying is that the present committee can look into it.

There was a lot of discussion on this, the alert and alarm levels, and what they should be, and this is condition number five for our charge one, recommendation number five.

It is understood that it should not exceed 5 and 10 ppm, and the MSHA district manager may establish lower alert and alarm levels depending upon certain mines, and the kind of equipment that they use, and local conditions that may be prevalent.

And they should automatically activate it on the surface and on the working sections when the CO levels exceed the established levels. So basically what this is, and one of the conditions which we said was that we should have alert and alarms, and we now

specify what should be the alert and alarm levels.

In mines using belt air to ventilate working places, increased emphasis should be placed on belt entry cleanup and conveyor belt maintenance, and we think that it is common sense that you will clean up.

But it doesn't appear to be common sense when you look at the record of fires and where the fires started. The fires started in coal spillage or floor dust accumulations and things like that.

And that is what we were given, and we were forwarded a lot of data to say that coal spillage and floor dust accumulations were the cause of the problems. It is case studies of fires being initiated due to these conditions led the committee to make this recommendation, okay?

And the recommendation applies to all mines. It is not just to mines using belt air as intake aircourses. Well, all the recommendations were voted on by the committee in a public meeting like this. Unanimous approval was for the use of belt air, and use of AMS, and MSHA AMS approval; minimum and maximum velocities for dust and methane control; lifelines, escapeway ventilation, and MSHA fire resistant belt approval, and alert and alarm levels.

Split approvals for training, and the

concern in introducing new training material was that we already had training required, and why do you want to put new training into it, and that was six to one.

Belt velocity minimum was six to one. Minimum air velocity for methane layering was five to two; and belt entry cleanup and maintenance was six to one. So you can see in general that the committee supported all of these 11 recommendations with a good majority.

Now after 15 years, I look back on things and things that one should really require to increase health and safety, and I think they are remaining the same. We have hazards that continue to exist, and we must eliminate the hazards.

If we cannot eliminate them, we should find ways and means to reduce the hazards. Then at the same time, we should reduce the potential impact of an occurrence if the hazards do materialize, and hazards are realized.

And for this increase the possibility of early detection, and increase the possibility of effective response, and increase the possibility of successful evaluation and escape.

And this is something that I always felt that we are constantly improving, but there is always

room for improvement. It is just like health and safety improvements are very much like quality. There can always be enhanced quality.

Quality can always be improved; quality of life, quality of material, quality of things, quality with which we evaluate things. All of these can be continuously improved. Quality is one of those continuous improvement variables, and that is why health and safety is a continuously moving target which can be improved.

Thank you very much. Jan and Linda, I appreciate the invitation, and I will be happy to answer any questions.

DR. MUTMANSKY: Raja, I am certain that there will be a lot of questions. Do you want to take a break now, Linda, and then come back to the questions?

MS. ZEILER: That's fine.

DR. MUTMANSKY: Raja, you did a good job. Thank you very much, but you brought up a lot of questions, and I think the committee will want to spend some time on those questions.

(Whereupon, a short recess was taken.)

DR. MUTMANSKY: Okay. We will now open up the discussion on Dr. Ramani's talk, and I think there

are a number of things that I am certain that the panel would like to discuss.

Dr. Ramani, I have a question concerning the subcommittee. You made a nice summary slide showing the committee votes, and how many of them were unanimous approvals.

In terms of the split approvals, was there a lot of -- I guess the word disagreement is probably appropriate here. Were there a lot of disagreements in the subcommittees on those issues even before it came to vote before the entire panel at that time?

DR. RAMANI: Well, I think we had four subcommittees, and it was fairly clear that the subcommittee that really had real problems was the escapeway subcommittee. That was the subcommittee that had to really look at ventilation and ventilation system design, and definition of escapeway, and what it is, and how they should be arranged.

But there was a lot of disagreement on the verbiage as to how the recommendation was to be placed, because anytime it was felt that the recommendation was either restricting the use of belt air, or restricting or that the technology was not available then, and we were requiring some technology and things like that, there was some dissention,

because what we were going to say may become a requirement for the future and things like that.

The other subcommittee that had some issue was the atmospheric monitoring system subcommittee, but those were fairly small in the sense of whether it should be 50 feet per minute ventilation between the sensors, or what should be the distance between the sensors and what should be the velocity of the air in the belt entry, and there were some discussions and some dissentions.

But really it was a very, very small group -- you know, nine people -- broken up into four subcommittees. It really did not create a lot of problems.

The training provisions were just approved without must discussion, though there was one dissenting vote on training that was basically to say we already have Part 48 training, and they are already doing Part 48 training, and why do we need this new training.

But this is a new piece of equipment, and new things to be done, and other things, and therefore the committee decided that this was okay. Fire and fire safety, and the question there really was with regard to the type of sensors that one can use, and

the smoke detectors, and additional requirements for monitoring and things like that.

But in general there was not much dissention. I didn't think that these non-unanimous votes did represent some difference of opinion with regard to -- well, I voted against two. One was the methane layering. I thought that it was very non-specific, and the issue was not studied.

And therefore to recommend that you should prevent methane layering is a very, very general statement. Who will let methane layering accumulate. Nobody would, but if it is not a problem or you don't detect it, or you don't use guidelines, then there is no real solution to the problem.

I think it was paraphrasing Cicero when he said that when you say there is a problem, you better have a solution, or otherwise don't tell me about the problem. You are just going to create more problems.

I am paraphrasing, and that is not exactly the words, but that is the issue; that if you think there is a problem, then you should have some solution to it. Methane layering, yes, and how are you going to define it was one of the issues.

The other issue that I disagreed with was 50 feet per minute, the velocity for travel between

sensors. My own feeling is that fires can be so rapid that within 15 minutes, you may have a raging fire on your hands.

So 15 minutes or 50 feet per minute, and things like that, you should have some justification; the size of the fire, or the magnitude of the fire, and some definitions on fire, and what it is and where it can occur.

And I suggested that we get an expert opinion from outside, and that's when I think MSHA went to the fire expert in the Department of Commerce, who wrote back basically saying that if you are assuming that there is a blocked fire versus an open fire, things can be different.

So other than that, I don't think that there was a lot of dissention. I was amazed at the unanimous passage of the escapeway provisions, because that created a lot of problems for a lot of people as to escapeway design.

That was the only thing that I can say, that I was surprised. If there was something that surprised me, that is the one that surprised me, that there was not a lot of objection. Discussions took place, and the language was very difficult to write, but it got through.

DR. TIEN: Raja, this is quite an interesting and quite informative presentation. I really didn't realize that 15 years ago there were hearings in Washington, D.C. I have a couple of questions. Would you have the same thinking as far as being a member of subcommittees looking back and what you were doing with four, that five might be better, or three might be even better? What do you think?

DR. RAMANI: Well, you guys are six, and I will say form six subcommittees. You will have no dissention, and whatever you say, it is the subcommittee's opinion, I guess. You will not have much choice, okay?

You know, subcommittees should be viable, and should be viable subcommittees. That is, you should not be less than two, and I would say with three subcommittees of two will be very good if you can identify the issues, and give each subcommittee one or two issues each.

That is what I would say, because I think six members, and more than three subcommittees will really dilute your efforts, and I don't like a person working on more than two subcommittees, or even one subcommittee for that matter, because then you have to divide your time between issues.

And I think you need to identify the issues, and if you have six issues, give each subcommittee two issues, rather than try to -- we divided ourselves into four subcommittees, okay?

The atmospheric monitoring subcommittee had two people, Mary Jacobs and Bhaskar. Both of them. The fire safety subcommittee was Jack Holt, Jack Stevenson, and Diane Doyle-Coombs. All of them, and two mine operating people who had experience in fighting fires and things like that, and Diane was a researcher from NIOSH and Bureau of Mines.

The training subcommittee was Lee Saperstein. He was good. He spent all his life training people, and developing standards, and evaluation, and competency. He keeps us all in a straight line with regard to standards for mining engineering curriculum. So that was a good person and a good committee. One issue, training.

And the escape subcommittee had the one with four members, myself, Bhaskar, Jack Holt, Diane and me. And I took the lead, in terms of saying that I will write, and you guys go ahead and comment on it, and after our discussions, I will write what the recommendations will be and what the issues are, and what do we mean by this, and you guys can comment on

it.

So that is how we broke up into four subcommittees, but it didn't prevent us from addressing a number of issues. The most important thing is to define the issues first, and what are these issues, and these issues are related, and therefore, you form one subcommittee.

And it goes to that subcommittee as issues that your subcommittee should address, and therefore, you may have 15 issues, but three subcommittees will be able to handle it at the rate of, let's say, three, or four, or five issues per committee, as long as these issues that you have that you see their relationship.

And that is the reason why I went back and put your recommendations in terms of issues. It doesn't matter that you have 12 recommendations, but we had only three issues that we had to address and seven of those recommendations, or six of those recommendations actually dealt with if you are going to use belt air, these are the things that you should do, period.

DR. TIEN: I know I have to be quick, and I'll be quick. One question is that you have listed 12 recommendations, but number one is your finding.

DR. RAMANI: I call it a finding, but it was taken as a recommendation. But as you grow old, you recognize the difference between recommendation and a finding. So that was really a finding, that belt air can be safely used.

DR. TIEN: Do you put in your mind the same weight as far as those two things?

DR. RAMANI: Well, in the record, it is a recommendation, and therefore, if in that recommendation you cannot use belt air safely, if we had come to that conclusion, then there was no need for anymore studies.

DR. TIEN: Okay. And a very quick one. Recommendation number 12. There is a dissention vote of 6 to 1, and that is on the cleaning of the belt. I am just curious as to what is the rationale for objecting to that one?

DR. RAMANI: Let me see whose recommendation is number 12, cleaning, and the person who said it was not required. There was a lot of discussion on that particular recommendation, and I will let you know who it was.

DR. TIEN: For those who don't have the words, the mines using the belt air to ventilate working places, increased emphasis should be placed.

DR. RAMANI: Yes.

DR. TIEN: Well, there is one person who objected to that.

DR. RAMANI: I think that objection came from the fact that increased emphasis was not a very quantitative term. There is already a standard, say, in the law, that accumulations of dust should be cleaned. So what do you mean by increased emphasis if there is a law that says that you have to clean it? Why do we have to place increased emphasis on it if there is a law?

So you can see that people can object just because they don't like the language, and not that they don't want cleanup and all of that. It is already there.

The same objection was raised with regard to the training of AMS. If you want to talk about the AMS operator training or competency training, well, since we already have Part 48, that certain training has got to be provided for certain things, and so why don't we just go ahead and use that rather than develop up new training standards, and training curriculum, and training things.

So people can object for reasons that may not be very substantial. So I personally felt that

the person was not against cleaning, but the person felt that the increased emphasis leaves too much to be desired, but somebody can say that you are not placing increased emphasis.

DR. TIEN: Have you thought of going back and rewording it?

DR. RAMANI: No. No, I think that once you decide that six people have decided it was okay out of the seven, people say that it is okay.

DR. WEEKS: Well, i have a lot of questions, and so let me just focus on a couple. First, I want to make a comment about the maintenance issue. It is not just an accumulation of combustibles that is a concern. I think maintenance also requires looking at the condition of the belt, whether the belt is out of alignment, or whether the rollers are stuck, and that sort of thing as well.

So if the emphasis for maintenance and so on of the belt entry is only concerned with accumulation of combustibles, it is only part of the story. I think there is more going on there.

All right. And I want to ask you a question about escapeways, but actually before I get to that, there is a way in which you all framed the questions that were basically illogical. Now let me explain

what I mean.

The way you framed the question was, the first question was can the use of belt entries be safe, and if yes, what are the conditions. That is putting the cart before the horse, because you cannot answer -- the way that it is constructed. the second question is contingent upon a positive answer to the first, the second question being what are the conditions. and the first, can it be safe, when in fact it is the reverse.

You cannot say whether it is safe until you say what the conditions are, all right? Now the problem with that is that the question is framed in such a way that it is almost a foregone conclusion, and it is something that is a subtle kind of issue that has characterized the debate over the use of belt entries here, and a number of other issues, and a number of other areas.

But it just struck me as illogical to put the question in that way for the reasons that I stated.

DR. RAMANI: Do you want an answer?

DR. WEEKS: Do I want an answer? Not really.

DR. RAMANI: No, do you want my comment on

that?

DR. WEEKS: Of course, but I do want to get on to the escapeways question.

DR. RAMANI: Yes, you can get on to it. You see, that is the presumption when the committee was appointed, that belt air is safe to use, and what are the conditions under which you can use it.

Our charge was state the conditions under which belt air can be utilized. So the decisions were made along the line.

DR. WEEKS: You put those two different ways just now.

DR. RAMANI: No, if you take a look at the charge to the committee, it says what are the conditions under which belt air can be safely used as an intake airway.

DR. WEEKS: But that is not the way that you put it.

DR. RAMANI: No, no, that is the charge to the committee, and so the charge to the committee took your tact, that let's underline the conditions under which belt air can be safely used an intake airway.

But the committee said let's go and ask the first question, because that was the leading question. In belt aircourse, can it be used as an intake entry

was the question, because the law has basically prohibited it.

The law has basically said that the belt aircourses will be isolated and the belt air will be dumped in the return. That was the law, and so our basic question was, and now the question that we were asked as a committee was what are the conditions under which belt air can be used?

That was the charge, and so the committee decided in the first place, well, let's go back and ask the question. You know, the law says that you cannot use it, and all modifications are being given under PFM. So the question is are we doing the right thing by giving this PFM. Can belt air be used in the face, and that's how we phrased it.

DR. WEEKS: Right. It is illogical, because first of all, you were not asked to interpret the --

DR. RAMANI: We were not asked to do so many things while we were there.

DR. WEEKS: I am not sure that I want to open this can of worms, but I do want to make the point that there is a logical problem here. If you say can it be used and it is a legal issue, then you have to give a legal answer.

And the legal answer, or my interpretation,

is that those were interim standards, and if you come up with something new, it has to be that there is no diminution of safety. That is the legal argument for whether it can, but can it be used as a physical phenomena.

Can you dig a hole, and put a belt in it, and put air into it? Obviously, yes, you can do that. The question is whether it is safe. And the way that the question was framed, first, can it be used safely. You can't answer that until you say what the conditions are.

And what you just said now is a mixture of the legal interpretation and the technical one. I am looking at the lawyer to see whether he has anything to say, and whether he is going to cut me off here, and he is hiding under the table. No, he's not.

DR. RAMANI: It is a good question, and without getting into a lot of discussion, if we had not decided to answer the first question at all, because we were not asked to answer the first question. Our charge --

DR. WEEKS: Well, it is listed here as a charge.

DR. RAMANI: No. No, that is not the charge.

DR. WEEKS: I am looking at our slide.

DR. RAMANI: Yes, but I didn't say that it was a charge. We said that in trying to respond to charge one, the committee decided. It was not that we were not charged.

Our charge was as you can see in on the front page, what are the conditions under which belt aircourses can be used as intake aircourses for ventilation working faces. So it said please give us the conditions. That was our charge.

DR. WEEKS: Okay. Slightly. It is a little bit different. I don't want to talk about this anymore. But I do as a matter of fact, but I don't want to take the committee time to do it, and I do want to go on to the issue of escapeways.

I think it is appropriate to focus attention on escapeways for the following reasons. When we go to using belt air as an intake aircourse, two things happen that degrade safety. Number one, if there is a fire in that intake, it is going to go to the face.

And, number two, it is usually associated with a reduction in the number of entries, and therefore a reduction in the number of escapeways. Therefore, escapeway integrity becomes a very important issue.

Now you can deal with the fire issue with -- it is proposed to use it with the AMS, and the question I raise or have is what do you really get from the AMS, and the presentation from Fred Kissel yesterday was that the common denominator for looking at safety, particularly in relation to fires, is time.

So how much time do you get from the AMS? Well, it is the time interval between when the CO monitor detects the smoke, and the nose detects the smoke. And I would argue that is not very much. Two minutes, or three minutes, perhaps.

But it is not very much. The thing that you actually do get from the AMS is the potential to communicate that information throughout the mine. You have got an AMS operator on the surface, and you have got people on the ground elsewhere, and if you communicate that information, then it becomes critical. Still, it is only a couple of minutes.

I mean, I think the AMS system ought to be seen not as an early warning system, but as a communication system, a completely different creature. That was the fatal failure at Aracoma. It was not a failure to detect the fire. It was a failure to communicate the information. So the importance of that is critical.

Still, you only come back to what you get from the AMS system is just a couple of minutes, and I would argue that is not enough. In order to improve safety there are other issues that we need to address, in terms of preventing fires, and not merely detecting, such as belt flammability.

But on the escapeway -- and this is going to come down to a very specific question here in a minute. On the escapeway, I think that you focusing attention on that is totally appropriate, particularly in terms of maintaining the pressure differential between the escapeway and adjacent entries.

The question I have is there a minimally acceptable pressure differential between those entries? I mean, there is a big difference between a tenth of an inch and three inches, or five inches of water.

And so is there or do you think there is a pressure differential that is minimally acceptable for maintaining escapeway integrity? And that is only one aspect of keeping escapeways clear, but that is one that I think is measurable and it is enforceable.

DR. WEEKS: You know, I would like to point out that pressure differential between intake and return decreases as you go inby, and when you are at

the farthest portion inby in the mine, the pressure difference is very small.

MR. MUCHO: Zero.

DR. WEEKS: It is zero, right.

DR. RAMANI: And therefore as long as there is a pressure difference the air will flow from a point of higher pressure difference to one of lower pressure difference.

So it is a physical phenomena. Now how much do you want, whether you want 0.05 inches, or whether you want 0.1 inch, is -- well, the orders of magnitude that I am talking about, and let's say it is five inches that you are talking about.

Five inches in many cases is the pressure difference between the fan and the total ventilation system in some mines.

DR. WEEKS: I just used that as a frame of reference.

DR. WEEKS: Well, no, I am also using mine as an example only. So what I am saying is that pressurizing really means creating that positive difference so that the air flow always takes from the belt intake -- from the intake entry to the other -- from the escapeway to the other entries.

And I don't want to be standing here and

hypothesizing what should be an ideal pressure difference, but it is a technical issue that can be easily handled, and what you really want is -- well, you don't want to decrease the amount of the air flowing from the intake entry to other entries, so that the intake air decreases dramatically. That is number one.

Number two is that people are constantly going to go from the intake escapeway outby, and that is where the quantity of air is going to be higher and higher.

DR. WEEKS: Right.

DR. RAMANI: And therefore you want to create as far as possible this pressure differential enough to cause this positive flow that you want, versus a large flow, and that is all that I am trying to say.

DR. WEEKS: I understand the intent, but I am just looking for something that we can hang our hat on. Say you go out by the face seven crosscuts, and what should it be at that particular point, you know, and is there something that we can say that is minimally acceptable that will maintain a pressure differential that will achieve the objectives that we want to achieve.

DR. WEEKS: Well, one of the things that I was looking at in terms of belt air, and the air leaking from belt to other entries, and say for example here is the return. There are several maps -- and I really -- this is a very, very useful set of things on the belt entry ventilation review.

If you take a look, it tells you what the pressure difference is and what the quantity leaking from one entry to other entries, and if you take a look at that data, it can tell you how much can leak in a given system for a pressure difference of, say, like 0.4.

And that is what I am trying to point out, that there is 4,000 or 5,000 cfm leaking with a 0.4 pressure difference, and that is the reason why I believe that I can't be here giving you a pressure difference, but it depends upon the quantity that you want to leak.

And there are analytical procedures, like computer methods, that you can analyze what pressure difference can create what kind of leakage.

DR. WEEKS: I guess what I want to do is --

DR. MUTMANSKY: Jim, I have a related question that I would like to ask Dr. Ramani if I might.

DR. WEEKS: Yeah, but I have one other thing that I wanted to mention, but let's continue this line of reasoning, but I do want to come back to another issue also. Go ahead.

DR. MUTMANSKY: All right. Dr. Ramani, the pressure difference concept of course is understandable by most mine ventilation engineers, and the leakage was discussed yesterday by Fred Kissell, and we looked at some issues here.

But the basic situation is that is a useful -- maintaining the primary escapeway at a higher pressure is a useful strategy only if the fire is in the belt, and it becomes a bad strategy if the primary fire is in the primary escapeway.

So how do you evaluate that, and that is another issue, particularly since there may be track haulage involved, and there may be other issues that might cause a fire in the primary escapeway.

DR. RAMANI: I think that is perhaps the most important question. The question is, where is the fire. If the fire is on the intake, you have a different set of problems.

DR. MUTMANSKY: Yes.

DR. RAMANI: Okay. If you are using belt entry as an intake escapeway and the fire goes to the

face, how do you fight the fire? Where do you fight it from?

Or if the fire is at the neck of the entry, then the entire belt entry is now contaminated. How do you access the fire going through the smoke. Things like that become very important. So it is one of those things where I believe we called for further analysis.

What you are pointing out is that if the fire is in the intake, you always have a problem because the smoke is going to go towards the face, and how are we going to fight it.

Standard ventilation text says reverse the ventilation. That is what the standard text would say; as well as possible, reverse, so that now it is taking the fire smoke -- you know, if it is more and more outby, you try to reverse. That's what the solution is generally.

It is something that we don't practice at all because it is so dangerous. It is so dangerous that we don't practice it. The question really is that you have to develop an emergency response rescue plan that can anticipate.

If something like this happens, what should be the strategy, okay? That means that what I am

saying is while you develop a rescue plan, an emergency response plan, an escape plan. This escape plan must be tested against some conditions where if the fire -- well, generally is okay to assume that the fire will start in the belt entry because that is the most common source.

But that does not eliminate a fire starting elsewhere. It can. It may. What does it do to the system. Can you be prepared for it is a question that one must answer.

DR. WEEKS: Well, what I am looking for is some way to translate the issue that you raised about maintaining the integrity of the escapeway. I mean, it is one thing to say that, and it is another to say, well, that translates into a specific requirement.

And I thought, well, how about saying that we have a minimum pressure differential, and you convinced me that is probably not feasible or appropriate, but that is what I am looking for.

DR. RAMANI: No, I did not tell you that that is not feasible or it is not appropriate. What I told you was that I can't give you one number because the leakage is just not dependent only on the pressure differential.

It is dependent on a number of other factors

as to the quantity of air flowing, and as to the other connections, and the other entries, and things like that.

But there again it is a question that can be answered. It is not a question that is beyond an answer. That's what I am saying.

DR. WEEKS: Okay. Well, like I said, I want to place it sort of on our agenda. The other comment that I want to make now also has to do with AMS. Again, coming off the presentation that Fred gave yesterday, and a sort of common denominator of time, if the AMS detectors are a thousand feet apart, and you have got 50 feet per minute, there is 20 minutes between combustion and detection. That is a long time it seems to me.

DR. RAMANI: No.

DR. WEEKS: It is. Well, whatever it is, it is a few minutes.

DR. RAMANI: Well, no, that is a good point.

DR. WEEKS: And one could by the placement of the sensors say that if you cut that to 500 feet, you cut it in half, down to 10 minutes, which is quite an improvement. It is still a lot more than the 2 to 3 minutes that you get between the detector and the nose.

DR. RAMANI: I agree with you, but I am not too thrilled about the 50 feet per minute, and nor am I thrilled with sensors a thousand feet apart, okay; because all members of the committee, except for Dr. Ramani, affirmed the recommendation on 50 feet per minute.

So I really did not affirm that particular recommendation, because I thought that 50 feet per minute was too low. That is my gut feeling at that point in time, and a thousand feet between sensors is also not something that I am convinced that it is a good distance.

But on the other hand, I am looking at some of the plans that MSHA had approved under a petition for modification. They have tied it to the quantity of air flowing or tied it to the velocity, because in some places as you go closer to the face, where the velocity is less because of the air having gone elsewhere, they want sensors 300 feet apart.

So they have a provision under the petition for modification where they do provide for shorter distances, and this is again another technical question.

It is not a question of one number. It is a question of the quantity of air flowing, and the

possibility of a fire occurring in a particular location, and the nature of the problem that can arise there, and decide accordingly what should be the distance between the sensors, and what should be the velocity of air.

So basically what I am saying is that those are technical questions which really you cannot say cannot be analyzed. That's how I feel. When I say you, I mean --

DR. WEEKS: No, I understand. It is conceivable, although it is probably not feasible, to say, well, there should be five minutes from combustion to detection. However you get there, the combination of velocity and the spacing of the sensors, is up to you. But it is five minutes.

DR. RAMANI: Well, that sounds about right.

DR. WEEKS: It is conceivable, and I don't know that --

DR. RAMANI: Well, that is another approach. You know, if you set the -- well, you know, whatever we are requiring now, that people should be evacuated within 15 minutes or something like that of a fire or something? I don't remember now what the provisions are.

But there is some provision that if there is

a fire that lasts for more than some minutes that people have to be recovered and things like that. So there are some time limits that are set. I don't remember exactly the phrasing.

MS. HONOR: I think it is 10 minutes for emergency evacuation.

DR. RAMANI: Yes. Something was done, and originally it was 30 minutes, or 15 minutes, or whatever it is, and it has been brought down to 10 minutes. So obviously the kind of question you are raising does provide an opportunity to look at that, instead of saying that all these other things, and let's add another constraint to it, and see how this constraint can be met.

So if you say 10 minutes, then there may be -- it now has to be analyzed in terms of distance between sensors and the velocity, because that will tell you how quickly you can get this information. So it is not beyond the realm of possibility that it can be done.

MR. MUCHO: I would like to comment on some of these topics that are running around here. The issue on time, and I would disagree on the two minutes, and I will explain why. When we are talking about an AMS system currently, we are basically

talking CO detectors.

And so what we are looking at is the production of CO from some process getting to a sensor, and the time before, say, where one would smell something is highly variable and dependent upon the type of event that is occurring, and the production of CO.

So you can have -- for example, yesterday, we talked about hot rollers, and hot rollers can be detected quite easily with an AMS system. It was one of our best detection systems for knowing that we had a hot roller and where it was located about, within the spacing of the sensors.

So that is an event that would be kind of a thing that is a very early event, and not even really fire flaming. Now the other part of that is that you can have the opposite. We talked yesterday about whiteouts, where we have the production of white smoke and white products, but no CO, or very little, not enough to alarm the sensors.

So the type of event that you are having, whether you are starting coal on fire, belts, bearings, grease, all those kinds of issues comes in, in terms of this whole issue of time.

DR. WEEKS: I accept all of that. I think

the other thing about my estimate is that it is assuming that the nose is there, and it is not always there.

MR. MUCHO: Right.

DR. RAMANI: I didn't want to comment on what happened yesterday because I was not here, but on the other hand, I would still comment that there are a lot more advancements in technology have taken place in the last 15 years to detect more than CO, or than other aspects of what happens in the event of a fire.

The precursors leading to an event, as time has passed, we probably recognize more precursors, okay? And therefore if those things are available, and we do know how to respond to some of those, they are the kind of things that should be done that can decrease the 15 minutes or the 10 minutes, okay?

So frankly I believe that when we were discussing it, even the best CO monitors were not there, and we were talking about smoke detectors and people were talking about temperature sensing devices, and things of that type.

So I personally believe that this is an area where the committee has to take a look at the point, in addition to velocity and spacing. They are related to the time, and can time be another factor, and can

time be another factor.

DR. CALIZAYA: I have one question. This is again related to velocity. You know, 50 feet per minute in a mine, you can hardly see it, and if you have smoke, well, smoke is traveling almost at the normal rate, and by the time that we see that one passes by the sensor, it is too late.

It may not even be the time that we expected, and so my question is that when you were considering this minimum velocity, I think that you disagreed on this point. What was your suggested figure?

And keep in mind that we are talking about mines where ventilation is the only means of supplying oxygen to the face.

DR. RAMANI: I am just a cantankerous person and so I just disagreed, okay? Nobody asked me what velocity do you recommend. But the important point is that there is a velocity probably, but the reason that I disagreed with 50 feet was the spacing between the sensors, and the time, and issues like that which kind of bothered me.

It is not just the 50 feet per minute, because people are looking at a thousand feet between sensors, and the 20 minutes, and all those things, and

then where the sensor is located with regard to the fire.

And it was not disagreement with the velocity limitation as much as specifying a velocity of 50 feet, which is too little. And part of the reason that I felt that a higher velocity will be useful is the ability of the sensor and where the five combustion products will lead to the sensor.

So higher velocities would have been okay with me. Now the question really is what is a good higher velocity. That of course -- you know, that is where the question came along on what should be the higher velocity, and the concern on dust was really very misplaced.

The concern on dust was really very misplaced, because data, again, and again, and again showed that the dust concentration -- that the respirable dust concentration in the face due to belt was very little, okay?

Jankowski I guess presented a lot of data to us, and we had done some work in our mines, and we didn't find a lot. So, respirable dust was not the question. But that was part of my reason that you can have a higher velocity than 50 feet per minute.

But what should be the highest velocity? I

am not one of those persons who says that we should have 500 feet, because my own feeling is that there is a primary escapeway which is in an intake, and there may be other intakes, and the belt, but technology has changed today. Conditions in mines may be different.

Production has increased and belt speeds have increased, and the rate at which -- you know, all of these create different entrainment possibilities. But minimum entrainment velocities are around 800 to a thousand feet per minute, and you may get some dust entrained.

That means that if the air is traveling, and if a belt is traveling at 750 feet per minute, your air cannot travel at more than 250 feet per minute, because at that rate, the ready velocity will be a thousand.

So you can see where I am coming from. As a mining engineer, I would be interested in designing the ventilation system so that the belt velocity is tied to the air velocity, and they travel in opposite directions. So that you study the entrainment propensity, and decide the velocity accordingly.

So there is no minimum for me, and there is no maximum for me, but it will be dependent upon the kind of velocity that you are likely to encounter, the

velocity that you are likely to encounter in the belt entry.

DR. BRUNE: Dr. Ramani, I have three questions for you. The first question is, in your deliberations why did you require the atmospheric monitoring system only in cases where the belt air goes to the face? Was there any discussion about requiring that in any case, or was that not part of the charge?

DR. RAMANI: No, that was not part of the charge. Part of the charge was not to deal with mines in general, and that's why you found that some committee members felt very strongly that you have been charged to do certain things, and why don't you do it, rather than run around and see what improvements can be made to mine safety overall.

And in some cases that would have taken us away from our focus, and that is the reason why we didn't talk about the AMS.

DR. BRUNE: Okay. Thank you. The second question is regarding the pressurizing of the intake. Would you agree that the requirement to pressurize the intake effectively caps the velocity that you can have going on with the belt, and basically saying that if you have a higher velocity, or as the velocity on

the belt approaches the velocity on the intake, the ability to keep the intake pressurized is much more difficult than if you have low velocities on the belt?

DR. RAMANI: I think Jim raised an interesting point. What are the alternative ways of pressurizing the intake was the question.

DR. BRUNE: Right.

DR. RAMANI: And unless we decide how you are going to do it, you really don't know how the system is going to behave. And one of the ways that you can do it is in the event of an emergency, having some kind of a booster fans that will pressurize the intake more than the -- let's say that these entries are isolated, you can pressurize the intake escapeway.

Now booster fans is an anathema to MSHA underground. It is not allowed. But in an emergency situation it may be a possibility, okay? That is the kind of thing that one has to look at.

Pressuring the intake is -- well, I don't disagree with Jim when he says you guys took the easy way out. Pressurize the intake and you just walked out. You didn't tell me how to do it.

Fred Kissell talks about parachute stopping, and pressuring. There is so many ways of pressurizing, and the question is what are possible,

and what are not possible, and what are feasible, and how can it be done. There is a lot of things, and that is the reason.

DR. MUTMANSKY: One of the things about using either a booster fan or a parachute stopping is that you had better know where the fire is. Otherwise, you can just make the situation much worse. So that is one of the things that has to be known before you use that strategy.

DR. RAMANI: I am just kind of answering the questions. The location of the fire is of course the key, depending upon where the fire is located, because it is a pressure source. As the fire builds up, it is going to throw a lot of thermal energy into the system, and that is going to affect your ventilation somewhere, at some point in time.

It may not affect it immediately, but somewhere, at some point in time, the fire will become a controlling factor for your ventilation.

DR. BRUNE: One more question. In recommendation number nine, you mention that you did not specify a general need to keep the intake escapeway isolated. Why did you not specify that?

On your slide here, it says here no need for totally separate and distinct split of intake air.

DR. RAMANI: This is the alternate intake air escapeway.

DR. BRUNE: Yes, for the alternate intake air escapeway.

DR. RAMANI: What we said was that we don't want that to be a completely isolated split. That means what I am saying is that if you have, say, two intakes, your primary escapeway is, say, already there and that is one intake.

And you say that you have two more intakes coming in, and you designate one of those as your alternate escapeway. We just suggested that that may not be on a separate split as compared to that. Two intakes may be coming down, and you designate one as an alternate, but these may not be separated from the one next to it.

DR. BRUNE: And so that has to be taken in a more specific way if I understand you correctly now, because I would still contend that from my perspective and from my experience that into the section, the intake escapeway should be completely isolated.

DR. RAMANI: That is your primary escapeway.

DR. BRUNE: It would not necessarily be the primary. It would be a secondary escapeway.

DR. RAMANI: The alternate escapeway.

DR. BRUNE: Yes, the alternate escapeway.

DR. RAMANI: The only thing we are saying is that the alternate escapeway, to be designated an escapeway, will have all of the features that are required -- the reflectors, the lifelines, and everything else. But let's not have two intake escapeways, both of them on separate splits.

DR. BRUNE: Okay. So if you have multiple escapeways, then obviously --

DR. RAMANI: That was the point that was being made there.

DR. BRUNE: Okay. All right. Thanks.

DR. WEEKS: Could I follow up to a question that Jurgen raised? You are not bound by the charge to the committee now in regards to the use of AMS systems in other belt entries, and what are your views on that?

DR. RAMANI: Frankly, I believe that the AMS is only a specific compliment of -- you know, I would say that the AMS in my terminology is automatic mine monitoring system, and it will include the monitoring of almost everything, including atmospheric.

And mines should generally do it if they can afford it, because over the years, the contribution of AMS -- and when I say AMS, not atmospheric, but

automatic monitoring systems -- to production, productivity, and safety is tremendous.

And therefore I am a strong proponent of automatic monitoring systems. Should I make it a law? I don't think so.

DR. WEEKS: Well, I wasn't so much asking that, but what else besides CO would you monitor?

DR. RAMANI: Well, certainly the velocity of air. The velocity of air is one of the things that we will monitor in an atmospheric monitoring system. CO is one.

DR. BRUNE: How about methane?

DR. RAMANI: Well, methane levels are -- you know, there are a number of gases that you can monitor, but I am thinking in terms of today, where a sensor package can monitor the absolute temperature, and can monitor the relative humidity, and things of those types.

And that is why I believe that if you go through what are the precursors, which are even before your CO, and if those things can be monitored, that is the kind of thing that you should monitor.

Then you will cut back the time that you are talking about, the 15 minute time for CO to be produced or CO to be transferred, okay? So my own

feeling is -- and it is not an area in which I specialize, and therefore I don't know what are the other precursors, okay?

And remember the tsunami that occurred in Indonesia, and Thailand, and all those other places last year? We have a small island off the coast of India called Blair Island. The elephants on that island ran away to the high ground long before the waters hit the shores, okay?

So it was said that the elephants have a sixth sense. They knew what was coming long before the tsunami hit the coat of Blair Island. It is a small island, which sits right there in the middle of the Bay of Bengal, okay? It was exposed first. But the elephants on that island, they all went back to the high ground.

DR. WEEKS: Did the people follow?

DR. RAMANI: There is not too many people, but what I am trying to point out is that there are some precursors that they say that some other animals and things like that can follow. So the question really is are there precursors here other than CO. By the time that CO hits the fire may be a raging fire. Any more questions?

MS. HONOR: I just wanted to follow up on

something that Mr. Weeks mentioned, and you were correct in saying that that standard that is in the Mine Act was an interim standard. And the Mine Act was always intended to be a technology enforcing statute.

And when that was written, of course, there weren't AMS systems in place, and some of these other technologies that have since developed that have decreased or made the use of the belt entry a lot safer.

So I just wanted to mention that, because I think you were looking over here for some response. And in fact when industry and labor sued MSHA following the promulgation of its belt air standard, that wasn't one of the arguments that the union made.

So they did make an argument that there was a reduction in protection based on particularly stringent petitions for modifications, but they did not make what seemed to probably be a more factually obvious argument that the Mine Act states that the belt entry has to be separate from your intake air. So I just wanted to let you know that.

DR. WEEKS: Well, thank you. I am aware of that. To my mind, the principal test that has to be met in making a change is that there is no -- and I

forgot what the wording is, but no diminution of safety.

Frankly, I don't think that MSHA has made the case, or at least I am not convinced, and at some point I will go into that in some more detail, but that is another matter, and I am aware that the union did not make that argument. They went off on a different direction.

MS. HONOR: Thank you.

MS. ZEILER: If I can make one comment on behalf of MSHA and NIOSH. I would like to thank Dr. Ramani for coming today, and presenting your insights to not only the inner-workings of the previous belt air advisory committee, but also your thought process on how you came to your recommendations, and it has been very helpful.

And I wanted to remind the panel that we do have copies of the transcripts of the actual meeting, and they were distributed. And also Bob Timko from NIOSH asked for a chance to say something on the record before we adjourn.

MR. TIMKO: Thank you, Linda. As the liaison to the committee from NIOSH, and for the record, I would like to inform the committee of two separate modifications that should be made to the

presentations.

The first is the presentation that I gave on Wednesday morning, entitled, "An Overview of Belt Air Issues and NIOSH Belt Interrelated Issues" on behalf of Dr. Kalich. Page 5, slide number 14, stated, and I quote, approximately 650 systems, and I am referring to atmospheric monitoring systems, are presently underground. This is obviously the wrong number.

The unsubstantiated number that I received informally was approximately 157 systems underground. I will check that number again, and what I will do is I will provide the committee with a formal presentation relative to that incorrect slide.

Secondly, on the presentation given yesterday by Robert Krog, entitled, "Ventilation Overview." Page 2, slide number 4, where Mr. Krog refers to air velocity guidelines, I want to again reiterate that these are not NIOSH guidelines. That is the incorrect terminology. These are typical numbers that you get from some background information obtained from some mines, eastern or Appalachian mines. Those are the two corrections that I would like to put on the record, and also as the liaison, I would like to thank the committee, and from the entire NIOSH organization, thank you for your

continued interest in our research, and with the pledge that we will continue to provide you gentlemen with any information that you need.

And on behalf of all of authors, I would like to thank everyone at the MSHA table for all the assistance that they provided to the authors. Thank you.

DR. RAMANI: Thank you again for inviting me, and I would like to thank the audience for their patience and giving me all the courtesies. Thank you very much.

DR. MUTMANSKY: Well, thank you, Dr. Ramani. Tom, you had some comments?

MR. MUCHO: Just two comments that I want to make relative to some of the things that have been said just to get them on the record. One, on the issue of pressure differential for escapeways, and of course the requirement for the primary or intake escapeway to be at a higher pressure is not in the law like it was recommended.

But what Jim was bringing up in terms of quantifying that, keep in mind that the whole issue is -- you know, for those of you who feel that would be enhanced escape, and so forth, the whole issue is whether there is a differential.

And Dr. Kissell yesterday in his presentation was alluding to how it dropped off at some distance going outby and so forth, but either if it is a thousandth of an inch of water gauge, as long as there is a pressure differential, and the smoke is not coming into it, but rather whatever little air, even if it is only a couple of molecules, is moving the other way, then that is what is important.

So quantifying that is -- and as Dr. Ramani pointed out, would vary with the systems that you are talking about quite a bit. The other issue that kind of ties in is this fire situation and where it occurs, the locations.

And just to be clear, for instance, I talked about the Marianna Mine 58 fire, and how problematic that was, in terms of escape. The issue is that if the fire occurs in the highest pressure airway, then that is the most problematic situation.

It is less problematic if the fire occurs in any of the non-highest pressure airways. And sometimes we have been throwing these terms around and saying the fire occurred on the intake, or in the primary, and kind of indicating that it is the highest pressure, but it may not be.

So the key is to make a distinction of the

most problematic situation, and the one that Dr. Kissell was addressing is when it is in the highest pressure airway.

DR. WEEKS: If I could just reply briefly. I accept Tom's criticism of that, but I want to focus on what I was trying to accomplish was -- I mean, I share Dr. Ramani's concern about maintaining the integrity of the escapeway.

The question is can we be more specific about how to accomplish that. I don't know. I would have to think about it some more, but I looked at pressure differential, and thought, well, maybe that is one way to do it. It is more complicated than I thought, but the aim is maintaining the integrity of the escapeway.

DR. MUTMANSKY: Okay. Are there any other comments?

DR. TIEN: If I could make an observation.

DR. MUTMANSKY: Yes.

DR. TIEN: With regard to the pressure differential, I think we all agree that it is desirable to have a positive pressure in the primary airways, but as a practical matter, Tom, I guess you just used a number to a thousandth of an inch water gauge difference, but when you have that low pressure,

first of all, it can change any minute.

So as a practical matter, I don't know what would be a good number to amend to a positive pressure. I guess we will have to look into it. Am I confusing the matter?

DR. MUTMANSKY: Yes. I think, Jerry, you realize that in most of these cases that it will vary as you get further from the face.

DR. TIEN: I understand.

DR. MUTMANSKY: And I think Tom's comment would apply in this particular fashion. As long as you maintained some small pressure differential in the primary escapeway along its length, then the smoke does not progress from the beltway into the primary escapeway, and that is a very important issue.

So in that particular case, if he were to clarify his statement just a bit, then I think we would take care of that matter.

DR. BRUNE: I think, Jim and Tom, from a practical perspective, if you open any of the doors that are provided in typically every other stopping between the belt and the intake, or the track, and if you just clap your hands and create a small cloud of dust, you can easily detect which way this dust travels.

And it is very easy to demonstrate and determine which way the pressure differential goes. So it is from an inspection and enforcement perspective that it is very easy to determine, and you don't need any technical gear to find out what is pressurized and what is not.

DR. MUTMANSKY: Dr. Ramani, do you have another comment?

DR. RAMANI: I think the practical limitation for pressure difference, really when you are talking about systems, is what you can measure. What you cannot measure, you cannot say that it exists there. So if you have pressure differences, and let's say the sensor instrument says 0.05 inches or something like that, that's it.

So I personally believe that pressure differential questions should be addressed by this committee both in terms of -- you know, our committee just basically said that when you apply for a petition for modification that you have to submit substantive data; data through experiment, or through computer analysis.

I don't know what the follow-up on that has been with MSHA, but we always felt -- and as Jim says, it is easy to say, but difficult to prove, that this

can be done. We said that we should have substantive data when you apply for a petition for modification.

And the question is if you want to measure what is there, equipment limitations will dictate automatically what you can measure, and 50 feet per minute velocity was something that I personally felt very difficult to measure.

Now we have instruments that can measure velocity much lower. At that time when we said, we couldn't. Guys, before my wife erupts into a fire, I am going to go.

(Laughter.)

DR. MUTMANSKY: Well, we have not yet achieved the end of this, because Tom wants to say something.

MR. MUCHO: Just quickly. When I was talking about the pressure differential, what I was talking about is a point in time when I am trying to escape, and for instance, I erect a parachute stopping, and now I create some pressure differential. I was not talking about system design of the ventilation system when I was talking about that.

DR. TIEN: I understand, yes.

DR. MUTMANSKY: Now does have any member of the panel have anything more to say?

(No response.)

DR. MUTMANSKY: I certainly would like to thank everybody who participated in the deliberations of the last 2-1/2 days. I thank Dr. Ramani for coming today, and all of the speakers who came. We had discussions last night concerning how much we have learned from the speakers, and how helpful that has been, and I am looking forward to continuing our process in Salt Lake City and Birmingham in upcoming months.

For the record, I would like to mention that in May, the panel will be going to Salt Lake City, and three members of our group will have a field trip on May 15th, and that is a Tuesday. We will convene a panel meeting in Salt Lake City on the days of May 16 through May 18, with primary discussions held on the 16th and 17th, and the date of May 18th will be used, if necessary, to continue discussions.

We will then move to Birmingham, Alabama, in June, and our meeting will be held from the 20th through the 22nd somewhere in Birmingham, Alabama, with a field trip on June 19th.

And we welcome any person who would like to come to those meetings to make public comments, and we encourage people who have things to say about our

deliberations to come forward at that time. Are there any other announcements, Linda, that you would like to have made at this point?

MS. ZEILER: No, I don't think so.

DR. MUTMANSKY: Okay. Then this meeting is at an end.

(Whereupon, at 11:45 a.m. the meeting in the above-entitled matter was concluded.)

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REPORTER'S CERTIFICATE

DOCKET NO.: --

CASE TITLE: TECHNICAL STUDY PANEL

HEARING DATE: March 30, 2007

LOCATION: Coraopolis, Pennsylvania

I hereby certify that the proceedings and evidence are contained fully and accurately on the tapes and notes reported by me at the hearing in the above case before the United States Department of Labor, Mine Safety and Health Administration.

Date: March 30, 2007

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