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NUCLEAR REGULATORY COMMISSION

Title: Gas Transmission Lines at Indian Point Nuclear Plant

OIG Case Number: 16-024

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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STAFF'S RESPONSE

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In the Matter of: :

CONCERNS PERTAINING TO GAS :

TRANSMISSION LINES AT : OIG Case No. 16-024

INDIAN POINT NUCLEAR POWER :

PLANT :

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Thursday, March 19, 2020

Teleconference

NRC STAFF PRESENT:

DAVID SKEEN, Team Lead; Deputy Director of Internal Programs

THERESA CLARK, Program Manager

DR. YUEH-LI "RENE'E" LI, Office of Nuclear Reactor Regulation

ALSO PRESENT:

RICHARD KUPREWICZ, President, Accufacts, Inc.

STEVE NANNEY, Pipeline and Hazardous Materials Safety Administration, DOT

JAMAL MOHMAND, Sandia National Laboratories

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

1:04 p.m.

MR. SKEEN: All right, so maybe we'll get started and if other folks join in that's fine. They'll just have to introduce themselves as they come along.

But for now, just let me start. Again, I am David Skeen, I'm leading this team that was put together to look into the IG event inquiry findings concerning the gas pipeline, the 42-inch gas pipeline that is on Indian Point's property.

Who just joined please?

MR. NANNEY: Steve Nanney with PHMSA.

MR. SKEEN: All right, great. Thanks, Steve. We have a court reporter on the line transcribing the meeting. Could you give your name and spell it for him please?

MR. NANNEY: Steve, S-T-E-V-E, Nanney, N-A-N-N-E-Y.

MR. SKEEN: All right, thank you very much, Steve, appreciate that.

So, to continue with the introductions again. We were put together, the Chairman looked at the event inquiry report and she asked our executive director for operations to put together a team that

would be independent from folks who have worked on this project up to this point within the NRC.

And also, to get some external expertise help to look at some of the concerns that were raised by the Inspector General. So, that's what we are.

I'm the team leader for this. My background was, I've been with the NRC about 29 years. And I had done the Japan lessons learned after the Fukushima event in 2011.

I worked with a group, a special projects group, for about three years at the time. And so the executive director asked me to put together a team, assemble a team of internal and external experts to kind of look at what the IG findings had put forward. So what's what I've done.

We have several, you've heard some of the team members on the line. The internal team members we have Theresa Clark and Suzanne Dennis, Rene'e Li, Brian Harris, who is an attorney, who is not on the call today but I'm sure we can back-brief him on whatever our discussion is.

And then externally, because we wanted to make sure we got expertise, technical expertise in gas pipeline issues, we were able to get Steve Nanney from DOT to be part of our team as well to help us with

that part of the evaluation.

And then we also have Sandia National Labs who is looking at some of the fire and explosion risks for us. So that's the basic, our team that we have. I just want to make sure you knew that.

And so, we do have on the line with us both Steve Nanney from, P-H-M-S-A, we say PHMSA, as well as Sandia National Labs are on with us too. Jamal is on from Sandia.

So, I know that's a long-winded introduction but I just want to make sure you understood who is on the phone and what our purpose is here.

So, if you're okay with that, what we've been doing with folks as we've interviewed them is just kind of have them talk about what's been their involvement in the process. So whatever they can remember from that.

And then we have some specific questions. But a lot of time when whoever we're talking with just kind of says here's what they've been doing, they answer a lot of our questions so that we don't have to go through those.

And if we miss --

DR. LI: This is Rene'e Li. Sorry.

MR. SKEEN: Oh, sorry. So, Rene'e, is that you?

If you could please give your name and spell it for the court reporter please?

DR. LI: Yes. Rene'e Li. My official name is Yueh-Li, Y-U-E-H, dash, L-I, and last name Li, L-I.

MR. SKEEN: Okay, thank you very much. Did you get that court reporter, please?

COURT REPORTER: Yes, sir. Thank you.

MR. SKEEN: Okay, thank you very much. And so, Rene'e is our piping and structural expert within the NRC. So that's who just joined us as well.

MR. SKEEN: So, anyway, Rick, if you want to just kind of talk about what your involvement has been in the whole process. I know it's going back a few years, but if you can talk about that.

And then maybe we'll have some questions for you when you get through kind of describing what your involvement has been.

MR. KUPREWICZ: No problem. And let me know if my voice starts trailing off here. Don't get real old is all I can tell you folks.

MR. SKEEN: Okay.

MR. KUPREWICZ: My involvement probably

initiated with the town of Portland, New York, in the original AIM applications with FERC. And there is documents in the FERC process that will show that I did some analysis for them and raised some questions.

And then there is a local group of people, and I don't know who they are, who have asked for some technical expertise on the specialized issues related to gas transmission.

I'm with Accufacts Incorporated. It's my own company. And Steve Nanney knows me. I got a lot of respect for Steve.

Steve and I go back interacting on various PHMSA committees. And so it's good to see Steve on the team, let me put it that way. I figure he didn't need the work.

So, I guess a couple of quick things. So there is back and forth documents related to the FERC application. And also sometime after that, I did met with members of the NRC after building in Washington, I don't remember what year that was, and kind of outlined some issues related to gas transmission, failure dynamics. Especially in regards to rupture.

And basically I just said, look, the issue here from a 42-inch pressure gas transmission line is if the line ruptures can you basically, you're going

to lose the power plant most likely if it ruptures in the wrong location. So you're coming down.

And my question to the NRC was, you have to demonstrate to somebody that if the gas pipeline ruptures you can, basically, what I call a cold shut down. You can bring the plant down.

And yes, I didn't know the answer to that. I didn't want to get into all the secret details. But as a process safety manager background, that's a simple question to me.

And so they did their thing. And then the last couple of years the Office of the Inspector General has interviewed me a couple of times while they were going through that process. And so I gave them my feedback on that, and that's about it.

MR. SKEEN: Okay. Well, I appreciate that. And certainly we agree. I mean, we want to make sure that the plant gets shut down safely if there is a rupture to that gas line.

And I guess the questions stem from, how did you look into evaluating that and what did our staff do, and did they do appropriate or was it inappropriate what we did? So we're relying on you as an expert is certainly something that we want to get your thoughts on that.

MR. KUPREWICZ: Well, let me just interject again. I've got no dog in this hunt. And Steve can speak up if he thinks I'm off-tangent here, but I try to stay neutral and objective. I'm not the judge or jury.

People bring me in to ask the right questions and then they'll evaluate whether those questions have been adequately addressed. And I don't advertise because I don't need the business.

So, in this particular case I would suggest to your team that the OAG, and I didn't see the report till just the other day, has raised many issues that I find relevant. Let me leave it that way.

MR. SKEEN: Yes, I understand. So, okay. Well, with that, maybe we can go through some questions and maybe that will help us if you can provide some more information to us.

So, one of the first things we looked at was, of any of the issues you raised during the time that you were consulting for them, have any of them been resolved?

Any of the issues at all that you raised?

Are you comfortable with any of them that they have been resolved?

MR. KUPREWICZ: No. And it's not, and again, in the little room we got to talk and be very frank. I want to respect everybody's approaches and all that.

It was clear that, from my perspective, the people evaluating this -- and again, the NRC aren't gas transmission failure experts. It's not your area of expertise. And that became obvious.

So, I would just suggest a couple of things. One, not overwork the issue of leak versus rupture.

They carry, and Steve can speak up if I'm missing this, rupture carries a special meaning in transmission pipelines. And while you have to talk about leaks, the reality is that leaks are not a bona fide threat here. Even if the line developed a leak.

It's the case -- the base case here is, has this been adequately evaluated for gas transmission pipeline rupture. Even though it may be a low probability event, the consequences of such an event in a certain location, and it won't matter if the pipe is underground or above ground, all right.

And so, I would suggest, be careful how the use of the word leak is used when you really are, if you're talking about rupture, use the word rupture.

MR. SKEEN: Okay. And can you help me with that? So can you maybe tell us what's the difference in rupture and leak then so we can --

MR. KUPREWICZ: Rupture is an imperfection that is in the pipeline that causes almost instantaneously the mechanical failure of the pipe. Either at the weld or at the pipe body.

The failure occurs in microseconds. Depending on the type of pipe, it can promulgate down the pipeline. But basically, rupture is the pipe fractures in tremendous force.

With tremendous force because of the compressible nature of the gas. And so you generate these huge craters and pipe shrapnel that may or may not ignite. More likely it will ignite. It can generate its own ignition source.

But you end up with the releases of massive force that generate, you know, it will throw tons of dirt and pipe steel around. And then it will end up generating usually a fireball.

And it's fed by, because the pipe is basically, completely fractured, it's fed by two full-bore ruptures from each end of the failure site.

MR. SKEEN: Okay. That's very helpful --

MR. KUPREWICZ: And ironically, you're not

likely to see pressure drop right away. So, yes.

MR. SKEEN: Right. Well, thanks, that's helpful.

MR. KUPREWICZ: And Steve he's got this -- again, Steve, I don't want to put you on the spot, but you can help them fill in the details.

MR. NANNEY: Yes, Rick, just to tell you I have been, and so, I have been going through this with them.

MR. KUPREWICZ: Good. Good. So if I'm repeating, shut me down because all I'm doing is losing my voice.

(Laughter.)

MR. SKEEN: Okay. All right. So, maybe we should get focused on the particular issues I think that you had raised in some of your dealings with the NRC or some of the problems you had.

So, let's talk first about the one to three minutes. If you can try to talk about that just a little bit.

And if the one to three minutes isn't the right value to use, what would be the right value to use if you could give us some thoughts on that.

MR. KUPREWICZ: Well, it's system-specific. And I don't know all the details of the

control that Enbridge has got in there, this has a pump, a compression station, excuse me, a compression station fairly close to the plant upstream.

And so I don't know the specific details of how they're designed to remotely monitor that compressor station and how they are measuring the various parameters along that pipeline for the segment that could affect the nuke plant, okay.

But what tends to happen is the laws of thermal dynamics. Even though these show up as two full-bore ruptures, the laws of thermal dynamics control.

And so you are more than likely not to see a loss of pressure for a while. By the time you see pressure loss, damage has already been done. Okay?

MR. SKEEN: Okay.

MR. KUPREWICZ: And so what you want to know, and Steve may be able to point you to some people, you want to have an expert that's an expert in pipeline in transient analysis that says, okay, pipes just failed at this point, and given this system, what's going to happen.

And what's going to happen is, you're probably not going to see changes in pressure for a while. A few minutes at least.

And more likely what you'll see is funny things happening in the compressor facility. And given all the information that the SCADA control room operator in Houston is looking at, he may not understand that he just got the indicators of a possible rupture.

So my point is, the remote monitoring, and without more detail, it could be many minutes before the control room knows they actually have a pipeline rupture. Okay?

So, there's quite a span in time before he would have to determine that there is an actual rupture and then order the valves closed. Because I assume on a 42-inch they're not putting in automatic closure valves. I don't know that, but I don't remember them doing that.

MR. SKEEN: Yes, our understanding is they are remote actuated valves but they are not automatic. That the control room has to recognize there is a problem and then push the buttons to isolate the valves. To close the valves.

MR. KUPREWICZ: That would not be a surprise to me. That's a fairly responsible approach.

I think one of the things that you might want to talk about in trying to figure out what's the

time when the actual rupture occurs between that and the time to order the valve closed, one pre-factor that I always tend to, when I talk to operators that have had ruptures in rupture investigations, it's not so much pressure loss that shows up, it's some sort of massive rate change.

And they may or may not be set up to see the rates. Now, as close as this compressor station is, I would think that these things, Enbridge might have some parameters that would say, if you get this signal you better be looking for a rupture. You don't know it's there, but this is a precursor to indicate.

MR. SKEEN: Okay.

MR. KUPREWICZ: Does that make sense?

MR. SKEEN: Yes, it does. And maybe you can help us with this. So does the operator have to have some alarm procedure or isolation procedure that says -- we're used to nuclear power plant operators, right, we have procedures for everything, so if they're control room do they say, this is your alarm procedure, that if you get this then you check this parameter, that parameter and if all those check out then you isolate the --

MR. KUPREWICZ: Yes, that's something that I think Steve wants to probably chase down. Now, my

suspicion would be, on a 42-inch running this high of pressure in this sensitive area, they probably have procedures. But having procedures and getting everybody to follow them is a different animal.

I think the point is will be, on a 42-inch you just don't go out and say, somebody calls you and says we got a rupture, the control room isn't going to shut the buttons right away until he's got confirmation. So there is some lag there between the actual event and the order to close the valve.

MR. SKEEN: Yes. So, would you have a ballpark of what would be normal?

Is it five minutes, ten minutes --

MR. KUPREWICZ: No.

(Laughter.)

MR. KUPREWICZ: I'm not laughing at you guys, I'm laughing, you know, you're more likely 15 minutes to half an hour.

MR. SKEEN: Okay.

MR. KUPREWICZ: Now, and let me tell you, as a person whose actually been in incidences in the control room, those minutes can move extremely quick or they can be dramatically slow, all right, during a real emergency.

So this is not something I want to pin on

the poor control room operator, it's a tough job.

MR. SKEEN: Sure. Thank you. I understand.

MR. KUPREWICZ: The industry will try to say, you know, well, it's not a few minutes, but when you start talking 15 minutes or half an hour, they get a little nervous.

And, you know, because people then start challenging them. And the answer is, it's hard. It's really difficult.

And it's pretty system-specific. But if Enbridge has got certain parameters that are focusing on, all of a sudden your compressor is acting weird because it's trying to run out on its curve because the resistance in the pipeline has gone to zip because of a rupture -- then that's a good indication of a rupture

But given the size of this line, it would be a reasonable for the pipeline operator, they just don't hit this button to shut everything down, they've got to really, it's not unusual to say, confirm these informations that you're getting and then take an action.

They may have the authority to shut down, but this is a 42-inch gas pipeline, you got to be,

there is a reason they didn't put in automatic control shutdown valves.

(Laughter.)

MR. SKEEN: Yes.

MR. KUPREWICZ: Make sense?

MR. SKEEN: Yes. You don't want nuisance tripping for sure, I understand. On lines that large, you don't want nuisance tripping your isolating gas lines when you don't need to.

MR. KUPREWICZ: Yes. A few more minutes, from a pipeline operator, isn't going to make a lot of difference.

Now, the question is going to be the facilities at risk, it's back to, you know, at Indian Point your reactors are in a big old concrete salter but all your auxiliary equipment, is anything there required that you would need to bring that plant down into a safe situation, right?

And if there is, then you can either, and this is, I had discussions with them in the meetings saying, look, I don't need to get into details. You've got pieces of equipment that are at risk, even though it's one out of a million.

Murphy said the one out of a million is going to occur. If this keeps you from bringing that

plant down safely, either you move that facility or you harden it. Make sense?

MR. SKEEN: Yes. Yes, I understand that. That's something we're trying to get to the bottom of.

So, that leads me to another thing about the distance. The potential impact radius that you can calculate with the DOT equation.

MR. KUPREWICZ: That, again, and this is where Steve and I are probably going to diverge. On a 42, the PIR's intent was not to be a citing tool, it was kind of used to help identify high consequence areas. Understanding that it was a compromise, all right?

And so, my experience is this. When you start getting into larger diameter, high pressure transmission pipelines, other factors kick in that make the empirical formula, and I don't want to take away from PHMSA and what they are trying to do with the temp regulations. Those are good things.

But large diameter pipelines, you can give PIRs, well, the actual impact zone can be much greater. All right.

And I don't say that to scare you, I'm just saying, I wouldn't overwork the PIR equation. You'll pretty well, just say, if I have a rupture at

this location, even if it's underground, it isn't going to matter.

MR. SKEEN: Okay.

MR. KUPREWICZ: What would a rational person say? What sensitive nuclear facilities are in that zone.

And you don't have to, whether it's 1,500 feet or 2,000 feet isn't going to make any difference. Does that make sense?

MR. SKEEN: Well, I'm trying to understand. So if the calculation comes down, let's say it's 900 feet, you're saying it could be much greater than that?

MR. KUPREWICZ: Yes. Because another factor kicks in that's not in the PIR. It's called turbulence.

MR. SKEEN: Okay. Can you talk about that a little bit?

MR. KUPREWICZ: Well, it's the mixing of the gas in the air, then what happens is, not only do you get one explosion -- these aren't modeled well, these are tough things to model. And so, what you have is a unique situation where they put a large diameter, high pressure pipeline next to a very sensitive facility.

So you're trying to get this tied down. And so, this is stuff that your other experts can try to work out. And there are various ways to do this.

We know ALOHA is not the tool. And so OIG was -- they figured that out all on their own. But there are other ways to calculate the transient releases from two ends of a pipeline. And that will give you the mass of the gas. And then you can decide, you know, does it ignite right away or not.

I'm just saying, you know, if it says you got a 2,000 foot zone and whether it's 2,000 or 1,500 and you got a piece of critical equipment that needs to either be moved or hardened, that's what you're after.

As engineers, we all think we can calculate these things to a decimal point when the reality is, the assumptions are throwing you all off.

MR. SKEEN: Okay. So --

MR. KUPREWICZ: So there are no real good tools to tell you the actual impact zone. But for a 42-inch pipeline operating this MAOP (phonetic), it's going to release a lot of tonnage.

Especially, you're more likely -- Enbridge is saying, I think six minutes. I'm not saying they're wrong with the six minutes. Six minutes could

easily be 15 and 15 could be 30.

But you know, in trying to calculate this stuff you'd like to tie it down, it's a tough one. So you probably want to think about, here's our base case and here's the sensitivity case.

MR. SKEEN: Right. When you talked about having facilities hardened, if our components are inside a, let's say an 18-inch or two footer or three foot thick reinforced steel concrete structure --

MR. KUPREWICZ: No problem.

(Simultaneous speaking)

MR. SKEEN: -- from hardening?

MR. KUPREWICZ: Yes, you're fine. Concrete, you know, it's going to handle the blast and the blast pressure, your own experts will help you out here, it dissipates very quickly with distance. And so the concrete is going to withstand that within reason.

The thermal radiation is what takes out your power lines and forces you into the power, you know, brings the plant, you can't get the power out the plant is coming down. That's what I told them in the Washington, D.C., meeting.

Come on, you guys. The fireballs generate so much thermal flux. I've seen it liquefy aluminum

or vaporize aluminum and liquefy steel. It's hotter than hell. And Steve knows all this stuff.

Where you get into discussion is, that can be disagreement is, well, how quickly does it dissipate. Well, heat radiation doesn't dissipate a whole lot with distance. Right? Your experts will tell you that.

MR. SKEEN: Right. Thank you. But like I say, if the components, because there's lots of components, it's a nuclear power plant, right?

MR. KUPREWICZ: Yes.

MR. SKEEN: I think you've seen from the maps or drawings, they talk about the different equipment that might be taken out by the blast or the heat flux. What we've seen so far is that the closest components that could be impacted, that we rely on for safe shutdown of the plant are probably at least 1,800 from the closest point of the pipe rupture.

And those buildings are all maybe two feet, or more than two --

MR. KUPREWICZ: You're on the right track. Again, that's the kind of detail that maybe you can't make public. And I didn't know all of -- I didn't have a listing of all the sensitive shutdown equipment, nor did I need to have it. But I said,

look, concrete can handle the blast forces, it can handle the thermal radiation.

If you've got a listing of that equipment, whether it's 1,800 feet or 2,000 or 2,500, here's your base case and they say, well, if this turns out to be 3,000, do I have anything else that's sensitive, and you say no, because I've got it reinforced and all that, then it's off the agenda, you're fine.

MR. SKEEN: Okay. Well, that's very helpful because that's what we've been trying to struggle with is when we talk about if the PIR is more than what you calculate through the DOT equation or even other equations, what is the impact on reinforced concrete structures because in nuclear power plants that's generally the really important to safety things that are relied on to shut down the plant. We call it safety related equipment.

That is all housed in very robust buildings. It's designed against hurricanes and tornados and the missiles that they can generate.

MR. KUPREWICZ: I think you're on the right tack. I would just, if you're telling me you're using the PIR then I'm going to come at you and say, that's in the regulation but that's not its intent. And I don't want to do that.

MR. SKEEN: Okay.

MR. KUPREWICZ: I just want to be sure that, okay, if you use the PIR and you said, well, you know, because this is not really a technically citing tool. It was developed to be sure that pipeline operators would be -- you know, do things to be sure their pipeline would not rupture.

Now, understanding you can't guarantee everything. And we've seen too many pipeline ruptures even after inspections --- assessments.

But it was a kind of a, use this as a starting point. So you can use PIR but then throw in a, let's do a PIR 1.5 and see, that's a sensitivity case.

And if you do that, someone can criticize you for saying, well, it wasn't big enough. But no, you tried to get the right away and you can't get away the criticism from the PIR.

MR. SKEEN: Yes. Well, and basically we're probably at two times the PIR for the components to nuclear plants that could possibly be impacted, right?

MR. KUPREWICZ: And that may be -- and that would be a good thing. And now you're into, okay, your kind of removing he criticism that appears

to be reversed engineering to get the answer that you wanted rather than just do what you think the science is. And that's what I think you guys are trying to do.

MR. SKEEN: Yes.

MR. KUPREWICZ: I don't have all the answers but I've got a lot of experience in this area. And so, just know the limits of your tools and if you, and you've stated a limit but not necessarily known whether it's absolute. Because engineers like to think we're actually calculating exactitude.

But thrown in another, and so if you go to two times and it's still covered, that's a defendable action.

MR. NANNEY: Hey, this is Steve Nanney. I've got to get off the phone. I'm just trying to let you all know.

Rick, good hearing from you today.

MR. KUPREWICZ: Yes, good, Steve. And you hang in there. You got a good man over there. And he'll answer your questions. And so --

MR. NANNEY: And just to let you know, I can't be answering the questions for you, but I am giving them the correct information they need to look at, so.

MR. KUPREWICZ: Because I -- it's in good hands, let me put it that way. Good luck, Steve.

MR. SKEEN: Well, I appreciate that. And, Steve, before you drop off, is there any questions you wanted to ask or anything you wanted to get from Rick before you drop off?

MR. NANNEY: No, if you don't mind, the thing that you said they've heard from me on all of those topics.

MR. KUPREWICZ: I wouldn't disagree they've been much different. Doesn't mean that we're necessarily both right, we could be both wrong.

MR. NANNEY: And just a, if you all don't mind, just to tell you what I had told them is that I had expected, with the remote control valves, my experience told me that they need between ten and 20 minutes to, after the rupture, to identify and close the valves with them being remote control, with probably 15 minutes being what I think the average number would be.

MR. KUPREWICZ: I wouldn't disagree with that, but it's kind of like a balloon, you squish it here and pops it.

MR. NANNEY: Yes.

MR. KUPREWICZ: Yes, we're on a very

similar, real world experience would tell you that control rooms are funny animals.

MR. NANNEY: And also, I gave them our proposed rule language for remote control valves --

MR. KUPREWICZ: Good.

MR. NANNEY: -- to see and see some of the issues in there so that they can read about it. So they do have that information too.

MR. KUPREWICZ: And the other data point I'd give you, not that I'm here to pick sides, but just on some of the OIG statements about Enbridge, clearly Enbridge is trying to be truthful here so that's a positive step.

MR. NANNEY: But the questions I have to answer, I gave to Theresa to ask. But Rick may cover them without asking. So Theresa has the ones I needed asking.

MR. KUPREWICZ: Okay, Steve, well you take care and don't be flying.

(Laughter.)

MR. NANNEY: I don't plan to. And you all, and Rick and everybody else on the phone, take care.

MR. SKEEN: All right, thanks, Steve. Appreciate your help.

MR. NANNEY: Yes.

MR. KUPREWICZ: Steve's a good man. You got a good one there.

MR. SKEEN: Yes, we're very pleased to have Steve as part of our team. So this is good so far.

Let me move on to, one of the things I think you raised was -- so it wasn't just the three minutes issue it was how long the event could occur and even if you shut the valves the gas is going to be released for a consider period of time. And you suggested a transient graph of mass release versus time.

Can you talk a little bit more about that? Is that what you would normally do in your evaluations of a line rupture?

MR. KUPREWICZ: Yes, we would. Though normally we're not dealing with such a sensitive area.

You follow the laws of thermal dynamics with two pipe ends blowing. And for a 42-inch running about 850 pounds, and I think Enbridge is saying that the valves that we would more reasonably close are 14 miles apart.

You're probably taking 20 to 30 minutes to de-pressure that line segment. Now you can, depending

on how your transient guys set up the models, they got to follow the laws of science. And the laws of thermal dynamics are the controlling factor.

And so the line is going to burn for quite some time but the massive heat flux, with possible explosions and high thermal radiation, probably occur in the first five or ten minutes.

MR. SKEEN: Okay, that's helpful. Explain that a little bit more.

MR. KUPREWICZ: Well, what happens is, and you'll see this if you search the literature and enough places are out there. Let's just say you got one pipe end with full-bore rupture. The laws of thermal dynamics are going to release at the speed of sound in the gas. Which is over 4,000 feet a second.

That's why they'll sound like a rocket engine blowing off, you can't tell direction. And the heat flux is so high you can't tell the direction of the heat. All right.

So what happens is, on this particular one, the pipe has got a full-bore rupture. Let's talk about the end that's feeding it from the compressor station.

All of a sudden, let's say you had three or four miles of pipe resistance there that went up to

40 miles to the next compressor station let's say. But now you only got three or four miles.

The compressor is going to try, depending how they've controlled that, going to try to take -- compensate for the reduced system curve pressure drop. Now I'm getting too techie, I'm probably losing you here.

But what happens is --

MR. SKEEN: This is --

MR. KUPREWICZ: -- the compressor tries to make up for the reduce resistance in the pipe.

MR. SKEEN: Okay, I understand.

MR. KUPREWICZ: And so, you get an increase in gas flow rate out the bore of the pipe. The mass goes up. The mass rate of release goes up but the velocity doesn't. It's set by laws of thermal dynamics.

And so you'll get a spike in gas mass release. All right. At that one end. You'll get the same thing on the other end, accept it's probably not fed by a compressor.

Those two releases on each end of the opposing pipes will come together and then the impact forces negate each other. So you get these huge gas plumes. And if it ignites, then you've got the

problem of buoyancy. The thermal effects take over.

So, what happens basically, let me step back, is you're going to see a massive increase in the tonnage of gas released. But it doesn't sustain that because eventually the compressors catch up or their under control.

So you'll see a peak in the gas rate and then it starts to decline.

MR. SKEEN: In fact --

MR. KUPREWICZ: You can people to argue whether its three minutes or ten minutes. It depends on the system specifics.

MR. SKEEN: Okay, thanks, Rick. Did someone else just join the line, I thought I just heard a -- thought I heard a beep?

MR. NANNEY: Yes, this is Steve Nanney, I came back on. My other call got cancelled so I decided to come back.

MR. SKEEN: Great. Thanks, Steve, I appreciate that. Sorry, Rick, go ahead.

MR. KUPREWICZ: Well, I was just saying that depending on how you're set up, your system curves and your transient analysis release, for both ends of the pipes, you'll see different curves when you plot pounds of gas release per time.

But what happens is, you can take a big jump up because the pipe system resistance has dropped way down and the system may or may not compensate for that. But then it starts dropping off.

And so it's the first five minutes or so that are the most dangerous. It still can be lethal, but super high heat radiations occur in that early stage.

MR. SKEEN: Would you say that -- according to you, they usually don't last very long, it's going to last five minutes or so and then it's going to --

MR. KUPREWICZ: Well, it will depend on the system. No matter how I answer this, someone is going to come at you.

But the key is, it's very lethal. And like I said, it's so high and the blast forces are so great, but the heat radiation is what really gets people. It will vaporize the aluminum. It will liquefy the steel, if you're too close.

Now, if you're in concrete structures, that's not a big deal, right?

MR. SKEEN: Yes. If I'm in a concrete structure 1,800 feet away you're saying --

MR. KUPREWICZ: Oh no, you're -- yes, I've

even seen wooden structures survive at those distances but they don't survive very long.

MR. SKEEN: Yes.

MR. KUPREWICZ: If you don't get the heat down some.

MR. SKEEN: Okay. Well now, that's helpful. I appreciate that.

So, I guess the next thing, and maybe you've already answered this, one of the other things that I've seen you had raised was by doubling the pipe, you're just going to double-end it guillotine break and say that's conservative, and I think you had said that that was not --

MR. KUPREWICZ: Well, I would step back a second. Be careful of the use of conservative because that opens you up to attack.

MR. SKEEN: Okay.

MR. KUPREWICZ: You may mean well by its application, but if it isn't conservative and they catch you at something that isn't conservative, it undermines your credibility and there's no need to do that.

What I would say is a pipe rupture is always a guillotine break. It's a guillotine break from both opposing ends with a big hole in the middle.

And so you may throw a hundred or two hundred feet of pipe steel weighing several tons into shrapnel and then you got a guillotine on one end, guillotine on the other. And they're coming out at the speed of sound in the gas, which is usually a little over 4,000 feet a second.

And those forces are hitting each other and they're trying to cancel each other. So it increases the buoyance, the net effect. Again, I'm getting into details, probably putting you to sleep, I'm sorry.

MR. SKEEN: No, this is fine, this is good. This is helpful.

MR. KUPREWICZ: But it generates big gas clouds. And if they're burning, that's where you see these huge clouds and these big turbulences. And it's hard to model the turbulence.

That's the thing that, that's why we agreed on the PIR, let's not overdo this. You know, some of these will work for 42-inches, some it will not. Just don't use it for a citing tool.

MR. SKEEN: Okay. Well, thanks for that. So, we talked a little bit about the use of ALOHA. And are you saying that's not the right code to use?

MR. KUPREWICZ: Well, no, I don't recall

if I told them, you know, they were using them. They said they were using ALOHA and I said, yes, I wouldn't have done that.

I did, I think, tell them, again, you're asking from memory and at my age, I don't forget anything, but the recall gets a little fogged up. Basically, and the OIG kind of smoked that out.

What tool do you use? And so they may have tried to use a tool, and clearly they've opened up themselves to criticism because it's not appropriate.

A pipeline rupture is gas coming out at both ends of the pipes. And it's tough to model that. There are attempts to do that by using mass calculations and thing like that. But it's only going to get you in the ballpark.

And that's why I say, try to use your PIR and if you want to double that distance of sensitivity and be sure everything is protected there, you're in real good, you're in defendable course here.

MR. SKEEN: Okay. Because what I'm looking at for this, what the team is interested in, is our processes and procedures. And if using ALOHA as part of what our process says to do, if that's not correct, that's what we're trying to understand. Is

that something that we --

MR. KUPREWICZ: Yes, I would say, again, I'm not the ALOHA expert, but I've never, I've seen it used in a couple of different scenarios and it's not appropriate for gas transmission pipeline ruptures. Would be my experience.

So I think you need to chase that one down a little more. And you're probably going to have a hard time, well, what do you use.

Well, you got to find somebody familiar with transient release dynamics for a gas pipeline rupture that models both ends of the release. And then you try to apply it to a specific site, which is really tough.

MR. SKEEN: And are there programs out there that do that?

MR. KUPREWICZ: I've not run across, usually I run across guys -- there are models that are out there, I haven't run across too many that I can site.

MR. SKEEN: Okay.

MR. KUPREWICZ: To be specific. It's a tough nut. A lot of this stuff is very site-specific.

MR. SKEEN: Yes. And I don't know, have you seen many 42-inch gas line ruptures?

MR. KUPREWICZ: Well, now you let me think in 50 years --

(Laughter.)

MR. KUPREWICZ: The answer is not many. You know, the first rule of gas pipeline, especially of 42-inch is, don't rupture. Which is why we've had so much time trying to make the PHMSA temp regulations a little more meaningful.

And many companies get it and are staying well ahead of the federal regulations and other companies don't. All right. And there are some things they just can't assess.

So I'll warn you this, you need to do what you guys are doing because there is no such thing as an invincible pipeline. And I've been across the table from companies under oath who have tried to explain they put one in, and the answer is, no, you didn't.

MR. SKEEN: Yes, so, I guess that leads us into integrity management program. Because there's threats you have to look at, right, under that --

MR. KUPREWICZ: You're supposed to look at them, yes. And again, many companies are way ahead of that, other companies are not.

We've had -- I don't think it's a problem

here but like SCC, stress corrosion cracking, we still don't have an inline inspection tool that reliably identifies that material.

Now, the good news is not all gas transmission pipelines have a bona fide threat from stress corrosion cracking.

MR. SKEEN: Right. But if this truly is an HCA and they enhance the piping and the maintenance and all that and they meet that program, does that reduce the probability of --

MR. KUPREWICZ: Yes, it does. And the answer to your question, the answer is yes.

And I say this many times in public, a pipeline company doing the right thing should have no problem explaining how they are in demonstrating what the right things they are doing to prevent a pipeline from rupturing. Right? It's when they get into secrecy and lack of transparency they start getting into trouble.

MR. SKEEN: Okay. Now that's helpful.

MR. KUPREWICZ: So just, you just don't want to meet, and Steve will tell you this, the federal mins are minimal so you want to exceed those, especially any lines that are getting around 24, 36, 42-inch. Those have big actual impact areas. So

don't rupture.

MR. SKEEN: Okay, thanks. Thanks, that's helpful. I think we've covered this already but I want to make sure. So when we look at the different aspects of a rupture where there will be detonation at the rupture or jet fire or vapor cloud detonation or the --

MR. KUPREWICZ: Let me help you out. It's not going to be a jet fire. No, that sounds like engineers trying to logic it.

If they try to say it's kind of like this, it's like a jet fire, they are showing to me that they don't grasp the real dynamics of a true gas transmission pipeline rupture. Yes, it could be jet fires, but they're coming together, all right, neutralizing each other and forming huge clouds of hydrocarbon that are mixing.

And so, engineers like to put these things in boxes, and I'm not trying to be critical, it's just that when they try to put those boxes in and they don't apply, they lose credibility. And so, I just warn you about that.

MR. SKEEN: Okay. So you would focus more on the detonation itself at the rupture or a vapor cloud detonation or detonation --

MR. KUPREWICZ: Yes, it's probably a detonation. The initial ones are the attention getter. And depending on a 42-inch, it's probably going to have multiple because, think of it as, you had this huge tonnage of gas release. It's coming out at the speed of sound on both ends of the pipe to kind of cancel each other. Not taking it to zero but their opposing forces are cancelling out.

And then it's mixing with the air and all this and there's a lot of turbulence. And so the turbulence can cause parts of the gas cloud to hit the area that will support combustion and then you'll get an explosion.

Other parts of the gas cloud won't hit that and won't explode. But then they'll re-explode. So it changes that mixing and the complexity and the turbulence is very difficult to model.

MR. SKEEN: Okay. But again, we would go back to, if we're twice the distance in the PIR, even with those clouds being formed and exploding, what about structures 1,800 feet away?

MR. KUPREWICZ: I would think that would be a defendable action. Now, I can open some criticism, but you've tried to do the best you can with the tools you have.

MR. SKEEN: Okay.

MR. KUPREWICZ: And the sensitivity analysis would be defendable.

MR. SKEEN: Okay. I appreciate that.

MR. KUPREWICZ: Part of the problem may have been not getting straight -- you know, you're kind of using these tools to say it's this impact area. But you may be off. And so it may be two or three times that impact area.

And you couldn't really list the structures that were needed to bring that plant down. So that could have been part of it.

MR. SKEEN: Yes. Well, I think clearly we can, I think we can identify the structures that we need, the components we need to do safe shutdown of the plant. And --

MR. KUPREWICZ: You don't have to list them in a public document but you can demonstrate to your organization that that's due diligence as best you can. Understanding that everybody thinks they can calculate this to the first digit, and the answer is there's a lot of uncertainty here.

MR. SKEEN: Yes. I appreciate that.

MR. KUPREWICZ: What aggravated this was hearing that they can shut this down in three minutes.

That's not credible.

MR. SKEEN: Yes, we're --

MR. KUPREWICZ: It may have been they took three minutes to close the valve, but it might take 15 minutes to understand you need to close the valve. You get it.

MR. SKEEN: Yes, I appreciate that. And we're still trying to track down the three minute issue.

Then we look at it, if three minutes is not the answer, then what's a credible amount of time, and even if that credible amount of time is the time that you have the high heat flux, is that going to impact the safe shutdown equipment for the plant?

MR. KUPREWICZ: You got it. You've got it right there. And they can argue 15, 20. But you're heading in the right direction there.

And that's where all I kept getting was, no, we can do it in three minutes and that's, where did you get this. No, that's three minutes to close the valve, that doesn't mean, yes, you're on the right, you get it. You guys have got it.

MR. SKEEN: Okay, thanks, I appreciate that. I'm going to open it up to the other team members I've been talking for a while.

I think I've captured most of the questions and concerns that I had, but others may have thoughts as well. So, Theresa, I'll turn to you and the other team members. If you've got any other questions or anything Rick can clarify for us while he's on the phone.

MS. CLARK: Hey, Rick, this is Theresa. Thanks so much, this has already been really, really helpful. And it's, obviously, as you mentioned, confirming a lot of the stuff that we've been hearing from Steve.

I wanted to ask you a question about, you talked some about the cloud and the mixing and the turbulence. What impact, in your view, does the topography of the location have on the consequences of a rupture?

MR. KUPREWICZ: It's extremely critical for gas. Natural gas.

MS. CLARK: Tell me more if you can.

MR. KUPREWICZ: Well, the back pressure generated from the blast forces, when the burning goes to detonation, at the velocities or whatever, it's the resistance. And so, like if you got more open structures, more open fields with a few buildings in it, there isn't a lot of resistance to build back

pressure, does that make sense?

MS. CLARK: Yes, it does.

MR. KUPREWICZ: And so, what drives people crazy -- and I'm in some places, like in Pennsylvania they're talking about HDL clouds, which you never want to disrespect, okay. And blast forces and all this. And they got both sides coming at each other.

And the answer is, is those blast forces are site specific, all right. And so that's what drive, you got two challenges here.

One, the heat radiation that's absolutely going to be just off scale. If you just, if you've ever been in these it will just do terrible things quickly. You don't have many seconds and then if you don't get out of the heat radiation you're dead. Or going to die.

The blast forces are a different animal. It's a different level of complication. So, if you've got some uncertainty in trying to model this, I think you got to do blast because you got to do projectile stuff.

But even your projectiles, you've got concrete structures, they're going to handle the projectile. Especially if they're reinforced.

So, you've got two lines of attack here.

One, the thermal radiation and the other one of the blast forces. And trying to model those are going to be more challenging because they tend to be more site-specific.

And if you've got fairly flat terrain, that's easier to model. So it's a challenge, that's all I can tell you.

MS. CLARK: That's really helpful because we were out at the site last week and it's a pretty hilly site but without a lot of tree cover in the area. They did clear cuts the way they should.

MR. KUPREWICZ: Yes.

MS. CLARK: But the plant is quite a bit downhill from where the pipeline area is. And in some cases there's a hilly part in between the plant and the pipeline. And then it's downhill from that. So we were trying to grapple with how that effects how things progress.

MR. KUPREWICZ: Yes, I think empirically you're in the right direction. The plant is not going to get the, blast forces are hard to calculate and predicate and they're very terrain specific.

But the fact that your lower for, is a direction. So you can do a directional thing. My experience would be, not knowing all the details, is

the heat radiation is going to be the real thing that's going to be the real threat for the plant. And if it's protected for that, that's a positive.

MS. CLARK: Okay, thanks, Rick. One more clarification and then I'll pass you off to the next person.

Very early in our discussion, and I'm only asking this because we have a transcript here, you made a comment like, when this -- if an explosion happens you're going to lose the power plant. I think that you meant like the switch yard and the offsite power that goes to the nuclear station. Is that what you meant there?

MR. KUPREWICZ: Yes. Now that's fair. That's a fair call. But when I said explosion, you get this blast force in the microseconds. The force is related to a pipeline rupture on a 42-inch are huge. This is like that concrete overbarrier. That's gone. That's going to be flying someplace.

And so when I said blast, it's the -- and I missed, and thank you for trying to get me to clarify that because it's important. You got the force of the actual failure which generates projectiles and massive forces.

And then you got other forces generated

from the ignition in such a manner that it generates detonation. And they'd probably do multiple detonations.

And that's what makes these things kind of complicated. So, you're covered, if your structures are reinforced and all that, you've got those really covered, then the real factor is, from the ignition, is what's going to happen is the heat flux is so how it's going to melt the high-powered transmission lines which are going to force the plant to come down. Does that make sense?

MS. CLARK: Yes, that makes a lot of sense. And certainly we analyze these facilities for losing offsite power because that can happen for any number of reasons.

MR. KUPREWICZ: Yes.

MS. CLARK: So, if that's what you were saying, then we understand that and how to move forward with that.

MR. KUPREWICZ: Well, I don't know if I've clarified that because there's different degrees of, I'm using blast to cover more than one term and that's not fair to you guys.

MS. CLARK: No, that's totally fine. And I think when you were saying you meant power in the T-

lines.

MR. KUPREWICZ: Yes.

MS. CLARK: Yes.

MR. KUPREWICZ: The plant can't come out, it's got to come down. And in doing that, in bringing those things down is a cold, what I call a cold shutdown, what facilities are required. And if they're covered then you got a defendable position.

MS. CLARK: That's fair, thanks. Maybe I'll call on Suzanne next. If you have any questions, Suzanne.

MS. DENNIS: No, I think you covered everything that I had questions on. I really appreciate you taking the time to talk with us, this has been so helpful.

MR. KUPREWICZ: Well, we're just trying to, yes, no one is looking for demons here. It's easy in today's environment, it seems like somebody has to win and the answer is, let's just do it right. If it's covered, fine.

But the OIG report is not a very -- those are the kind of things I don't like seeing because -- well, you understand, I'm preaching to the choir.

But, you know, they did their job. OIG did their job. And they got some important findings

there that you folks need to address.

MR. SKEEN: No, and that's exactly what we're trying to do. So, again, we appreciate, Rick, that you're forthcoming.

MR. KUPREWICZ: Do you think you're going to have a shot at being able to do this in 45 days with all this other stuff going on?

MR. SKEEN: Well, we're all working from home right now. None of us are in the office. But we're doing pretty well with communication. So we're hoping to still get something to the Commission within the 45 days.

MR. KUPREWICZ: Let me, it's easy for me to say it, because I don't have to deal with, I'm too old and don't agree. Hopefully, I survive the next 60 days, but it's very, my advice, it would be very important, if you get hung up for whatever reason and there's a lot of pressure to get this thing done but the last thing you want to do is get rushed and not cover your bases and to find out that you expose yourself.

And so it's important to do it right as best you can. And no one, they may criticize you, but it's not going to go very far if you're trying to do the right thing. So don't let time cause you to short

circuit something.

MR. SKEEN: No, we understand that. But again, like I say, talking to people like you, and we're going to talk with Mr. Blanche as well to make sure we understand their concerns.

Our role here is to try to figure out if there are weaknesses in our processes and practices that we do --

MR. KUPREWICZ: Yes.

MR. SKEEN: -- we can make that better with the NRC. And also, we want to ensure that the plant would be able to safely shutdown if there is a problem with that gas line.

MR. KUPREWICZ: I had a chance to talk with Paul yesterday. I said, look, I just went through this report, the OIG is pretty dead on and so you've raised, Paul, you raised some serious issues. I don't know the answers to these but the questions are valid.

But I did tell him, you know, you got Steve Nanney from PHSMA on this, he's a pretty straight shooter. So, hopefully the team is trying to get to where they need to be.

So I'm not here to convince people what's right and wrong, just to be sure the right questions

have been asked and the answers are complete. But I think your, it sounds like your heart is in the right place.

MS. DENNIS: Hey, this is Suzanne Dennis. I just had a question I wanted to ask.

So, one thing we talked about a little is the -- when ignition would occur, and Steve has given us his thoughts. But do you have any thoughts, just from your history working with gas pipelines, of a vapor cloud traveling and then igniting later?

Is that something that you think would be credible or something you've ever seen working in the industry?

MR. KUPREWICZ: Well, let me state real clear, not all pipeline ruptures ignite, okay. That's a fact.

Now, those that ignite usually dose out fairly quickly within 30 seconds or so. In the Carlsbad, New Mexico, case it was 22 seconds. They can tell that from the seismic. That was in 2000, I think. But that was a 36-inch I believe.

So I think the odds of having a large gas cloud moving a long distance is probably low. But I can't say it isn't absolute. But my experience has been, if they're going to ignite they tend to ignite

within a minute.

MS. DENNIS: Okay, great. Thanks.

MR. KUPREWICZ: Now, what people do miss is, well, if we ignited once and it's burning like hell over here but it's so great a release that it's generating multiple combustion areas. So, that's what makes modeling really crazy. So, anyway, that's the way it is.

MS. DENNIS: Can you expand on that a little bit more?

MR. KUPREWICZ: Well, and again, I don't like to get into this too detailed. You guys are okay, but the issue of turbulence with large gas releases aren't modeled by the PIR. That's an empirical developed thing that has limitations to it.

And so, people more sophisticated with this stuff who do this for a living might try to model that. But the tonnage is so great and the rate of release is so huge, that you'll get pockets of areas where it burns and other areas it doesn't burn. And then as they mix for various reasons, it will reignite.

And so, yes, you can't really, it's hard to model that so you just try to do the best you can and just say, here's what it is and we'll say, it's

got an ignition of a long time (phonetic).

MS. DENNIS: Got it. Thanks.

DR. LI: This is Rene'e. I would like to ask you a question. You mentioned earlier when a pipeline break, assuming double-ended break, and then the blowdown from both ends, it generate turbulence and it will have a peak mass release. And then after a couple of minutes it may drop off.

In your opinion, that peak mass release, in general, will last about how long?

MR. KUPREWICZ: Well --

DR. LI: Are we talking about minutes or a couple of minutes?

MR. KUPREWICZ: Oh, it's probably a couple of minutes or less. It comes down pretty quick.

Why I'm a little hesitant about this is you've got a big gas compressor station a couple of miles upstream, all right. That could take over and actually drive more gas to go down this.

Now, that's a thing that Steve and Enbridge can lock down. A couple of years ago I told the industry, if you're looking for a rupture indication you look for flow, not for pressure. The flow rates will go up.

So, generally where there is not a

compressor station nearby, you get this peak and it drops off fairly quickly within the first minute.

When you got complexities like compressor stations, it's a couple of minutes.

DR. LI: Okay.

MR. KUPREWICZ: But --

DR. LI: Yes, because the duration of --

MR. KUPREWICZ: -- the facility --

(Simultaneously speaking.)

MR. KUPREWICZ: -- is still pretty long.

DR. LI: -- release will affect potential impact radius that we are talking about.

MR. NANNEY: That's right.

MR. KUPREWICZ: No, you're on the right track. Now, let me be clear here --

MR. NANNEY: Hey, this is Steve Nanney.

MR. KUPREWICZ: The nature of gas transmission pipeline ruptures, they're always two full-bore ruptures with a bit old hole in the middle. Right?

DR. LI: Right.

MR. KUPREWICZ: And they don't have a precursor that shows up as a leak, they go right to rupture. The nature of the anomalies go to a point where they fracture. And the pipe is, you know,

fractures apart.

So, you know, someone says, well, I want to model it with both bars, the answer is no, that's what actually goes on.

(Laughter.)

DR. LI: But does it make a difference if the pipe is above ground or underground? Do you also still assume a double-ended break when the pipeline is buried under ground?

MR. KUPREWICZ: Yes, it makes no difference. The forces are so huge that your buried pipeline is going to be right above ground when you get done.

DR. LI: All right.

MR. KUPREWICZ: There's going to be a huge crater. The resistance of the soil, even if with the concrete barriers, isn't going to make any difference.

DR. LI: Okay.

MR. KUPREWICZ: Now, let me give you a little story a few decades back. It wasn't a gas line, it was another pipeline.

And they had put a thick concrete barrier over their pipeline as a safety measure to try to keep people from trying to hit their line. And the people who were working around the pipeline, who didn't

bother to call One Call, decided to just go right through that concrete barrier.

And so, it sounds real good to have that as a safety, but it can't necessarily be effective.

DR. LI: Yes.

MR. KUPREWICZ: So that's, again, it's back to all steel transmission pipelines can rupture if you're not respecting them.

DR. LI: Okay, thank you.

MR. SKEEN: Steve, did you want to jump in, I thought I heard you try to say something?

MR. NANNEY: Yes, I was just going to say something. And Rick can answer.

Based upon what Rick said, the reason the volume would keep up is normally your gas transmission compressor stations would be on a set pressure because they do not have flow measurement at every compressor station. But the main way to maintain volume is to maintain a set pressure.

And that's why Rick said what he did is because they'll have the compressor at the station set to maintain, let's just say 800 pounds or 850 some set pressure. And so if you rupture the line and the pressure starts going down, it's going to start moving more gas initially until it basically deadheads that

it's not getting enough volume to feed the compressor.

MR. KUPREWICZ: Yes, it will trip on such low flow.

MR. NANNEY: Yes.

MR. KUPREWICZ: Maybe.

MR. NANNEY: So that's why Rick made the comment that he did.

MR. KUPREWICZ: Yes, Steve is better explaining. I'm too much, I'm too old to be clear I guess. You're dead on, Steve, thank you.

Well, I hope this helps.

MR. SKEEN: Very helpful. Did anyone else have any questions for Rick?

MR. NANNEY: Could I ask just a question or two?

MR. SKEEN: Oh yes.

MR. NANNEY: Or did you all ask a couple of the questions or the thoughts I gave to Theresa, did you all ask them while I was off the phone?

MR. SKEEN: No, we did not get to all those. No.

MR. NANNEY: Do you mind if I just ask an item or two?

MR. SKEEN: Please do.

MR. NANNEY: Okay. As far as if you did

have a rupture and everything and you had facilities that were hardened, but if you had any metal facilities that were support facilities for that structure, do you have any comments on it? On those types.

MR. KUPREWICZ: Oh, that's an excellent point. Yes, we talked about concrete. And a lot of this is, you know, those are good.

But if you've got something that's got, and I take an example, and I don't remember the location, you got a diesel tank outside storing up diesel for backup generators, if it's in within a heat flux zone it's going to blow up, right?

Or the tank can fail, all right. Because the metal structures are going to weakened. The heat radiation, depending how close it is to the pipeline, can be incredibly high.

MR. SKEEN: Yes. So we had looked at that, and I appreciate that, because that's one of the things we did look at. One of the first things we looked at was that diesel fuel storage tank out there.

And while they could lose that tank, the diesels themselves can run for four hours on the tanks that they have internally, inside the building.

MR. KUPREWICZ: Yes. I think I remember

having that discussing some years ago. That's good. Good to reinforce that.

MR. SKEEN: Then they have tanks below, storage tanks that sit underground, underneath the diesels, that are good for seven days. Seven day tanks they call them.

And then they have these, they have this tank that sits out on the parameter of the plant. They have a tanker truck, basically, that they fill that up and bring it in to fill up the day tanks is what they try to do, right?

So what they've done is they've taken that tanker that used to sit out with the diesel tank and moved it to the other side of the plant. So it's probably 2,000-plus feet, 2,500 feet away from where the diesel tank is now. So further away from the gas pipeline.

MR. KUPREWICZ: And I think, I didn't mean to interrupt you, but one of the issues that came up was the control room location. And I don't remember, it's been awhile, is the control room recently protected from any of this or is that --

MR. SKEEN: Yes. So the same thing with the control room, it's in the auxiliary building, which is also thick concrete building.

MR. KUPREWICZ: Yes. No, you're totally fine. Okay.

MR. SKEEN: It's well-protected too. But there was a concern about the fuel for the diesels. So, they did move that tanker truck to the opposite side, farthest away from the pipeline.

And so that gives them additional fuel for the diesels as well. But we did look at that. That was one of the first things we looked at was that diesel fuel tank out there that was sitting near the perimeter of the plant.

MR. KUPREWICZ: Good.

MS. DENNIS: And, Dave, just to be clear, I think the fuel that co-located with the diesel was a couple of days, not seven days. You might have said seven.

MR. SKEEN: I'm sorry if I said seven. Yes, it's a few days.

MR. KUPREWICZ: It will bring the plant down, yes.

MR. SKEEN: That's also a full plant load if you have an accident. And so, for normal plant loads, if you shut down normally, those fuels should last more than several days.

MR. KUPREWICZ: Steve, did you have

another question?

MR. NANNEY: Yes, sorry. Rick, another question. I know you talked about the PHMSA or the Part 192 potential impact radius.

And the question I have there is, in your understanding, the potential impact radius in the Part 192 code is a radius to give people basically X number of seconds to get out of that potential impact radius before basically it kills them.

And if you go read in the code and go on how it was developed. It wasn't developed to protect structures, it was protected to just give people X seconds to get out of that PIR.

MR. KUPREWICZ: Yes, if memory serves me right, it was the same thing we used for flare design, 5,000 btu per hour, per square foot.

MR. NANNEY: Yes.

MR. KUPREWICZ: And 5,000 --

MR. NANNEY: And it is 5,000.

MR. KUPREWICZ: -- btu per hour, per square foot, you're not going to be in real comfortable zone.

MR. NANNEY: Right. And in fact, you'll see people getting burned --

MR. KUPREWICZ: Yes.

MR. NANNEY: -- getting out of that a lot of times when there is an explosion.

So, your understanding is, that's what it is.

MR. KUPREWICZ: Right.

MR. NANNEY: Which is what I have told the folks there at the NRC.

MR. KUPREWICZ: Yes. And I just try to be real careful because in my mind, in my experience, some were around 20 or 24-inch diameter pipe, you know, the PIR is very accurate and reasonable.

But after that you start getting into this turbulence factor and that's hard to predict. And so I just, you got to do what you got to do.

We were trying to get a transmission integrity management rule moving forward. And it turned out it was 7.3 miles per, not the total mileage of gas transmission lines.

But anyway, we're on the same wavelength.

MR. NANNEY: The other, and probably the last little couple of questions is, if you put a pipeline like this in and you put additional mitigation measures in, like heavier wall pipe, you put the pipe deeper in the ground and you put, as you all were talking earlier, things in the ditch such as

warning tape and maybe the concrete barriers as mitigation measures against someone getting into the pipeline, do you have any thoughts on like heavier wall pipe and it being a High Consequence Area and doing all the risk assessments and remediation efforts there?

MR. KUPREWICZ: Well, I do. It's moving in the right direction going, from your early conversation, maybe you were off, I just counsel people to be careful. While these are good and they're moving in the right direction.

Like thicker pipe, that's a good thing. Even the concrete barriers. I gave them a case where --

MR. NANNEY: I heard that. Okay, we're good.

MR. KUPREWICZ: -- I can't tell you what state that was in, but it was a state of confusion.

(Laughter.)

MR. NANNEY: Okay.

MR. KUPREWICZ: And it wasn't the operator's fault, or Christ almighty, they were blowing right through there with a big old backhoe.

But anyway. So those are all moving in the right direction. You just have to be real

careful, in especially in sensitive locations where the consequences can be catastrophic, that you're not overcompensating in your risk analysis and saying, well --

And I think one of the criticisms is, one of the specialists came up with, well, we'll use a 65 percent factor here, well, wait a minute, how the hell you get, you know, that puts you in a bad spot. Try to avoid that.

So, you can list those things as positive things, you just got to be careful when you try to be careful when you quantify their effect because there is no such. It's amazing how people can figure out a way to rupture steel pipeline.

And I've been in places where these guys are under oath and they may believe it but it's not necessarily true. Even though it's thicker and deeper and all that, you got to be careful that certain factors don't come together.

The law of Murphy works to conspire to cause a failure.

MR. NANNEY: Okay.

MR. KUPREWICZ: And those are good things. I don't want to downplay them, that's good that they did them. But I also don't want to overcompensate for

what they did.

MR. NANNEY: I understand. Thank you.

MR. SKEEN: All right. Well, thanks, Steve. Does anyone else have any other questions for Rick?

All right, hearing none, Rick, we really appreciate you talking with us. As I say, we're under a tight deadline to try to get a report to our Commission.

And we do have a good team working on this but we thought it was very important that we spoke with you since you were one of the technical experts that were involved in this and had raised some concerns about what the NRC might have done. So we appreciate that.

And we've learned a lot from talking to you today. Very helpful. I wonder, if we have any subsequent questions would we be able to reach back out to you and contact you again if we have any other questions for you?

MR. KUPREWICZ: Any time. Just give me an email and I may have a couple of, it comes in waves. I just finished one.

So, send me an email and like I say, I can come back and talk to you guys at this time or

whatever. But yes --

MS. DENNIS: Hey, Dave?

MR. KUPREWICZ: -- anything I can do to help you guys try to meet your deadlines.

MS. DENNIS: Hey, Dave, this is Suzy. I forgot one question. I'm sorry I'm not very on top of the ball today.

So, when we were looking at the PHMSA data, it has a separate category for leaks and ruptures. So, I was just wondering if this was something that you, like, would you assume that a leak in relation to the PHMSA data would cause this kind of catastrophic event?

MR. KUPREWICZ: There is no correlation between leaks and rupture.

MS. DENNIS: Got it.

MR. KUPREWICZ: It's not illegal to leak. If you rupture, you're probably in big trouble.

(Laughter.)

MS. DENNIS: Got it. Thank you.

MR. SKEEN: All right, thanks for that, Suzanne. And thanks, Rick.

MR. KUPREWICZ: Hey, you guys take care and have a good -- what day is today, Thursday?

MR. SKEEN: Today is Thursday.

MR. KUPREWICZ: Okay. Boy, I'm losing it.

MR. SKEEN: And if you think of anything else we didn't cover or something that you think you need to share with us, please feel free in the next few weeks as we continue our efforts to get through this evaluation.

MR. KUPREWICZ: No, I had a list of things and you guys pretty well covered them. That's good. That's a good thing you brought your team.

MR. SKEEN: Well, thank you, I appreciate that. And again, thanks for talking with us. And if we have any other questions we may reach out to you again, but if you think of something else that we didn't cover, please let us know.

MR. KUPREWICZ: I sure will. You take care now.

MR. SKEEN: All right, thank you very much.

MR. KUPREWICZ: Bye-bye.

MR. SKEEN: All right, bye.

(Whereupon, the above-entitled matter went off the record at 2:21 p.m.)