

1 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4 LIBERTY ENERGY, INC. AND LIBERTY OILFIELD
5 SERVICES LLC
6 Petitioners

7 V.

8 U.S. WELL SERVICES, LLC
9 Patent Owner

10 Case No. IPR2024-01274
11 Patent 11,091,992

12 *****
13 ORAL DEPOSITION OF MICHAEL NIKOLAOU, Ph.D.
14 NOVEMBER 20, 2025
15 *****

16 ORAL DEPOSITION of MICHAEL NIKOLAOU,
17 Ph.D., produced as a witness at the instance
18 of the Petitioners, and duly sworn, was taken
19 in the above-styled and numbered cause on
20 November 20, 2025, from 8:58 a.m. to
21 11:26 a.m., before Mendy A. Schneider, CSR,
22 RPR, in and for the State of Texas, recorded
by machine shorthand, remotely at the offices
of MENDY SCHNEIDER, LLC, The Woodlands,
Texas, pursuant to the Federal Rules of Civil
Procedure and the provisions stated on the
record or attached hereto; that the
deposition shall be read and signed.

APPEARANCES

FOR THE PETITIONERS:

CHAD C. WALTERS
BAKER BOTTS, LLP
2001 Ross Avenue, Suite 1100
Dallas, Texas 75201
chad.walters@bakerbotts.com
214.953.6511

FOR THE PATENT OWNER:

RICK QUARLES
WINSTON & STRAWN
300 South Tryon Street, 16th Floor
Charlotte, North Carolina 28202
704.350.7728
rquarles@winston.com

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WITNESS: MICHAEL NIKOLAOU, PH.D

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EXHIBIT INDEX

(No exhibits were marked.)

(REPORTER'S NOTE: All quotations from exhibits are reflected in the manner in which they were read into the record and do not necessarily denote an exact quote from the document.)

1 THE REPORTER: The attorneys
2 participating in this deposition
3 acknowledge that I am not physically
4 present in the deposition room and
5 that I will be reporting this
6 deposition remotely.

7 They further acknowledge that
8 in lieu of an oath administered in
9 person, I will administer the oath
10 remotely.

11 The parties and their counsel
12 consent to this arrangement and waive
13 any objections to this manner of
14 reporting.

15 MICHAEL NIKOLAOU, Ph.D.,
16 having been first duly sworn, testified as
17 follows:

18 EXAMINATION

19 BY MR. WALTERS:

20 Q. Good morning, Dr. Nikolaou.

21 A. Good morning, Mr. Walters.

22 Q. Can you state your name for the

1 record.

2 A. Michael Nikolaou.

3 Q. And where are you physically
4 located right now?

5 A. I'm in my house in Houston,
6 Texas.

7 Q. Are you alone?

8 A. Well, my wife is in another
9 room. She just underwent hip replacement
10 surgery, actually. So I hope we won't have
11 to be interrupted. That's so you know in
12 case there is a very brief emergency, I'll
13 let you know.

14 Q. Sure. Just let us know if
15 that's the case.

16 But you have been deposed
17 before?

18 A. I have.

19 Q. About how many times?

20 A. About a dozen times.

21 Q. Okay. And you understand that
22 you've been sworn to testify truthfully

1 today?

2 A. I do.

3 Q. Is there any reason you cannot
4 testify truthfully today?

5 A. No.

6 Q. What did you do to prepare for
7 today's deposition?

8 A. I reviewed material related to
9 my declaration, previous declaration on the
10 subject. And I had discussions with
11 Mr. Quarles on the same.

12 Q. Which declaration are you
13 referring to?

14 A. The declaration I gave in
15 connection with the '992 patent.

16 Q. You -- you've given more than
17 one declaration in connection with this
18 patent, haven't you?

19 A. There was a previous one, yes.
20 One -- the latest one was filed, I believe,
21 in October and the previous one in June, if I
22 remember correctly.

1 Q. But you're referring to
2 Exhibit 2107 when you said that you reviewed
3 your declaration in preparation for this
4 deposition?

5 A. That is correct.

6 Q. Okay. When did you meet with
7 Mr. Quarles?

8 A. I met about a week ago. The
9 reason being that my wife, again, would have
10 to have surgery in between, so I needed a few
11 days to have my undivided attention on her.

12 And I also had a brief
13 discussion with him for a few hours
14 yesterday.

15 Q. Was anyone else at those
16 meetings?

17 A. No. Those meetings were online
18 between myself and Mr. Quarles.

19 Q. Okay. About how long did you
20 spend preparing your declaration,
21 Exhibit 2107?

22 A. About a dozen hours.

1 Q. Okay. Do you have access to
2 the exhibits and documents that have been
3 used with this IPR proceeding?

4 A. I do. I have them on my
5 computer and I only have my declaration
6 opened. All the other documents I can access
7 easily.

8 Q. What's your understanding of
9 the point of novelty of the '992 patent?

10 A. The '992 patent describes a
11 centralized system for monitoring fracturing
12 operations. And I can read you from the
13 abstract of the patent, which does a good job
14 summarizing these.

15 So I'm reading from the
16 abstract of '992.

17 A system and method are
18 disclosed for centralized monitoring and
19 control of a hydraulic fracturing operation.

20 The system includes an
21 electric-powered fracturing fleet and a
22 centralized control unit coupled to the

1 electric-powered fracturing fleet.

2 And it ends, the centralized
3 control unit can be configured to monitor
4 and/or control one or more operating
5 characteristics of the electric-powered
6 fracturing fleet.

7 Q. Is that your understanding of
8 the '992 patent's point of novelty?

9 A. Yes.

10 Q. Anything else?

11 A. Anything else in terms of what?
12 Of any other novel points or --

13 Q. Right.

14 A. -- any other...

15 All the points of novelty in
16 this patent are described in the claims of
17 the patent and the text that precedes these
18 claims.

19 Q. Okay. What is a gas filtration
20 skid?

21 A. A gas filtration skid, as
22 described in the patent, is a system that is

1 used to remove impurities from natural gas
2 that will be fed in the context of this
3 patent to generator, a gas generator.

4 So in a bit more detail,
5 natural gas can be used as a fuel to power a
6 generator. Natural gas, as taken out of the
7 ground, may have impurities such as
8 particles, which are other things.

9 So a filtration system
10 remove -- removes these impurities to make
11 sure that the gas is suitable as to -- to be
12 used as a fuel in the generator. And that
13 system is on a skid as is specified in the
14 patent.

15 Q. Were gas filtration skids
16 commonly used in hydraulic fracturing in
17 2015?

18 A. Apologize, I lost connection
19 for a moment. Can you repeat the question.

20 Q. Sure. Were gas filtration
21 skids commonly used in hydraulic fracturing
22 in 2015?

1 A. Gas filtration skids were known
2 as a technology.

3 Whether one would use these in
4 the context specified in the claims of '992,
5 for -- for this to happen, one would have to
6 get guidance from the patent so that one
7 would use a gas filtration skid along with
8 everything else as specified in the patent.

9 Q. Sure. And that's not my
10 question.

11 My question was: Were gas
12 filtration skids used in hydraulic fracturing
13 in 2015?

14 A. As a technology, gas filtration
15 was used and it was known at the time. It
16 was an available technology that one could
17 use in any setting desirable.

18 Q. Including fracturing?

19 A. That, I would have to check on
20 what exactly was the use of gas filtration in
21 isolation.

22 But as I mentioned, the patent

1 refers to gas filtration, along with other
2 elements for which one would have to get
3 guidance on which elements to include so that
4 one could have the system described in the
5 claims of the patent.

6 Q. Okay. And I'm not asking about
7 the other elements of the claims. I'm just
8 asking about gas filtration skids.

9 And so I understand that you
10 have over 27 years in oil and gas experience;
11 is that right?

12 A. That's correct. Yes.

13 Q. Okay. And so in your 27 years,
14 have you ever seen gas filtration skids used
15 in hydraulic fracturing?

16 A. So let me put it this way: If
17 one wanted to use -- if one selected to use a
18 gas filtration skid, one would know how to do
19 it as the technology would be available for
20 one to use a gas filtration skid.

21 Q. Okay. And why would a -- one
22 want to use a gas filtration skid in

1 hydraulic fracturing?

2 A. For the reasons that I alluded
3 to in my description of how the gas
4 filtration skid operates.

5 Namely, when natural gas is to
6 be fed to a generator that uses natural gas
7 as a fuel, that gas must be suitable to be
8 used as a fuel.

9 And the -- to make it suitable
10 for use as a fuel, one has to remove
11 impurities; and a filtration system
12 accomplishes -- helps accomplish that.

13 Q. What is a water separator?

14 A. It's another element that helps
15 make natural gas for suitable use as a fuel.
16 So if the natural gas contains moisture,
17 water, that is, that clearly cannot be
18 included in the gas that is fed to the
19 generator.

20 So a water separator separates
21 the water from the rest of the gas to make
22 sure that the gas fed -- used as a fuel that

1 is dry.

2 Q. What does water separator
3 status refer to?

4 A. Whether the water separator is
5 operating in a way that is reasonable.

6 Q. Could it refer to the liquid
7 level of the water separator?

8 A. I'm sorry, can -- can I refer
9 to the liquid level?

10 Q. Could water separator status
11 refer to the liquid level of the water
12 separator?

13 A. Are you referring to something
14 specified in the patent or something I stated
15 in my declaration?

16 Q. No.

17 A. So is this a general
18 question --

19 Q. Yes.

20 A. -- about my knowledge of the
21 subject?

22 Q. Yes.

1 A. Well, whatever refers to the
2 status of the water separator I have
3 commented on in my declaration.

4 And there are places in the
5 patent where the water separator status is
6 referred to, so I would be willing to comment
7 on these so I can be specific about the --
8 what all that is.

9 Q. Okay. And so my question is:
10 Could the status of the water separator refer
11 to the liquid level of the water separator?

12 THE WITNESS: I think...

13 A. So to understand your question,
14 are you asking whether the liquid level
15 status would be -- could refer to the water
16 separator as one of the things monitored as
17 described in the patent or -- I -- I need to
18 understand the context in which --

19 (BY MR. WALTERS)

20 Q. Yes.

21 A. -- this would be relevant.

22 So the patent does -- '992 does

1 refer to liquid level and it does refer to
2 the filter liquid level.

3 So this is one of the things
4 referred to in the patent text in Column 15.

5 Q. Is that your answer?

6 A. Yes.

7 Q. Okay. If there was a water
8 separator -- strike that.

9 If there was a fracking system
10 out there with a centralized control unit
11 that reported on the liquid level of the
12 water separator, would that read on the
13 limitation that requires monitoring an
14 operating characteristic that includes water
15 separator status of a gas filtration skid?

16 MR. QUARLES: Objection; form.

17 A. Well, all the limitations of
18 the patent are explicit in the patent. So
19 are you referring to one of these limitations
20 and what it means or how -- what it implies
21 for the liquid level?

22 I need some help to understand

1 what part of this you're referring to.

2 (BY MR. WALTERS)

3 Q. Sure. One of the operating
4 characteristics of the gas filtration skid
5 that it's monitor -- that is monitored is the
6 water separator status.

7 And so if there was a system
8 that monitored the liquid level of the water
9 separator, would that satisfy water separator
10 status?

11 A. Well, the --

12 MR. QUARLES: Objection; form.

13 A. So the water separator status
14 is something referred to explicitly in the
15 patent. For example, in Column 13, and
16 everything else related to what exactly is
17 monitored and what operating characteristics
18 are relevant for monitoring the system, all
19 that is described in the claims specifically.

20 (BY MR. WALTERS)

21 Q. Okay. So I'll ask my question
22 again because you're not answering it.

1 One of the operating
2 characteristics of the gas filtration skid
3 that's monitored is the water separator
4 status.

5 You understand that?

6 A. Where -- what -- what part of
7 the patent are you referring to?

8 Q. I'm referring to substitute
9 claim 41.

10 A. Substitute claim 41. And give
11 me just one second.

12 So you're -- you're referring
13 to a table, perhaps, that I have in my
14 declaration that has the substitute claims,
15 including claim 41.

16 Q. I'm not sure it's in a table.

17 Actually, it probably is in a
18 table in your support for written
19 description.

20 A. Let me see. There is in my
21 declaration, Page 48 of the exhibit, there is
22 a list of substitute claims and it starts

1 with substitute claim 41.

2 Is that what you're referring
3 to?

4 Q. I'm not referring to that
5 table, but -- but you're free to consult
6 that. I'm referring generally to substitute
7 claim 41.

8 A. Okay. And from what document
9 are you reading substitute claim 41, just to
10 make sure we're on the same page.

11 Q. Your declaration.

12 A. My declaration. Very good.
13 Okay.

14 And go ahead, please.
15 Regarding substitute claim 41, you're asking
16 me something about, again, the water
17 separator status, right?

18 Q. You see limitation 41(i).

19 A. 41(g), (h), (i). Yes, sir.

20 Q. Do you see where it says where
21 in the monitored operating characteristics of
22 the gas filtration skid include at least

1 water separator status?

2 A. Correct.

3 Yes. It's in Page 51 of the
4 exhibit.

5 Q. If there were a system, a
6 potentially infringing system, that monitored
7 the liquid level of the water separator,
8 would that satisfy this limitation 41(a)
9 requiring monitoring the water separator
10 status?

11 A. So water separator status is
12 left as such. Namely, it is a general
13 description that refers to what is the status
14 of the water separator.

15 And that could be any -- that
16 would include any variables that would be
17 appropriate for characterizing the status of
18 the water separator.

19 Q. Did that include the liquid
20 level of the water separator?

21 A. Yeah, a POSITA would understand
22 that as one possible thing to monitor.

1 Q. Why would a POSITA want to
2 monitor water separator status?

3 A. A POSITA, in general, would
4 like to monitor the status of the water
5 separator to ensure that there is proper
6 operation.

7 Namely, there is no compromise
8 in performance.

9 There is no indication of
10 potential impending problems.

11 No potential problems that
12 might create problems downstream from the --
13 the water separator and so forth.

14 Q. How are water separators used
15 in 2015 in hydraulic fracturing?

16 A. Water separators were a general
17 piece of equipment that would be applied in
18 any application that required removing
19 moisture from a stream that would be fed to a
20 downstream piece of equipment that would
21 require a gas -- a dry -- a dry stream to be
22 fed.

1 Q. Was it known to monitor water
2 separator status in 2015?

3 A. In the context of monitoring
4 water separators, that is along with
5 everything else described in the claims of
6 '992, it was not.

7 Q. And I'm not asking about
8 everything else in the claims. I'm asking
9 just about the monitor -- the water separator
10 status.

11 A. As a technology --

12 Q. Was --

13 A. Sorry for interrupting you.

14 Q. Was it known to monitor water
15 separator status in 2015?

16 A. Again, not in the context
17 described in the claims of '992.

18 Q. And, again, that's not my
19 question.

20 My question is: Was it known
21 to monitor water separator status in 2015?

22 A. The technology for monitoring

1 water separator status was available and
2 known. A POSITA would know that technology.

3 Whether that technology should
4 be used in that context, along with
5 everything else described in '992, one would
6 have to have the blueprints from '992.

7 Q. What is "particulate filter
8 status"?

9 A. It is the status of the filter
10 that removes particulate matter from the gas
11 stream that will be used as fuel.

12 So as we explained, natural gas
13 contains impurities, which have to be removed
14 before natural gas can be used by a
15 downstream unit for power generation.

16 So the filter -- the
17 particulate filter removes that particulate
18 matter. And the status of the particulate
19 filter is the condition, the status, that is,
20 of that filter, namely whether it is
21 operating as intended.

22 Q. Would the extent of filter

1 fouling be an example of particulate filter
2 status?

3 A. One of the characteristics,
4 yes. It would -- it would be.

5 Q. And -- and what's your
6 understanding of filter fouling?

7 A. Well, fouling is something that
8 happens in equipment from extended use.
9 There may be deposit essentially on various
10 surfaces of the equipment. And -- and those
11 degrade the operating characteristics of that
12 equipment.

13 So the filter, if the filter
14 started showing -- exhibiting fouling
15 characteristics, the filter would not operate
16 as intended, and therefore it would be
17 something that one would have to -- something
18 that one could include in the monitoring of
19 particulate filter status.

20 Q. Was it known to monitor
21 particulate filter status in 2015?

22 MR. QUARLES: Objection; form.

1 A. The technology for monitoring
2 particulate filter status was available, but
3 using that technology in the specific context
4 and setting as described in the claims of
5 '992, one would have to have the blueprints
6 from '992 to know that this would be an
7 appropriate element in the operation.

8 (BY MR. WALTERS)

9 Q. Were implementers -- strike
10 that.

11 Were implementers of fracking
12 systems in 2015 monitoring particulate filter
13 status?

14 A. The technology for doing that
15 was available. It's a generic technology.
16 And to what extent -- to whatever extent one
17 wanted to use that technology, that would be
18 available at the time.

19 Q. Were they doing that?

20 A. To what extent they were doing
21 that is not something I focused on, because
22 there wasn't anything that used all the

1 elements of '992, so I could see whether that
2 was used in the context described in '992.

3 Q. Okay. As one with over
4 27 years of oil and gas experience, you don't
5 know whether in 2015 implementers of fracking
6 sites were monitoring particulate filter
7 status?

8 MR. QUARLES: Objection; form.

9 A. Well, to monitor filter status,
10 they would have to have the equipment and
11 setting described in '992.

12 So this is not about the
13 technology being available. It's whether
14 that was part of the overall system described
15 in '992.

16 (BY MR. WALTERS)

17 Q. I'm not asking about the system
18 described, the claims of the '992 patent.

19 I'm asking whether in your over
20 27 years of oil and gas experience you know
21 whether in 2015 implementers of fracking
22 sites were monitoring particulate filter

1 status?

2 MR. QUARLES: Objection; form.

3 A. Again, I have not collected
4 specific data on this because my focus was
5 whether one would use that capability in the
6 context of '992.

7 The technology of monitoring
8 filter status, as I already mentioned, should
9 one select to use it, it was available, yes.

10 (BY MR. WALTERS)

11 Q. Okay. So your testimony to the
12 judges of this proceeding is that you don't
13 know whether in 2015 implementers of fracking
14 sites were monitoring particulate filter
15 status?

16 A. My -- my --

17 MR. QUARLES: Objection; form.

18 A. My testimony is that I focused,
19 you know, on the specific context of '992 and
20 whether one would use all the elements of
21 '992 as specified in the claims of '992.

22 The technology for monitoring

1 filter status, as I already mentioned, should
2 one select to use it, it was definitely
3 available.

4 (BY MR. WALTERS)

5 Q. Okay. And you don't know if
6 one selected to use it in 2015?

7 MR. QUARLES: Objection; form.

8 A. Again, I didn't look at
9 everything that one would implement this
10 technology.

11 I focused on what is the
12 context of '992, the specific system with all
13 the elements specified in the claims of '992.

14 (BY MR. WALTERS)

15 Q. Sure. And I'm not asking about
16 what you looked at and what you considered
17 for this IPR.

18 I'm asking in terms of your
19 general oil and gas experience and your
20 experience in fracturing -- fracking sites.

21 And so in your experience in
22 fracking sites, do you know whether in 2015

1 implementers were monitoring particulate
2 filter status?

3 MR. QUARLES: Objection; form.

4 A. Again, I -- I didn't focus on
5 this because my focus was the overall system
6 of '992.

7 The technology, if one -- if
8 one wanted to use the technology, namely
9 monitoring filter status, the technology was
10 certainly available in 2015.

11 (BY MR. WALTERS)

12 Q. Is it your testimony that you
13 don't know whether in 2015 implementers of
14 fracturing sites were monitoring particulate
15 filter status?

16 A. Well, that particulate --

17 MR. QUARLES: Form.

18 A. -- filter status would have to
19 be in conjunction with everything else for
20 which the filter was used.

21 So that was not there at the
22 time. In --

1 Q. What do you mean "everything
2 else"?

3 A. Everything else? Described in
4 the claims of the '992.

5 Q. Again, I'm not asking about the
6 claims of the '992 patent. Okay.

7 I just want an answer to my
8 question. I'm sure the judges would be
9 interested in an answer to my question.

10 So my question is very simple.

11 My question is whether you know
12 or you don't know whether in 2015
13 implementers of fracking sites were
14 monitoring particulate filter status?

15 MR. QUARLES: Objection; form.

16 A. Again, I will have to look at
17 to what extent filters were used in any
18 context. If you want to extend the context
19 so I can give you an informed opinion on what
20 was the extent to which that was used.

21 If one wanted to use that
22 technology, the technology was certainly

1 available.

2 (BY MR. WALTERS)

3 Q. Okay. So without looking at
4 any other information, sitting here today,
5 you don't know whether in 2015 implementers
6 of fracking operations were monitoring
7 particulate filter status?

8 MR. QUARLES: Objection; form.

9 A. The partic- -- the particulate
10 filter is used in conjunction with gas
11 generators.

12 So I will have to see whether
13 people were using particulate filters in
14 other contexts, which was not the focus of
15 all this discussion.

16 So if that question is where
17 particulate filters used in frac --
18 fracturing -- hydraulic fracturing
19 operations, my answer is I didn't focus on
20 that because this was not the focus of this
21 discussion.

22 Was the technology available if

1 one wanted to use it? Yes, absolutely. It
2 was available if one wanted to use it.

3 Were people using it in other
4 context? I haven't checked that. I would
5 have to do a search to find out the extent to
6 which this was used, this type of
7 filtering -- monitoring of filtering status
8 was used.

9 (BY MR. WALTERS)

10 Q. Is it fair to say, then,
11 without looking at any other information, you
12 don't know, sitting here today, whether in
13 2015 implementers of fracturing sites were
14 monitoring particulate filter status?

15 MR. QUARLES: Objection; form.

16 A. But that particulate filter
17 would have to be used for a purpose. So
18 whether people were using particulate filter
19 in general I haven't looked at for the
20 specific details.

21 But I can certainly say that
22 the technology would be available to them

1 should they choose to use it.

2 (BY MR. WALTERS)

3 Q. Okay. I -- I -- this is going
4 to be a long deposition, okay, if -- if you
5 continue not to answer yes-or-no questions.
6 And that's all I'm asking, is a yes-or-no
7 question. Okay?

8 A. Okay.

9 Q. And you understand that this
10 transcript is going to be filed in front of
11 the Board, correct?

12 A. Correct. Correct.

13 Q. Yeah. So my question is yes or
14 no. Okay.

15 In 2015, do you know whether
16 implementers of fracturing sites were
17 monitoring particulate filter status?

18 MR. QUARLES: Objection; form.

19 A. I do not know the extent to
20 which hydraulic fracturing operators were
21 monitoring filter status in 2015.

22

1 (BY MR. WALTERS)

2 Q. Okay. Why would a POSITA want
3 to monitor gas pressure of a gas filtration
4 skid?

5 A. To make sure that pressure is
6 within safe bounds, safe operation, to
7 prevent damage of the equipment, to maintain
8 good performance, to make sure, again,
9 overall that the operation proceeds as
10 intended.

11 Q. Was it known in 2015 to monitor
12 gas pressure of a gas filtration skid in a
13 hydraulic fracturing operation?

14 MR. QUARLES: Objection; form.

15 A. Not in the context in the
16 setting of the overall system described in
17 the '992 patent.

18 (BY MR. WALTERS)

19 Q. That's not my question. Okay?

20 A. Yes.

21 Q. My question is: Was it known
22 in 2015 to monitor gas pressure of a gas

1 filtration skid in a hydraulic fracturing
2 operation?

3 A. So if you're asking whether the
4 technology was known for how to do that, yes,
5 the technology was known.

6 Q. Were implementers of fracking
7 systems monitoring gas pressure of a gas
8 filtration skid in 2015?

9 A. The -- the technology for doing
10 that was known. To what --

11 Q. Were they doing that?

12 A. To what extent they were doing
13 this, well, I would have to look at the
14 extent of overall use. My focus again was in
15 the context of the '992 patent, which is for
16 the overall system.

17 Q. Okay. So you don't know
18 whether, in 2015, implementers of fracking
19 sites were monitoring gas pressure of a gas
20 filtration skid?

21 MR. QUARLES: Objection; form.

22 A. If they have a gas filtration

1 skid, they would certainly have availability
2 of the technology for monitoring pressure.

3 (BY MR. WALTERS)

4 Q. Does that mean they would have
5 been monitoring pressure?

6 A. If they chose to do so, the
7 technology would be there, yes.

8 Q. Okay. I'm understand- -- I'm
9 trying to understand the difference between
10 the technology being known and implementers
11 actually doing it.

12 And I understand -- because you
13 keep going back to the technology being
14 known. And I'm wondering whether you're
15 suggesting that the technology was known, but
16 they weren't actually implementing that
17 technology at the time?

18 A. Well, what I'm trying to
19 explain is that the '992 patent refers to a
20 specific system and a collection of elements
21 that are supposed to work combined, so that
22 the overall objective of the patent can be

1 met which is the reason why I say "this
2 technology" or "that technology" or even --
3 whenever I say "the technology was known" I
4 mean that a POSITA would definitely have
5 access to such technologies.

6 They were not technologies that
7 would have to be invented from scratch.

8 The idea is of the many
9 technologies that are out there and one could
10 pick and choose from, which ones would one
11 select so that one could put together the
12 systems suggested in the '992 patent.

13 So it is in that context that I
14 refer to -- I use this phrase that "the
15 technology was known." One would have to
16 make a judgment call as to whether this is in
17 a system that makes use of that technology.

18 Q. Okay. And I understand it's
19 your position that no one was implementing
20 all these aspects of the claims. Okay?

21 A. Yes.

22 Q. I understand that's your

1 position. But -- but I'm asking about, in
2 this question, monitoring gas pressure of a
3 gas filtration skid.

4 And so irrespective of the
5 other elements of the other operating
6 characteristics that the claims require to be
7 monitored, irrespective of those, were
8 implementers of fracking sites in 2015
9 monitoring gas pressure of gas filtration
10 skids?

11 A. So those would be gas
12 filtration skids for what purpose?

13 Q. Fracking operation.

14 A. Okay. But the gas would be
15 used for what in the fracking operation?

16 Q. The same reason the gas was
17 used in the '992 patent.

18 A. You mean for power generation?

19 Q. Yes.

20 A. So where -- where people using
21 filter status monitoring in fracturing
22 operations where there was power generation

1 using natural gas?

2 Q. Yes.

3 A. So -- so for -- for that
4 operation, again alone, if one wanted to use
5 that technology, the technology would
6 definitely be there.

7 Q. Okay.

8 A. To what extent it was actually
9 used, I've not focused on this in isolation.
10 I focused on using all the elements combined
11 in the context of '992.

12 Q. Okay. So it's your
13 testimony -- I'm not asking about to the
14 extent it was being used. Okay. You
15 understand that?

16 I'm asking whether or not known
17 to use -- whether or not it was known to
18 monitor gas pressure of a gas filtration skid
19 in a fracturing operation in 2015?

20 MR. QUARLES: Objection; form.

21 A. If -- if a gas filtering
22 operation was used in fracturing, how to

1 monitor gas pressure would be known, yes.

2 (BY MR. WALTERS)

3 Q. Why would a POSITA want to
4 monitor gas temperature of a gas filtration
5 skid?

6 A. Again, to make sure that the
7 system operates as intended and to avoid any
8 operating problems that might jeopardize the
9 integrity of the system itself or the
10 integrity of a systems downstream from that.

11 Q. Was it known to monitor gas
12 temperature of a gas filtration skid in 2015
13 in a fracturing operation?

14 MR. QUARLES: Objection; form.

15 A. The technology was available.
16 Using it in conjunction with everything else
17 was not something that I have seen.

18 (BY MR. WALTERS)

19 Q. Okay. And that's not my
20 question. We can keep going in circles with
21 every question I've got if you would like,
22 but it's going to be a really long day.

1 A. Okay.

2 Q. You understand that?

3 A. I understand that. I'll try to
4 comply.

5 Q. Was it known to monitor gas
6 temperature of a gas filtration skid in 2015
7 in a fracturing operation?

8 MR. QUARLES: Objection; form.

9 A. No.

10 Q. Your testimony for the judge
11 is -- is that it was not known to monitor gas
12 temperature of a gas filtration skid in 2015
13 in a fracturing operation?

14 MR. QUARLES: Objection; form.

15 A. I explained that. Mainly it
16 was not -- it was known how to do that.

17 Whether one would select to do
18 that depends on what is the system that one
19 deals with.

20 And it is in this context that
21 I'm saying no. Namely, I am interpreting the
22 question, "Was it known to do something?"

1 I'm interpreting that, "Was it known that
2 somebody would select to do that without
3 undue experimentation?"

4 (BY MR. WALTERS)

5 Q. What does undue experimentation
6 have to do with this?

7 A. Whether one would select to use
8 that technology without putting some effort
9 on whether this technology is beneficial or
10 appropriate to their liking so that they can
11 use it in a particular context.

12 Q. Okay. So I just want to be
13 clear. It's your testimony that it was not
14 known in 2015 and in a fracturing operation
15 to monitor gas temperature of a gas
16 filtration skid?

17 MR. QUARLES: Objection; form.

18 A. Again, I'm interpreting the
19 phrase "known to do something" as it was
20 known that this something should be done.

21 Whether that should be done or
22 not depends on the particular system that one

1 has, and that's why I'm saying whether one
2 should -- would select to -- to do that
3 depends on everything else in the context of
4 the patent.

5 Was it known how to do that?

6 It was absolutely known, yes.

7 (BY MR. WALTERS)

8 Q. Okay. Let me ask a different
9 way.

10 Were implementers of fracturing
11 systems in 2015 monitoring gas temperatures
12 of gas filtration skids?

13 A. Let me put it this way. So --
14 and I'll take your admonition that we
15 shouldn't be here all day, which I really
16 appreciate.

17 So let me put it this way. If
18 one used a gas filtration system, would
19 one -- would it make sense for one to monitor
20 the operating characteristic of the system.
21 My answer is, yes, it would make sense to
22 monitor these characteristics of that system.

1 Would one definitely choose
2 that system in connection with everything
3 else? On that you would have to have
4 guidance from the patent.

5 Q. And I'm not asking whether one
6 would choose to do it. I'm asking whether,
7 in your 27-plus years of experience in the
8 oil and gas industry, whether in 2015
9 implementers of fracking sites were
10 monitoring gas temperatures of gas filtration
11 skids.

12 A. Well, again, I haven't looked
13 at that because gas filtration systems, who
14 knows where they may use those.

15 Let me -- let me put it this
16 way. If one used the gas filtration system,
17 would they have available the technology and
18 would there be an incentive to use that
19 technology for monitoring that system? Yes.

20 Q. Okay. So you said you haven't
21 looked at that?

22 (Speaking simultaneously.)

1 (BY MR. WALTERS)

2 Q. Okay. That's how you
3 qualified -- that's how you qualified your
4 answer, right?

5 A. I focused on the overall system
6 described in the patent, correct.

7 Q. Okay. So irrespective of what
8 you looked at, I'm -- I'm interested in -- in
9 the answer to the question based on your
10 current experience in the industry.

11 And what I take your answer to
12 be is that you don't know whether, in 2015,
13 implementers of fracking sites were
14 monitoring gas temperatures of gas filtration
15 skids.

16 MR. QUARLES: Objection; form.

17 A. I do not -- I don't know the
18 extent to which they were doing that because
19 again --

20 (BY MR. WALTERS)

21 Q. And I'm not asking about the
22 extent.

1 I'm asking whether or not they
2 were doing that. And if the answer is you
3 don't know, that's fine. We'll -- that's
4 your answer for the Board, but I'm just
5 trying to understand what your answer is. So
6 I'll -- I'll ask the -- the question again.

7 You don't know whether, in
8 2015, implementers of fracking sites were
9 monitoring gas temperatures of gas filtration
10 skids?

11 MR. QUARLES: Objection; form.

12 A. For a fact, no. I -- I do not
13 know this as something that I have checked to
14 be a hundred percent sure as to whether this
15 was actually done and to what extent in that
16 particular time.

17 (BY MR. WALTERS)

18 Q. Okay. Would it surprise you if
19 implementers of fracking sites in 2015 were
20 monitoring gas temperatures of gas filtration
21 skids?

22 A. No.

1 Q. Why not?

2 A. Because it's a technology
3 that -- that was available and it's
4 reasonable to monitor this to ensure proper
5 operation.

6 Q. Okay. Why would a POSITA want
7 to monitor valve status of a gas filtration
8 skid?

9 A. For similar reasons that we
10 mentioned before.

11 Namely, to make sure that the
12 system operates as intended and perhaps catch
13 and try to prevent potential malfunctions
14 either to this -- the filtration system
15 itself or downstream operations to which the
16 filter -- the filtration system is connected
17 to.

18 Q. Would valve status include
19 whether a valve is open or closed?

20 A. It's overall condition of the
21 valve, namely whether it's operating as
22 intended, actually. Valves may be stuck, may

1 chatter. There are all kinds of issues
2 related to valves.

3 Q. I understand that it can
4 include other things, but can it include --
5 can it include whether the valve is open or
6 closed?

7 A. It can include that, yes.

8 Q. Okay. And are there additional
9 steps that a system might take, depending on
10 whether the status comes back, that the valve
11 is open or closed?

12 A. Additional steps in response to
13 that, or example, to counter the problem or
14 try to remedy the problem or something like
15 that?

16 Q. Yes.

17 A. In principle, yes, of course.
18 One -- if one gets such a signal that a valve
19 is not working properly, then one would pay
20 attention to that and act accordingly.

21 Q. In 2015, was it known to
22 monitor valve status?

1 MR. QUARLES: Objection; form.

2 A. Again in the spirit of avoiding
3 a lengthy discussion, no.

4 In the context of everything
5 that we mentioned about the patent and the
6 system if one had the filtration system and
7 monitored the valve status -- was known to
8 monitor the valve status for such a system,
9 assuming a filtration system was used, yes,
10 one would know what the technology would be
11 and it would be reasonable to monitor valve
12 status.

13 (BY MR. WALTERS)

14 Q. Okay. What is a filter bypass?

15 A. If there is a problem -- well,
16 the -- the filter has a main line and there
17 is a bypass stream for -- mainly for safety
18 purposes.

19 Namely, if a system is stuck or
20 if something is impending the natural flow,
21 there's a bypass so that you can use that
22 extra line to avoid the operating problems.

1 Q. Could it include a -- you said
2 extra line.

3 Is that like a conduit?

4 A. It's -- well, we have the main
5 line, so you have natural gas going through
6 the filter. And right before the filter,
7 there's a split of the line that goes around
8 the filter. It bypasses the filter.

9 Q. Okay. So -- and if the filter
10 is not working properly, then the gas would
11 go through the bypass line?

12 A. To identify it -- for example,
13 if -- if the filter is stuck and there can be
14 no flow and there is continuous flow of gas
15 from the other end, the -- the whole system
16 may blow up, for example.

17 So to avoid these things, you
18 have, for safety purposes, a bypass line.

19 Q. Okay. What does filter bypass
20 status refer to?

21 A. Whether that line is also
22 available and operating as intended.

1 Q. Okay. Could filter bypass
2 status refer to whether the bypass is
3 activated or inactivated?

4 A. Yes. It could include that.

5 Q. And could filter bypass status
6 indicate whether the filter is working
7 properly or needs to be repaired?

8 A. Well, strictly speaking, the
9 filter bypass status is about the bypass
10 line.

11 Now, what one could infer from
12 that is subject to analysis. If you're
13 asking whether the two are compatible, they
14 are, but I would leave it at that.

15 The filter bypass status
16 monitoring refers to monitoring just the
17 filter bypass.

18 Q. Okay. And if the filter bypass
19 is activated, then that might suggest there's
20 a problem with the filter?

21 A. Something triggered that. So
22 that might be a problem with the filter

1 itself, yeah.

2 Q. Why would a -- why would one
3 want to monitor filter bypass status?

4 A. Well, first of all, to know
5 what is going on with the filter bypass and
6 to make sure that the filter bypass is
7 operable and it can work as intended if
8 needed.

9 Q. In 2015, were implementers of
10 fracking sites monitoring filter bypass
11 status?

12 A. If they were using a filter and
13 a bypass, it would be reasonable for them to
14 monitor filter bypass status and the
15 technology would be available.

16 Q. Was it common to use filter and
17 bypass in fracturing systems in 2015?

18 MR. QUARLES: Objection; form.

19 A. That has to do with how common
20 filter use was.

21 So filter bypass status is at
22 the same level of use with filter use. The

1 two go together.

2 (BY MR. WALTERS)

3 Q. Okay. Well, you answered my
4 other question, if they were using a filter
5 and a bypass.

6 A. Uh-huh.

7 Q. And so my question in response
8 to that is: In 2015, was it common to use a
9 filter and a bypass in fracturing systems?

10 A. That filter and a bypass, it is
11 referred to in our discussion in conjunction
12 with power generation in feeding natural gas
13 to an electricity generator.

14 So to the extent that such a
15 filter was used for that purpose, yes, that
16 technology was available and people could use
17 it. The POSITA would -- would know how to
18 use it.

19 Q. And you understand that's not
20 my question?

21 A. You're asking about the overall
22 use of filter bypass?

1 Q. My question -- I'll just ask it
2 again.

3 My question was: In 2015, was
4 it common to use a filter in the filter
5 bypass in fracturing systems?

6 MR. QUARLES: Objection; form.

7 A. I haven't -- I haven't looked
8 at that in detail so I can have specific
9 estimates.

10 (BY MR. WALTERS)

11 Q. Okay. In 2015, were -- and I'm
12 not asking for any estimates for the extent
13 of use.

14 My -- my question is: In 2015,
15 were implementers of fracking systems using
16 filters and filter bypasses for the gas?

17 A. For gas fed to a generator?

18 Q. Yes.

19 A. For gas fed to a generator, the
20 technology was there. So if they were using
21 a generator, they would know how to use a
22 filter and a filter bypass.

1 Q. Okay. How would a system
2 detect that the filter bypass was activated?

3 MR. QUARLES: Objection; form.

4 A. That can be in a number of
5 ways. For example, a typical one would be
6 based on the status of the valve of the
7 bypass.

8 (BY MR. WALTERS)

9 Q. Could one use a sensor?

10 A. One could use a flow sensor
11 perhaps, yes. If indicated there is flow,
12 but yes.

13 Q. What are inlet valves of a gas
14 filtration skid?

15 A. The valves that are at the
16 entry points of the inlet, the input to the
17 system, to the filtration system.

18 Q. What types of valves would be
19 used as inlet valves?

20 A. In any kind of valve that one
21 would use for a gas flow.

22 Q. A solenoid valve?

1 A. I'm sorry?

2 Q. A solenoid valve?

3 A. Solenoid refers to how you
4 actually activate the valve and the solenoid,
5 yeah.

6 Q. A ball valve?

7 A. I'll have to check on these
8 things, on the specifics whether one would
9 use something like that.

10 Q. What does it mean to control
11 the inlet valve?

12 A. To control the inlet valve
13 means to adjust the opening of the valve.

14 The -- these valves are not
15 just on/off. They can open to various
16 percentages from 0 to 100 percent.

17 And the flow rate is not
18 proportional to opening. All of these valves
19 have flow characteristics that the
20 manufacturer can provide.

21 So controlling the valve means
22 that you adjust the opening of the valve,

1 essentially.

2 Q. Why would a -- why would one
3 want to control inlet valves of the
4 filtration system?

5 A. To make sure that flow rate is
6 as desired, the operating characteristics
7 overall are as desired.

8 So the valve essentially
9 dictates -- but by -- by adjusting its
10 opening, the valve can adjust flow rate of
11 the gas.

12 So in -- in this sense, the
13 valve is an extra point of resistance to gas
14 flow through the pipe that goes to the
15 filtration system.

16 And by adjusting the opening of
17 the valve, you adjust what is the pressure
18 downstream of the valve, what is the flow
19 rate, and the oper- -- other operating
20 characteristics of the system.

21 Q. What are the outlet valves of a
22 gas filtration skid?

1 A. It's a similar thing. They are
2 valves that can adjust flow rate, and they
3 are -- they have similar function in
4 principle to the inlet valves, but they are
5 the outlet to provide an extra degree of
6 freedom on how you adjust flow rate.

7 Q. Could the outlet valve be
8 located well downstream from the filtration
9 system and still affect the flow through the
10 filtration system?

11 A. Well, that's -- well, the --
12 the outlet valve of the filtration system is
13 associated with a filtration system.

14 So I would expect that people
15 refer to that outlet valve, you know, in
16 the -- in the overall system, the filtration
17 system.

18 Now, as that filtration system
19 is collected, downstream equipment, could
20 people introduce valves downstream? That's
21 hypothetical. I haven't checked that.

22 Q. Would an inlet valve that is

1 upstream of other equipment before the
2 filtration system be able to control gas flow
3 through the filtration system?

4 A. An inlet valve that is upstream
5 of the filtration system?

6 Q. Correct.

7 A. Well, so you're referring to
8 the valve that would be in addition to the
9 filtration system inlet valve?

10 Q. Yes.

11 A. Yes, it could. So you're
12 referring to -- so let me make sure I
13 understand the -- the context of -- of this,
14 the setting, the physical setting, so you
15 have a filtration system. You have an inlet
16 stream, right? There at the inlet stream
17 there is a valve. That's what we understand
18 as the inlet valve. Right, so far?

19 And then upstream of that,
20 you're asking, could there be another valve
21 and would that valve affect the -- the system
22 downstream from that valve, namely the inlet

1 valve of the filtration system and the
2 filtration system?

3 Q. Yes.

4 A. Yes. The answer is yes. There
5 could be another valve further upstream, yes.

6 It's in the production. This
7 is gas that is coming from the production, so
8 you can adjust production by using the
9 production valves. So you could have things
10 like that further upstream.

11 Q. What are bypass valves of the
12 gas filtration skid?

13 A. Bypass valves are the valves
14 that adjust the flow rate of the bypass
15 stream -- regulate the flow rate of the
16 bypass stream.

17 Q. What is the pressure release of
18 a gas filtration skid?

19 A. A pressure release?

20 Q. Yes.

21 A. So, if -- a release or relief?

22 Q. Release.

1 A. Release. So, if -- if there is
2 excessive pressure, you need to make sure
3 that the capability is there to avoid damage
4 to the system by having a successive
5 pressure, so you must be able to have
6 pressure release so that you can avoid
7 problems in the operation and health of the
8 equipment.

9 Q. Were implementers of systems --
10 strike that.

11 Were implementers of fracking
12 systems in 2015 controlling pressure releases
13 of gas filtration skids?

14 A. If a gas filtration skid were
15 used, it would be reasonable to see these
16 pressure release -- this pressure release
17 capability there.

18 Q. Controlling pressure releases
19 of gas filtration skids was not novel in
20 2015?

21 MR. QUARLES: Objection; form.

22 A. As to -- as a technology, no.

1 (BY MR. WALTERS)

2 Q. What are gas compressors?

3 A. Gas compressors are compressors
4 that take gas and compress it.

5 Q. Why would a -- one of skill in
6 the art want to monitor operating
7 characteristics of a gas compressor in a
8 fracturing system?

9 A. To make sure that the
10 performance is as intended and also to make
11 sure that there are no impending problems in
12 case something abnormal would be detected.

13 Q. What types of problems?

14 A. Operating problems due to all
15 kinds of upsets and external disturbances.
16 For example, I -- you said above the gas
17 compressor only?

18 Q. Yes. My question was about the
19 gas compressor.

20 A. Yeah. So the gas compressor
21 might not be providing the pressure boost
22 that you want or the -- the feed might not be

1 providing enough gas.

2 All kinds of issues related
3 with the proper operation of a gas compressor
4 and might create problems.

5 Q. We've been going a little over
6 an hour, is -- would you like to take a
7 break?

8 THE WITNESS: This a good time?
9 Say, what, ten minutes?

10 MR. WALTERS: Ten minutes is
11 good with me.

12 THE WITNESS: Great.

13 (Break from 10:05 a.m. to 10:16 a.m.)

14 (BY MR. WALTERS)

15 Q. Welcome back, Dr. Nikolaou.

16 A. Thank you.

17 Q. You understand that rules in
18 IPR depositions prevent discussing the
19 substance of your testimony with counsel
20 during breaks?

21 A. I do.

22 Q. Have you had any such

1 discussions during the last break?

2 A. No.

3 Q. Okay. What is compressor motor
4 run status of a gas compressor?

5 A. It's the status of the motor
6 that runs the compression part of the
7 compressor.

8 Q. Could it refer to whether the
9 motor is running or not?

10 A. Yes.

11 Q. How would one monitor
12 compressor motor run status of the gas
13 compressor?

14 A. So there are various options
15 depending on the manufacturer and depending
16 on what technology one uses.

17 Those typically would come with
18 the compressor, and they would have -- they
19 would provide the user that capability to
20 connect to hook up whatever with equipment is
21 going to use these signals for monitoring.

22 Q. Could one use a sensor to

1 measure the compressor motor speed?

2 A. That would typically -- the
3 short answer is yes, and that typically would
4 be provided by the manufacturer of the
5 compressor.

6 Q. Why would one want to monitor
7 the compressor motor run status of the gas
8 compressor?

9 A. To make sure that the operation
10 is satisfactory and also catch potential
11 impending problems that might jeopardize the
12 operation or the health of the equipment,
13 either the compression system itself or
14 downstream systems.

15 Q. What types of problems?

16 A. The compressor, for example, is
17 not providing enough boost to the pressure.

18 Q. Was it common to monitor the
19 status of the compressor motor in 2015?

20 A. If -- if a compressor were to
21 be used, yes, it would be common to monitor
22 the status.

1 Q. What is an enclosure exhaust
2 fan?

3 A. So the -- and you're referring
4 to this term as used in the patent, I
5 presume, correct?

6 Q. As it's used in the substitute
7 claims.

8 A. In the substitute claims, yes.
9 So the -- there is -- for that
10 enclosure, there must be a possibility --
11 capability to have an exhaust, and there is a
12 fan that ensures that the -- there is an
13 exhaust that provides that capability for air
14 to be fanned out of the system.

15 Q. "Fanned out," is that what you
16 said?

17 A. Yes.

18 Q. Okay. What does it mean to
19 monitor enclosure exhaust fan status?

20 A. Whether its performance is
21 the -- the exhaust fan performance is as
22 intended and whether that performance might

1 create potential problems, either for the fan
2 itself or for the system for which the
3 exhaust fan is supposed to provide exhaust.

4 Q. Okay. Could it -- could it
5 mean to monitor whether the exhaust fan is
6 activated?

7 A. Or whether it has been
8 activated? Yes.

9 Q. Yes.

10 A. Yes, it could include that.

11 Q. Could it monitor whether the
12 exhaust fan needs repair?

13 A. It could.

14 Q. Why would one want to monitor
15 enclosure exhaust fan status of the gas
16 compressor?

17 A. Because if that doesn't work as
18 intended, there may be operating problems,
19 performance problems, that is, or problems to
20 the health of equipment.

21 Q. And could that relate to
22 temperature inside the enclosure?

1 A. It -- it could. It could.

2 Q. Okay. Was it common to monitor
3 the status of an enclosure exhaust fan of a
4 gas compressor in 2015?

5 A. If a gas compressor were used,
6 yes, one would monitor that. It would be
7 reasonable to monitor.

8 Q. What is compressor inlet
9 pressure of a gas compressor?

10 A. It's the pressure of the
11 incoming gas.

12 Q. Why would one want to monitor
13 compressor inlet pressure of the gas
14 compressor?

15 A. To make sure that it is within
16 the specifications for which the compressor
17 has been designed.

18 Q. Why is that important?

19 A. Because compressors cannot work
20 on infinitely wide pressure ranges for the
21 incoming gas. There is a further wide but
22 nonetheless finite range of pressures over

1 which compressor works well.

2 Q. Was it common to monitor
3 compressor inlet pressure of a gas compressor
4 in 2015?

5 A. If one was using a gas
6 compressor, yes, it would be common to
7 monitor the pressure.

8 Q. What is compressor discharge
9 pressure of a gas compressor?

10 A. Similar thing. No air at the
11 other end of the compressor. The compressor,
12 again, its main purpose is to provide a boost
13 in the pressure of the gas that is flowing
14 through it.

15 So at the other end, you are --
16 one monitors that pressure to have an idea of
17 whether, indeed, the compressor works as
18 intended.

19 Q. Why would one want to monitor
20 compressor discharge pressure of the gas
21 compressor?

22 A. Because the very reason for

1 using a compressor is to provide gas at or
2 around a certain higher pressure than the
3 inlet pressure.

4 And if the compressor is not
5 delivering that, then there is obviously
6 going to be a problem.

7 Q. Does the compressor discharge
8 pressure refer to pressure of the gas flow
9 downstream from the compressor?

10 A. Yes. It's -- it's gas flowing
11 out of the compressor to -- to the downstream
12 direction?

13 Q. Okay. Is the compression
14 discharge pressure impacted by the outlet
15 pressure of the gas filtration skid?

16 A. Well, if the gas filtration
17 skid provides gas at a certain pressure, that
18 is what the compressor has to work with, say,
19 that conflicts, yes.

20 They are -- the two are related
21 and one impacts the other.

22 Q. Would one monitor the

1 compressor discharge pressure of the gas
2 compressor to prevent over-pressurizing the
3 system?

4 A. By over-pressurizing, you mean
5 the gas were to be delivered at a pressure
6 higher than intended?

7 Q. Correct.

8 A. Yes.

9 Q. What about to adjust the speed
10 of the compressor?

11 A. Sorry, you're asking if one
12 would monitor the RPM, the speed of the
13 compressor and would adjust accordingly?

14 Q. My question is: Would one
15 monitor the compressor discharge pressure --

16 A. Uh-huh.

17 Q. -- in order to adjust the speed
18 of the compressor?

19 A. Oh, it's a corrective pressure,
20 you mean. So if the pressure is not at the
21 right value, would one adjust the RPM, the
22 rotation speed of the compressor? Yes.

1 Q. Okay.

2 A. Yes.

3 Q. Was it common to monitor
4 compressor discharge pressure in 2015?

5 A. Over all of compressors, yes.

6 Q. Okay. What is an emergency
7 power off unit operated by a switch that
8 sounds an audible alarm?

9 A. So if -- if there is an
10 emergency, then there would be a switch that
11 would be activated and there would be an
12 alarm so that people around the area would be
13 alerted about the problem that has emerged.

14 Q. Why would one -- why would one
15 want to implement such a -- an emergency
16 power off unit in a fracturing system?

17 A. An emergency power off unit is
18 a way to stop the operation if continuation
19 would create problems for the equipment or
20 for humans.

21 Q. Was it common to implement such
22 an emergency power off unit in 2015?

1 A. Power off units were used in
2 2015, yes, in various contexts, yes. Yeah.

3 Q. Power off units that are
4 operated by a switch of that sounds an
5 audible alarm?

6 A. The technology for doing this
7 was definitely available and such units were,
8 indeed, used, yes.

9 Q. Were they used in fracturing
10 systems?

11 A. I have not checked the extent
12 to which they were used in fracturing systems
13 but a -- would a POSITA consider these as a
14 reasonable safety measure, yes.

15 Q. What is a turbine air inlet
16 filter transmitter?

17 A. So it's a transmitter that
18 provides measurements signals that they're
19 measured for the air filter.

20 Q. How does -- how does that work?

21 A. Which part? The -- how the
22 transmitter works?

1 Q. Yes.

2 A. The transmitter has a signal
3 that is based on whatever source and it has
4 to -- it transmits that for further
5 processing using any available means -- in
6 general, using any available means one may
7 want to consider for transmitting signals.

8 Q. What components would you use
9 to implement an air inlet filter transmitter?

10 A. Anything that could be used to
11 transmit a signal. There are many options
12 that one can use, either wired or wireless or
13 anything that one can think of. There are
14 lots of technologies for doing that.

15 Q. Could you implement one using
16 load cells that measure the weight of the
17 filter?

18 MR. QUARLES: Objection; form.

19 A. I'm not sure I follow that.
20 One more time, please.

21 (BY MR. WALTERS)

22 Q. Sure. You could use load cells

1 to measure the weight of the filter to
2 determine whether the filter was clogged, for
3 example, correct?

4 A. Okay. So what would you do
5 with that measurement?

6 Q. I'm sorry?

7 A. Why -- what would you do with
8 that measurement? Are we still in the mode
9 of signal transmission or did we jump to a
10 separate item?

11 Q. Well, one could use the load
12 cells to measure the weight of the filter,
13 correct?

14 A. Okay. Yes. Yes.

15 Q. And then the load cells would
16 transmit a -- an electrical signal that's
17 indicative of the weight, correct?

18 A. Yes. Yeah. They -- the load
19 cell would function as a sensor, basically,
20 and there would be a measurement that could
21 be transmitted for further processing, yes.
22 That is correct.

1 Q. Okay. Could you also implement
2 the turbine air inlet filter transmitter
3 using a differential pressure sensor that
4 measured the differential pressure across the
5 filter?

6 A. If you wanted to measure the
7 differential pressure across the filter,
8 certainly you could use a DP cell and then
9 take the measurement and transmit it for
10 further processing, correct.

11 Q. And the differential pressure
12 sensor would transmit a signal indicative of
13 that pressure, correct?

14 A. Of the pressure difference,
15 correct.

16 Q. How could the turbine air inlet
17 filter transmitter fail?

18 A. In any way that filters -- I
19 mean, the transmitters may fail. So there
20 could be complete loss -- loss of connection.
21 There could be drifting.

22 The -- it depends on the

1 particular kind of transmitter, the
2 particular technology, the conditions to
3 which this is exposed, and so forth.

4 But as I already said, modes
5 that are fairly common for these kinds of
6 failures include the complete loss of
7 connection or drifting. Those were -- those
8 are typical things that one considers.

9 Q. If the transmitter needed
10 service or repair, would that be an
11 indication of failure?

12 A. Well, the -- the -- the idea
13 goes the other way. If you think that a
14 transmitter is on the verge of failure, you
15 need to do something about it.

16 So if you did something about
17 it, it's because there was a trigger for the
18 maintenance or repair.

19 So it -- the trigger may have
20 been an impending failure, but it may have
21 been deterioration of performance. Like I
22 said, it could be a milder situation that

1 still does not deliver a good performance.

2 Q. If the transmitter produced a
3 suspicious reading, could that be an
4 indication of failure?

5 A. It could be an indication that
6 the sensor definitely needs attention.

7 Q. Yeah.

8 A. It's -- it's not -- the sensor
9 is not working properly. Let's put it this
10 way.

11 Q. Which could indicate failure?

12 A. Well, it -- I don't know how
13 you're using the term. In -- in my
14 understanding, failure means complete loss of
15 functionality.

16 You may not have complete --
17 complete loss of functionality, but you may
18 have deteriorated functionality. Still, one
19 would want to do something about it.

20 Q. One might interpret a
21 transmitter that was not working as intended
22 to be a failed -- to be failure?

1 A. Again, it's a matter of
2 semantics.

3 If you define failure as
4 anything below proper operation, yes. It's
5 not operating properly, but it may still
6 maintain some functionality, which is not
7 complete failure, but it -- it -- it does
8 need attention.

9 And you may have, of course,
10 complete failure, which means I don't get
11 anything from that sensor.

12 Q. Was it common to monitor for a
13 failure of a turbine air inlet filter
14 transmitter in 2015?

15 A. For -- for turbines, yes. In
16 general, yes.

17 Q. Were differential pressure
18 sensors known in 2015?

19 A. Definitely.

20 Q. Was it known in 2015 to use
21 differential pressure sensors to monitor
22 industrial equipment?

1 A. Definitely.

2 Q. Was it known in 2015 to use
3 differential pressure sensors to monitor
4 turbine generators?

5 A. Yes.

6 Q. Were load cells known in 2015?

7 A. Yes.

8 Q. Were load cells known to
9 monitor filters in industrial equipment in
10 2015?

11 A. Yes.

12 Q. Were load cells known to
13 monitor filters in turbine generators in
14 2015?

15 A. Yes.

16 Q. A differential pressure sensor
17 is not used to measure odor; is it not?

18 A. Odor? Like smell?

19 Q. Yes.

20 A. Not that I know of.

21 Q. A load cell is not used to
22 measure odor, correct?

1 A. Not -- not that I know of.

2 MR. WALTERS: Your video is
3 frozen. It's not a problem for me,
4 but I just want to make sure.

5 (Discussion off the record.)

6 (Break from 10:37 a.m. to 10:49 a.m.)

7 (BY MR. WALTERS)

8 Q. Welcome back, Dr. Nikolaou.

9 A. Thank you.

10 Q. Could you turn to exhibit
11 Page 39 of your declaration, Exhibit 2107.

12 A. Exhibit 2107.

13 Q. Actually exhibit Page 38.

14 A. Exhibit Page 38, yes.

15 Q. And it's on that page claim 44
16 starts?

17 A. 44, yes.

18 Q. Okay. Claim limitation 44(b)
19 states: "The system further comprising a
20 hydraulic system"?

21 A. Yes.

22 Q. Okay. What components of the

1 fracturing system would be part of the
2 hydraulic system that's claimed there?

3 A. So the hydraulic system is the
4 system that provides capability for
5 preparation of the hydraulic fluid so that
6 the -- that fluid can be ready for use in the
7 fracturing operation.

8 In the hydraulic system in a
9 fracturing operation may help with -- in
10 general, it can help with auxiliary
11 activities for providing temporary flow
12 rates, boosts in pressure, and things that
13 are needed for the preparation of the fluid
14 to be injected during the fracturing
15 operation.

16 Q. What components would it
17 include?

18 A. So the -- the hydraulic system,
19 again, it's -- it includes a hydration unit,
20 which mixes essentially water with whatever
21 additives you need for the water to have the
22 properties that allow it to flow as intended

1 when used in the fracturing operation. And
2 that is the main thing that this
3 accomplishes.

4 Q. Would it include anything else?

5 A. Well, it's all the auxiliary
6 equipment that has to work with this. So
7 there -- there has to be pumping of fluids,
8 there has to be pressurization, transfer of
9 fluids, and so forth.

10 Q. Would it include the electric
11 pump?

12 A. Pumps used for transfer of that
13 fluid, yes. The electric pump you're
14 referring to, the main pump that injects the
15 prepared fluid into the formation?

16 Q. Yes.

17 A. Okay. That pump itself is
18 something that usually is understood as
19 something that is a separate piece of
20 equipment. Everything around it can be
21 looked at as a hydraulic system that feeds to
22 that. It's -- it's a matter of jargon.

1 Q. Okay. Can you turn to the '992
2 patent, Exhibit 1001?

3 A. Yes.

4 Q. And specifically to claim 6?

5 A. Claim 6. Yes.

6 Q. Claim 6.

7 A. In Column 22, right?

8 Q. Yes.

9 A. Yes.

10 Q. Claim 6 includes an emergency
11 power off unit.

12 Do you see that?

13 A. Yes.

14 Q. And at the end it states:

15 "Wherein the emergency power off unit is
16 configured to substantially immediately cut
17 power from the generator when activated"?

18 A. Correct.

19 Q. When does power have to be cut
20 for it to be considered substantially
21 immediately?

22 MR. QUARLES: Objection; form.

1 A. So the -- the -- the term
2 "substantially" is used here, as I understand
3 it, to suggest that maybe power is not cut
4 off in zero time, as -- within zero time
5 after the emergency is recorded or
6 understood, but very, very quickly, and
7 that's why -- what -- what is very quickly,
8 they use the term "substantially
9 immediately."

10 (BY MR. WALTERS)

11 Q. Okay. If the word
12 "substantially" weren't there, and if the
13 claim required that power -- that the
14 emergency power off unit be configured to
15 immediately cut power from the generator when
16 activated, when would power have to be cut
17 for it to be considered immediately after
18 activation?

19 A. Very, very quickly.

20 Q. How quickly?

21 A. Very quickly. It's -- there is
22 no direct specification of that.

1 Q. Half a second?

2 A. Well, the -- it depends. It --
3 it's -- the idea there is that you do
4 everything you can so that once you detect
5 that emergency, you want to switch off power
6 as quickly as possible.

7 Q. What does it depend on?

8 A. What does what depend on? The
9 time of response, you mean?

10 Q. Yeah. I asked whether, in
11 order to satisfy immediately, power would
12 be -- need to be cut within half a second,
13 and you said "it depends."

14 And so my question is: What
15 does it depend on?

16 A. On how quickly one can respond
17 as a practical matter.

18 Q. Does that vary based on the
19 particular emergency power off unit being
20 used?

21 A. Well, it's a matter of going
22 through that process very, very quickly.

1 But if one said "immediately,"
2 that might be interpreted as zero time, and
3 zero time might not be technically correct
4 because, you know, signals, for example,
5 cannot be transmitted faster than the speed
6 of light.

7 So which -- which is a
8 ridiculously high speed, then it refers to
9 ridiculously low response time.

10 But nevertheless, it's not
11 zero, so that's why it -- it's there
12 substantially to suggest that this is
13 reasonably immediate for all practical
14 purposes.

15 Q. If power were cut within half a
16 second, would that satisfy immediately?

17 A. Reasonably speaking, yes.

18 Q. If power were cut within
19 three-quarters of a second, would that
20 satisfy immediately?

21 MR. QUARLES: Objection; form.

22 A. I would consider these to be

1 very fast response times.

2 (BY MR. WALTERS)

3 Q. Is that a "yes" or "no"?

4 A. Yes.

5 Q. If power were cut within one
6 second, would that be considered immediately?

7 MR. QUARLES: Objection; form.

8 A. I would reasonably assume that
9 this would mean immediately, yes.

10 (BY MR. WALTERS)

11 Q. If power were cut within
12 2 seconds would that be considered
13 immediately?

14 MR. QUARLES: Object to form.

15 A. Still in the category of very
16 short time, and to actually tell whether
17 this -- how well this would qualify for
18 substantially immediately, I would have to
19 know more about the configuration of the
20 system, the risk for letting power continue
21 before it gets shut off, and it depends on
22 the specifics on -- on -- on how this is

1 handled.

2 (BY MR. WALTERS)

3 Q. And my question -- the last few
4 questions have been about the word
5 "immediately," not about the term
6 "substantially immediately."

7 Do you understand that?

8 A. Well, again, I understand that
9 in the context of immediately referring in
10 the sense that, well, maybe it's not zero
11 time but very short time.

12 So I understand that you're
13 asking what would half a second or
14 three-quarters or 1 or 2 seconds, would those
15 qualify as very fast time. Reasonably
16 speaking, yes, from my --

17 Q. No, my --

18 A. -- from an engineering
19 viewpoint.

20 Q. Yeah, my question is not with
21 respect to the word "substantially." Okay?

22 A. Okay.

1 Q. My question is: If the claim
2 required that power be cut immediately when
3 activated, what kind of range are we talking
4 about?

5 MR. QUARLES: Objection; form.

6 A. Well, the -- this is not a term
7 used within specific numbers. It's a term
8 that is understood, as -- as indicated there,
9 immediately.

10 (BY MR. WALTERS)

11 Q. Indicated where?

12 A. In Column 22 in claim No. 6
13 they don't give any specific numbers, and
14 they just use the term "immediately," and
15 it's standard understanding. And to leave
16 some room for this immediately might not mean
17 zero time. They say substantially
18 immediately.

19 Q. If power were cut within
20 5 seconds from the power off unit being
21 activated, would that satisfy immediately?

22 MR. QUARLES: Objection; form.

1 A. I will have to -- I have to
2 have more information about the specific
3 system so that I can give a more quantitative
4 response to that.

5 (BY MR. WALTERS)

6 Q. Okay. If power were cut within
7 five seconds, would that satisfy the term
8 "substantially immediately"?

9 MR. QUARLES: Objection; form.

10 A. Again, "substantially" is used
11 in the context of the specific system, and
12 there is an engineering judgment as to how
13 much that would be.

14 There is no specific number
15 assigned to it. In the same sense that
16 beyond reasonable doubt doesn't give a
17 percentage of probability that how much doubt
18 there is in the criterion.

19 (BY MR. WALTERS)

20 Q. Does it depend on the
21 particular emergency power off unit being
22 used?

1 A. It -- well, it -- it -- what
2 that specific number would be, you're asking
3 whether it depends on the specific switch
4 that would be used to cut it off?

5 Q. Yes.

6 A. Well, the switch itself
7 actually is going to be very fast. The
8 switches work very fast, but there may be,
9 say, very small delay due to the transmission
10 of signals, for example.

11 So the idea here is that all of
12 that, if it's there, it would be very, very
13 small, so that you can have power cut
14 substantially immediately, substantially --
15 in substantially zero time.

16 Q. So I'll -- you've had some time
17 to think about it, so I'll ask again.

18 A. Uh-huh.

19 Q. How quickly does the power need
20 to be cut in order to satisfy the term
21 "substantially immediately"?

22 MR. QUARLES: Objection; form.

1 A. In -- in as much time as a
2 POSITA would consider to be substantially
3 immediate response.

4 (BY MR. WALTERS)

5 Q. You're a POSITA, correct?

6 A. Yes.

7 Q. Okay. Is there an industry
8 standard for how long after activation an
9 emergency power off unit needs to cut power
10 to satisfy the term "substantially
11 immediately"?

12 A. Well, the -- these units
13 each -- each one of these units has a
14 response time and their response times are
15 typically very, very, very short.

16 So upon activation, the unit
17 cuts off power, the emergency power of the
18 unit, that is. Cuts off power substantially
19 immediately.

20 How quickly that happens
21 depends on the particular situation, like I
22 said, the system, the design of the unit and

1 so forth.

2 All of those units essentially
3 are designed to substantially immediately cut
4 power off.

5 Q. I understand there's no
6 industry standard.

7 A. Well, there are -- the
8 standards for these units are whatever the
9 equipment standards are.

10 For these and beyond that, I
11 would have to do my search to see what
12 exactly these standards are.

13 Q. Okay. Does the '992 patent
14 specification provide any standard for how
15 long after activation an emergency power off
16 unit needs to cut power to satisfy the term
17 "substantially immediately"?

18 MR. QUARLES: Objection; form.

19 A. It -- it says in the claim only
20 substantially immediately.

21 (BY MR. WALTERS)

22 Q. Is there any other information

1 in the patent specification --

2 A. I --

3 Q. -- that provides any standard?

4 A. I don't recall off the top of
5 my head, but I can do a check once more to
6 see if anything to that effect is used there.

7 Would you like me to take a
8 quick look to see if any detail is provided?

9 Q. Yes. Thank you.

10 A. Thank you.

11 Okay. So as I recall, there is
12 no specific standard. Therefore, the actual
13 emergency power off unit, it is left in
14 general as emergency power off unit in the
15 way understood in engineering.

16 Q. Do you understand what
17 switchgears are?

18 A. Switchgears, yes.

19 Would you like me to give you a
20 brief summary?

21 Q. Sure.

22 A. Yes. So it's gears that

1 essentially add just the ratio of RPMs so
2 that you can have the right combination of
3 the revolutions per minute and torques.

4 Q. Was it common in 2015 for
5 signals to switchgears to be transmitted over
6 armored shielded Cat5e cabling?

7 A. The technology was definitely
8 available at the time, yes.

9 Q. Were switchgears signals
10 transmitted over armored shielded Cat5e
11 cabling at the time?

12 A. Well, whether that particular
13 option was used, I would have to check. But
14 it wouldn't surprise me if that was, indeed,
15 the case. To what extent, I don't know. I
16 would have to check.

17 Q. Why would one want to transmit
18 switchgear signals over armored shielded
19 Cat5e cabling?

20 A. To have a monitoring capability
21 of what is happening with the -- the
22 switchgears, including the actual operation,

1 the -- the health of the equipment, to detect
2 perhaps even diagnosis potential issues with
3 the equipment, things like that.

4 Q. Why would one want to use
5 armored shielded Cat5e cabling versus other
6 types of cabling to transmit signals to
7 switchgear?

8 A. That would be a cost benefit
9 analysis.

10 So that might be an option that
11 an engineer would choose based on whatever
12 specifications they had on the operation,
13 what would be their costs, the potential
14 benefits from the equipment, and how this
15 would fit in their overall system.

16 Q. What are the benefits of used
17 armored shielded Cat5e cabling?

18 A. Well, that -- that has to do
19 with the capabilities in transmission speed,
20 in robustness, in ease of use, cost, things
21 like that.

22 Q. Are you suggesting that it's

1 beneficial to use that type of cabling
2 because of speed, robustness, and ease of
3 use?

4 A. Beneficial in comparison to
5 what?

6 Q. Other types of cabling.

7 A. Well, each type of cabling has
8 its own pluses and minuses, benefits and
9 shortcomings, strengths and weaknesses, so to
10 speak.

11 So this one has also -- I mean,
12 Cat5e has specific characteristics. So if we
13 want to compare it to a specific other
14 option, I can actually find the specific
15 advantages and disadvantages of each option
16 so that I can give you a more informed
17 opinion.

18 Q. Is Cat5e cabling faster than
19 other traditional types of cabling used in --
20 to transmit signals to switchgear?

21 A. I -- to which ones are you
22 comparing this to?

1 Q. Other types of cabling used in
2 2015.

3 A. It depends. I have to see
4 which ones you're comparing this to.

5 MR. WALTERS: I don't have any
6 further questions, so I'll pass the
7 witness.

8 MR. QUARLES: Okay. Just maybe
9 about 15 minutes?

10 THE WITNESS: Sure.

11 MR. WALTERS: Yeah.

12 MR. QUARLES: Look at my notes.

13 THE WITNESS: Back in
14 15 minutes.

15 (Break from 11:12 a.m. to 11:26 a.m.)

16 MR. QUARLES: No further
17 questions.

18 MR. WALTERS: That should end
19 the deposition.

20 Thank you for your time again,
21 Dr. Nikolaou.

22 THE WITNESS: Thank you,

1 Mr. Walters.

2 (The deposition concluded at 11:26 a.m.)

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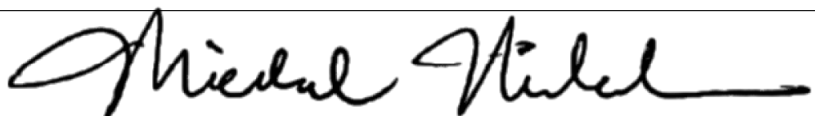
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Page	Line	Correction/Change and Reason
10	3	to generator <-- to a generator
10	8	which are <-- or
13	15	for suitable <-- suitable for
28	9	that one would <-- that would
37	16-17	is in a system <-- is a system
38	20	where -- where <-- were -- were
40	10	of a systems <-- of systems
47	12-13	catch and try <-- catch or try
47	16-17	connected to<-- connected
47	20	It's overall <-- It's the overall
49	20	impending <-- impeding
49	22	avoid the operating <-- avoid operating
64	20	whatever with <-- with whatever
68	21	further <-- rather
69	10	No air <-- Pressure
70	18-19	say, that conflicts, yes<-- yes
71	19	it's a corrective pressure<-- in a corrective fashion
72	5	Over all of<-- Overall, for
73	18	they're<-- are
82	8	In the <-- The
90	17	time. They<-- time, they

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ACKNOWLEDGMENT OF DEPONENT

I, Michael Nikolaou, Ph.D., do hereby
acknowledge that I have read and examined the
foregoing testimony, and the same is a true, correct
and complete transcription of the testimony given by
me and any corrections appear on the attached Errata
sheet signed by me.

11/25/2025

(Date)

A handwritten signature in black ink, appearing to read "Michael Nikolaou", written over a horizontal line.

(Signature)

1 CERTIFICATE OF SHORTHAND REPORTER

2 I, MENDY A. SCHNEIDER, Certified Shorthand
3 Reporter within and for the State of Texas
4 do hereby certify:

5 That MICHAEL NIKOLAOU, PH.D, the witness
6 whose deposition is hereinbefore set forth,
7 was duly sworn by me before the commencement of such
8 deposition and that such deposition was taken before
9 me and is a true record of the testimony given by such
10 witness.

11 I further certify that the adverse party,
12 U.S. WELL SERVICES, LLC, was represented by counsel
13 at the deposition.

14 I further certify that the deposition of
15 MICHAEL NIKOLAOU, PH.D., occurred virtually via Zoom
16 on Thursday, November 20, 2025, commencing at
17 8:58 a.m. to 11:26 a.m.

18 I further certify that I am not related to
19 any of the parties to this action by blood or
20 marriage, I am not employed by or an attorney to any
21 of the parties to this action, and that I am in no way
22 interested, financially or otherwise, in the outcome

1 of this matter.

2 IN WITNESS WHEREOF, I have hereunto set my
3 hand this 21st day of November, 2025.

4
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9
10 Mendy A. Schneider

11 MENDY A. SCHNEIDER, CSR, RPR

12 Certification No.: 7761

13 Expiration Date: 1-31-2027
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