UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT TRIAL AND APPEAL BOARD

BERKSHIRE HATHAWAY ENERGY COMPANY, PACIFICORP	§	
	§	IPR2025-00274
Petitioners,	§	IPR2025-00278
	§	IPR2025-00280
vs.	§	IPR2025-00281
	§	IPR2025-00422
BIRCHTECH CORPORATION,	§	IPR2025-00423
	§	IPR2025-00424
Patent Owner.	§	IPR2025-00425
	§	

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REMOTE REALTIMED ORAL

DEPOSITION OF

JOHN HENRY PAVLISH

FEBRUARY 26, 2026

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Job No. 2026-1015353

REMOTE REALTIMED ORAL DEPOSITION OF JOHN HENRY PAVLISH, produced as a witness at the instance of the Petitioners, and remotely duly sworn by agreement of all counsel, was taken in the above-styled and numbered cause on February 26, 2026, from 9:06 a.m. to 4:38 p.m., before Karen L. D. Schoeve, RDR, CRR, RSA, reported remotely by computerized stenographic machine shorthand, pursuant to 37 C.F.R. § 42.53(d)(1) and the provisions stated on the record or attached hereto.

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Quotation marks are used for clarity and do not necessarily reflect a direct quote.

Exhibits were presented in nonsequential order.

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ALL PARTIES APPEARED

REMOTELY VIA ZOOM

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P R O C E E D I N G S

THE COURT REPORTER: My name is Karen Schoeve. My CSR Number is 3354. I'll be the court reporter for today's proceedings.

If the attorneys could please introduce themselves and the parties they represent, then I will swear in the witness.

MR. TOBIN: This is David Tobin on behalf of Petitioner PacifiCorp. With me on the call is a client representative, in-house counsel, Mr. John Hutchings.

For most of this deposition, I don't intend to get into confidential materials, but Counsel, if you think we're getting into that, let me know, and we can excuse Mr. Hutchings. But I think most, if not all, of the deposition will be with public materials.

MR. NEMUNAITIS: I am Justin Nemunaitis with Caldwell Cassady Curry. And with me today is Richard Cochrane of the same firm, here on behalf of the

patent owner.

MR. PATTON: And Thomas Patton with Fredrikson & Byron on behalf of BHE, Berkshire Hathaway Energy.

THE COURT REPORTER: Sir, Mr. Pavlish, could you raise your right hand for me.

THE WITNESS: (Complied.)

THE COURT REPORTER: I'm sorry. Is it Dr. or Mr.?

THE WITNESS: Mr.

THE COURT REPORTER: Mr. Thank you.

JOHN HENRY PAVLISH,

having been first duly sworn to tell the truth, the whole truth, and nothing but the truth, so help him God, testified as follows:

THE COURT REPORTER: Thank you, sir. Y'all may proceed.

MR. TOBIN: Thank you.

EXAMINATION

BY MR. TOBIN:

Q. Good morning. Could you please state your full name for the record.

A. John Henry Pavlish.

Q. Thank you, sir.

If at any point you cannot hear me, just because we're remote, will you let me know?

A. Will do.

Q. Great.

Is there any reason you cannot give complete and accurate testimony today?

A. No.

Q. Do you understand that you're giving sworn testimony at this deposition and that your testimony will be truthful and accurate, just the same as if you were testifying in front of the judges?

A. I do.

Q. If you don't understand a question, will you let me know?

A. I will.

Q. All right. And just so we're clear on the record as to which proceedings this is for, we're taking this deposition as a consolidated --

Mr. Pavlish, you understand that there's a number of IRP proceedings that have been filed, right?

A. Yes.

Q. Right.

MR. TOBIN: And in the interest of efficiency for everybody, we're taking this deposition as a consolidated deposition in eight proceedings. It's IRP 2025-00274 and -00278, each regarding U.S. Patent Number 10,343,114.

This deposition is also being taken in IRP 2025-00280 and -281 regarding Patent Number 10,596,517.

This deposition is being taken in IRP 2025-00422 and -00423 regarding Patent 10,668,430.

And last, this deposition is being taken in IRP 2025-00424 and -425 regarding Patent 10,589,225.

Counsel, is that your understanding, too?

MR. NEMUNAITIS: Yes. I believe that's right.

MR. TOBIN: Thanks very much.

BY MR. TOBIN:

Q. Mr. Pavlish, where are you located today?

A. I'm located in The Villages, Florida.

Q. All right. Can you state your full address for the record, please.

A. 2517 Kincaid Place, The Villages, Florida 32163.

Q. Is -- is this your -- is this your residence?

A. Yes, it is.

Q. Okay. How often do you travel to North Dakota for business?

A. I split my time roughly 50/50. I have a home in Minnesota. Originally from Minnesota. I moved to Florida -- I don't know -- five, six years ago, so my primary residence is Florida.

So almost half -- not quite half the time I'm in Minnesota, which is right across the border from Grand Forks. So I don't need to travel there often, since I'm there.

Q. Okay. The other 50 percent of the time when you're not in Florida, are you in East Grand Forks?

A. Correct.

Q. And that's just over the border from North Dakota?

A. Yes. Yes, right across the river.

Q. Great.

I take it you're in Florida for the winter months?

A. That is correct.
Q. Totally understandable.
Sir, is anybody else there in the room with you?
A. No.
Q. If anyone joins you in the room, will you let me know?
A. I will.
Q. Thank you.
Do you have any access to Chat or messaging applications, besides this Zoom window we're all talking through?
A. I don't have Facebook Chat, Instagram. I don't have any of those.
Q. Okay. Do you have -- let me ask a more specific question.
Other than the Zoom window we're chatting through, do you have any other programs running on your computer that are open?
A. No, I've closed them out.
Q. Oh, great. Thanks for doing that.
And just to keep everyone fair and square, will you let me know if you receive any communications about this case during the course of our deposition today?

A. I'll let you know. I don't anticipate any.

Q. I don't either.

Are you using your personal computer for the deposition today?

A. Yes, I am, my personal business. I mean, primarily, I use it for business, but it is a personal computer.

Q. All right. Do you have any documents available to you on the laptop regarding this case?

A. Yes, I would have some available. I don't know if I have them all available, but some. A declaration I have available.

Q. Okay. Great.

Sir, who are you employed by?

A. Birchtech.

Q. What's your position at Birchtech?

A. Senior VP and CTO.

Q. Are you familiar with a company called Midwestern Energy Emissions Corporation?

A. Yes, I am.

Q. Do you refer to that company as "ME2C"?

A. Correct.

Q. What's the relationship between ME2C and

Birchtech?

A. Well, essentially, they're the same now. It used to be ME2C, and then that was traded out for Birchtech. And so our trading symbol and everything became Birchtech. So it's the same entity, other than essentially a name change.

Q. Is that just a corporate renaming?

A. Yes.

Q. Were you involved in the decision to rename the company "Birchtech"?

A. No.

Q. Do you know what the name "Birchtech" refers to or where it came from?

A. It came from our CEO. How he arrived at that I'm not sure. There was a process of trying to come up with a different acronym or term of which I did provide some, which were not selected. So I'm not sure exactly how he arrived at Birchtech.

Q. Now, I have to ask, which names did you provide?

A. Oh, hell, I don't remember. I'm sorry. I provided a few others, but it was not that one.

Q. Okay. You mentioned your CEO. That's Mr. MacPherson?

A. Yes.

Q. For how long have you -- or what's your position -- you said you're senior VP at Birchtech?

A. Yeah, I've been senior VP and chief technology officer since I hired on in November of 2014.

Q. Are you one of the founders of ME2C?

A. There's been a few name changes along the way. RLP was originally formed back in, I think, '08, which eventually became Midwest, which eventually became ME2C, which now is Birchtech. So there's some corporate history there.

BY MR. TOBIN:

Q. Do you currently have any affiliation with the University of North Dakota?

A. No.

Q. When did your affiliation with University of North Dakota cease?

A. When I hired on with ME2C, November of 2014. I mean, I know a few people there, but I really don't have any work or consulting or anything of that nature.

Q. That's really -- that's what I was asking about. You're not doing any work or consulting

for UND?

A. No.

THE COURT REPORTER: Could I just jump in for a second.

MR. TOBIN: Yes.

THE COURT REPORTER: Mr. Pavlish, could please let the attorney finish his question before you start your answer so I can avoid have two people overlapping and speaking at once.

THE WITNESS: Yes, I can. Thank you for the reminder.

MR. TOBIN: Thank you. And I'll try not to speak over you as well, just so Karen doesn't yell at us. Okay.

BY MR. TOBIN:

Q. And I don't know if I mentioned this, but again, I'll try to ask clear questions. I think you're entitled to clear questions, Mr. Pavlish, but if for some reason you can't hear, don't understand my question, will you follow up with me and just let me know? And I can rephrase, if I need to.

A. Yes, I will.

Q. Okay. Very good.

Mr. Pavlish, when did you first join the University of North Dakota?

A. 1993. I believe summer of '93.

Q. In what capacity did you join -- withdrawn.

Let me help place that. You have some kind of bachelor's degree in engineering; is that right?

A. I have a bachelor's -- a BS degree in Mechanical Engineering from the North Dakota State University.

Q. When did you get your BS in Mechanical Engineering?

A. '83, '84 time frame.

Q. Do you have any advanced degrees after your BS?

A. Not advanced. But I did pursue a master's degree. I completed the coursework through Kansas University, but I didn't finish my thesis, so I don't actually -- I didn't actually get a degree. But I did finish the coursework associated with that.

Q. Is that coursework in mechanical engineering also?

A. Yes.

Q. Can you describe for me the circumstances under which you joined University of North Dakota, like, what did you join it to do?

A. I primarily joined it to return back to home. There was an opportunity to return me and my family closer to where I grew up, which was in Minnesota. That was a motivating factor.

I guess the other factor was -- is there was an opportunity, an opening there to do research in a similar field, co-fired power plant. So that was also a motivating factor.

Q. What's a co-fired power plant?

A. Co-fired power plant?

Q. Yes.

A. It's a fairly large plant that generates electricity that uses coal that's fired to the combustor. And then that heat is transferred to steam, and the steam turns the turbine, and the turbine turns the generator, and the generator generates electricity that is distributed throughout the United States.

Q. What's meant by the term "co-fired"?

A. Co-fired usually means that you're firing more than one fuel. For example, you might fire coal, and then you might also co-fire a small

amount of, say, gas -- natural gas. That would be considered co-firing. Co-firing could be coal with biomass. I mean, it generally means two, rather than just a single supply of fuel.

Q. Got it.

In 1993, did University of North Dakota have a power plant on campus -- a co-fired power plant on campus that actually generated electricity?

A. The University of North Dakota had a plant that generated steam for heat, and then the University of North Dakota -- EERC had several smaller-scale pilot facilities. It didn't really generate electricity. They were more there to do research.

Q. So if I can understand that. UND university -- do you call it "UND"?

A. Yes, UND. University of North Dakota.

Q. Okay. So UND had a larger plant on campus to produce steam, correct?

A. Correct, for heating.

Q. For heating.

Does steam from the larger plant at University of North Dakota -- did not generate electricity, correct?

A. No. Not to my understanding, no.
Q. Okay. And then I think you mentioned EERC. What does that stand for?
A. Energy and Environmental Research Center.
Q. Did -- I think you also mentioned EERC had pilot facilities?
A. Yes.
Q. What's a pilot facility?
A. A pilot facility is the larger-size system, compared to a coal plant, much smaller, but it's still a fairly large system compared to, say, like a lab, something you would do in a lab. So it's a larger-scale system that is representative in terms of, like, a flue gas or the way it operates.
It's got a combustion -- it's got similar equipment to what a coal plant would have, but it's a little larger in size than, say, a finscale sytem, which is very small, but certainly smaller than a large coal plant.
Q. The pilot plant, did EERC have one pilot plant or two pilot plants?
A. Well, EERC has what they call a pilot facility. And within that pilot facility, there are several pilot systems. So I don't remember

exactly how many, but they had a gasification system.

They had two different combustion systems. I believe they had a fluid bed. So there's four or five different pilot systems within that facility.

Q. Did any of the pilot systems at EERC generate electricity?

A. No.

Q. So am I correct, you would not consider EERC to be a -- an actual power plant, correct?

A. Correct.

Q. And the pilot facility at EERC, did it exist in 1993 when you joined?

A. Yes.

Q. Does the pilot facility at EERC exist today?

A. Yes.

Q. And has the pilot facility been more or less the same kind of equipment between when you joined and today?

A. It's probably changed -- I mean, even during the process when we were testing mercury, we added, for example, a dry scrubber to that system.

So pieces of equipment, different elements, different controls likely have been added throughout the years. Haven't been at the facility for over a decade. So I couldn't say today.

Other pieces of equipment haven't been added, but the essential components remain.

Q. When you joined EERC in 1993, what research did you expect to be doing?

A. Research focused on coal plants, problems, issues, slagging, following, issues that coal plants would bring to the EERC. And say "Hey, we're having this problem. Can you help resolve or solve or do the research to come up with a solution to that?"

Q. So was the -- was EERC a private company, or was it part of a public university?

A. It's a non-for-profit entity. Essentially, it is part of the University, a department within UND, University of North Dakota. But it operates, essentially, autonomously from that. In other words, UND doesn't direct how it operates or what contracts or what research it does. It's separate in that sense.

Q. Understood.

Okay. And I think you mentioned that various industry -- companies in this industry, if they were having problems with coal plants, would go to EERC to help find solutions. Is that a fair summary?

A. That's a fair summary. I mean, I focused on coal, but EERC did work in other areas. I mean, it did work in water treatment. So I mean, it wasn't just coal-fired power plants that they did research on or for.

Q. So was the EERC facilities available to University researchers to use?

A. Generally not. I mean, yes, we would employ students as part of our contracted research, but I'm not aware of where, say, a professor at UND could say, "I'm going to use your facility to take control" or -- I mean, it would have to be coordinated with the EERC, if, indeed, that did happen, and I don't recall that happening.

We were usually involving them -- they weren't involving us much, and we weren't involving them in our projects. If we involved them at all. EERC has a fairly large staff too.

Q. All right. I think you mentioned that

you were doing mercury research at EERC; is that correct?

A. Yes.

Q. Okay. And were you actually employed by EERC? Or were you employed by the broader university?

A. Well, I was directly employed by the EERC. But, again, EERC is a department within UND.

So you know, ultimately, am I employed by UND? Indirectly, yes. But I was hired to work at the department of the EERC.

Q. Okay. And I'm not asking for the amount, but when you get a monthly paycheck, it would come from EERC?

A. Yes.

Q. So over -- did you do any mercury research before 1993?

A. No.

Q. When did you start doing mercury research?

A. '93, '94, almost immediately upon hiring.

Q. And when did you stop doing mercury research -- or did you stop doing mercury research at any point?

A. I still do it to this day. It's not as much. But I still consider myself doing R&D-type work in that field.

Q. What kind of R&D-type work in the field of mercury research do you do today?

A. Today is typically looking at either problems that come up, in terms of a specific plant. They're not able to achieve, you know, a certain level of reduction. You could call it research. You could call it problem-solving.

I look at it more as a research as to why and then try to come up with solutions to that. Certainly, the R&D has not been nearly as intense as it was, say, in the 2000 time frame when we're trying to come up with solutions.

Q. Is that -- is that because by now the solutions to mitigate mercury have been figured out already?

A. Yeah, I'd say probably for many years now, that there hasn't been too much new inventions that have come through.

I mean, it's pretty well-established what technologies are being employed and what works either best or works most cost effective.

Q. What technologies work best for mercury

remediation?

A. Well, it depends on the plant configuration. When I say "plant configuration," it's what other equipment is installed as part of the plant.

You have to -- you burn coal in a boiler combustor. But due to regulations, you then have to take care of removing, say, SO2 or NOx or particulate matter. And all that involves other equipment that is installed downstream.

And so it depends on what fuel you're burning and what regulations you're having to abide by in terms of what other equipment will be installed at the plant.

So it's a fairly, I guess, complex process overall.

Q. And I don't know if you coined the term, but do you have an understanding of the term "two-part process" in the field -- context of mercury?

A. I do understand that.

Q. What do you understand the "two-part process" to be a reference to?

A. Well, it's a process that we coined in terms of simplicity, but it involves adding an

additive or a material in conjunction with a sorbent; in particular, activated carbon.

So it's a two-part -- meaning you need two different additives or sorbents to accomplish removing mercury; whereas a one-part, if you want to refer to that, would be you only need one.

Q. And you agree that there are certain coal plant configurations where you would only need one part but not both, right?

A. There'd be certain configurations that had the potential to meet the regulations with a one-part. So yes, there'd be certain configurations and firing conditions where that might be the case.

Q. Do you have any specific configurations in mind?

A. Generally, yes. It's -- you're burning bituminous coal. And, for example, say you have an SCR and a scrubber. That might be the ideal system, especially if it has a fiber filter.

So like I said, it depends on the components in the field it's being fired. In some cases, you don't need even a one-part. I mean, they're already achieving, say, the 90 percent or

whatever. But they need two to meet the regulations. If they're slightly below that, that might be where you use a one-part, if you want to refer to that as such.

Q. So there are plants now where you would not need an additive or the downstream sorbent? You would use a no-part solution?

A. There are probably some -- yeah, there are a few plants out there that are meeting regulations, if you want to call it, like, really nothing.

But, I mean, they're not -- they are doing something. Obviously, they're running the scrubber. They're running SCR. They're burning certain fuel. They're firing it under certain conditions. So they are able to achieve the regulations, you know, because of those conditions.

Q. I want to make sure we're using a similar term. What is "mercury"?

A. Well, mercury, when you say -- and, again, as applied to this industry, usually, when you say "mercury," it can involve different species, so to speak.

You have elemental mercury, an oxide

form of mercury, particulate-bound mercury. If you were talking to someone probably beyond the industry, if you said "mercury," they would probably just say, "Well, it's just mercury."

Q. Sure.

A. And generally, when you say "mercury," without defining it further, it involves all three of those. I mean, it's like a total mercury. Like, it includes it all -- it includes all of those.

Q. So the chemical symbol for mercury is Hg?

A. Hg or Hg0. I mean, some people leave the zero off. I mean, it's in an elemental state. Some people just call it Hg.

Q. So let's take the --

(Speaking simultaneously.)

A. Hg could be misleading, though. Hg could mean everything.

Q. Okay. And so Hg could refer to Hg0, which is elemental mercury?

A. Yes.

Q. And have you also heard of elemental mercury being referred to as "metallic mercury"?

A. Yes.

Q. And then I think the other type you

mentioned is "oxidized mercury"?

A. Yes.

Q. What are the types of oxidized mercury?

A. Well, there could be many. I mean, the one that's most commonly referred to is mercury -- mercuric oxide is the specie that's most commonly referred to, but it could be any oxidized form of the mercury.

The measurement technique doesn't define -- it doesn't give you the exact oxidized form or species. It just says it's an oxidized form, meaning it's got an extra few protons sitting there.

Q. Okay. And I think you said "extra few protons in there."

Did you mean extra -- a few less electrons?

A. Yes, I mean, that's generally what the oxidized form means.

Q. Okay. So we spoke about metallic mercury, oxidized mercury.

Is there a third kind of mercury in your field?

A. Yeah. Again, it's applicable to this industry. Probably other industries as well. But

we call it particulate bound.

So it's mercury that is somehow associated. But it's not just associated. It's somehow bound to a particulate. And that particulate then can be removed using a particulate matter (PM) device.

Q. When mercury is bound to a particulate, is the mercury an elemental form? Is it an oxidized form? Or is it something else?

A. That's a good question. No answer. It could be both. Likely, it is both.

It's called particulate bound because the exact form of the mercury that's on that particulate is not known.

And as far as I know, even today, it's -- we've tried to identify what it was years ago and was not overly successful because of the measurement techniques available.

Q. Okay. So is it fair, as of today, when mercury is bound to some kind of sorbent or other particulate, you're not sure if it's oxidized, elemental, or both, right?

A. It could be one or the other or both. Certainly, there's some indication as to some of the research we've done as to whether it's bound

as an oxidized form versus, say, an elemental form, but ...

Q. Okay. But as of today, you're not sure, right?

A. Again, to prove it measurementwise, no. Certainly, based on models and theory and our understanding, you know, we would say that the mercury ultimately is -- using a two-part process and is bound as an oxidized mercury, but ...

In some cases, they're bound too. There's some particulate bound with mercury there.

Q. Sure.

Have you heard the term "ionic mercury"?

A. Same as oxidized. It's just the change in electron charge. So all three of those, like, they're divalent, oxidized, ionic.

Oxidized is generally the one that's used most often. Some of those other ones get to be a little more scientific in their notations.

Q. Um-hum. Is mercury ever just, by itself as an ion, without being bound to anything else?

A. Yeah, I mean, assume it could be. Certainly in a combustion system. Especially

leaving the combustor, you know, most of it's in atomic form at that point.

It's a very reduced elemental state, if you will. And then -- you know, then the reactions occur downstream of that, so ...

Q. When the mercury leaves the combustion chamber, is it ever in a -- do you know what is meant by "charged state" in the context of chemistry?

A. Charged state would mean it's either got a negative or a positive charge on it.

Q. Um-hum.

A. That would be my understanding, and I could be wrong. But that would be my understanding of what that means. And so likely, the -- our understanding of when it leaves the boiler, it's as Hg0. It's in the elemental form.

Q. Are you aware of any specie that leaves the boiler in a charged form?

A. I'm not aware of any. Could they exist? Could you measure them? No.

Q. And by "charged form," I mean having a plus charge or a minus charge or some kind of ion.

Is that what you understood I meant by "charged form"?

A. Yeah. Yeah, it's that -- our understanding is that it's -- leaves the combustor as Hg0.

Q. Got it.

And talk about all the other species floating around in a combustion chamber. They would also leave the combustion chamber either bound to something else as a zero charge but not as an ion.

Is that how you understand it as well?

A. No, I wouldn't necessarily say that. For example, a chlorine species that could be leaving, say, the combustion zone, it could be in a radical form which would not survive long because of it's gonna -- it's going to be highly reactive. It's combined with something else to neutralize that charge.

Q. In the chemistry context, what does it mean for a species to be in a radical form?

A. Usually means in a very atomic state with some imbalance in charge, you know, either positive or negative. So it's similar to, like, an ion, if you will.

And, again, I'm not a chemistry

expert, so -- I'm a mechanical engineer, so this is my understanding of what that means.

Q. Did you work with any chemistry experts at EERC?

A. I did. Like, a co-inventor had a Ph.D. in chemistry.

Q. Who was that?

A. Ed Olson.

Q. His Ph.D. was actually in chemistry?

A. Yes.

Q. Okay. Is it fair to say that Dr. Olson knew more about chemistry than you did?

A. Oh, much more. I can say I learned a lot along the way.

Q. Sure.

A. It's not that I knew it at the time, you know.

Q. How many chemistry classes did you take in undergrad, by the way? Do you remember?

A. I think two. General -- I remember the one class having, like, 300 people in it.

Q. Okay.

A. So I know it was a very basic chemistry course.

Q. Got it.

And then the rest of your chemistry kind of learned on the job at EERC?

A. EERC? I learned certainly some. And I also learned some at Black & Veatch where I was employed when I left -- or when I got my four-year degree. I worked there for almost ten years and got involved, you know, combustion of coal. So there was some general understanding of when you burn coal, what does it convert into.

Q. Got it.

And that would be more for -- when you burn coal, what does it convert into? That's more Dr. Olson's field?

A. No -- well, I mean, certainly, he would understand that.

But in terms of practicality or practice, you know, generally, when you burn coal, you generate SO2 because there's sulfur in the coal. You generate, certainly, carbon dioxide, which is the ultimate goal of combustion, right?

I mean, you don't want carbon -- I mean, ideally, you want to burn hundred percent of the carbon and convert it to carbon dioxide.

So that's a -- you know, a chemical formula, if you will, right? The carbon --

Q. Sure.

A. -- plus oxygen gives you CO or CO2, so ...

So those are some of the things you -- you know, you certainly pick up on the way if you're working in that field.

Q. So talking about chlorine, I guess as one example, do you know how many valence electrons chlorine has?

A. I thought I heard seven at one time, but I may be totally wrong, so ...

Q. I thought it was seven -- I mean, I didn't want to give it away, but I think it is seven also.

And a valence, like --

A. That's taken back -- that's taken back many years in my recollection there, so ...

Q. Okay. The valence electrons, are those electrons in the outer shell that are merely responsible for bonding? Is that fair?

A. I guess so. It'd be my understanding, yes, that they would be the ones available to interact.

Q. Okay. So if chlorine has seven valence electrons, do you happen to know how many valence electrons it would still have after it leaves the

combustion chamber?

A. No.

Q. Is that something Dr. Olson would know?

A. Possibly. Again, I -- the combustion process is very complex. We -- you might speculate, but there's no way to measure and ascertain what that would be.

Q. Did -- did -- when you were doing your -- at any point -- let me ask a better question.

From when you were at EERC from 1993 to 2014, was the primary field of your research mercury control?

A. Yeah, well, I wouldn't say "control." We -- mercury in general.

THE COURT REPORTER: I'm sorry. I'm sorry. John, you're breaking up badly. Can you repeat your answer.

A. I said not just control. I mean, there was research underway in terms of measurement, in terms of modeling, in terms of trying to understand the transformations that occur, you know, within combustion systems. So I didn't -- it was -- it was more than just control.

Control certainly was the -- a primary focus, but not -- not the only focus. And

that changed over time too.

BY MR. TOBIN:

Q. When you -- you were at EERC -- and let's pick the 2000 to 2005 time range -- what tools did EERC have to measure the concentrations or presence of various species in the mercury-containing gas?

A. Well, the EERC led the industry in terms of measurement. It conducted a multimillion-dollar project on validating the wet chemistry approaches to measuring mercury. It also led in terms of the continuous mercury-monitoring capability, and it was also part of the sorbent trap method that's used today, so...

EERC was on the cutting edge of that. Some of that was done through programs I managed. Some of that was done through programs that were managed by others at the EERC.

And so we had -- at the EERC, there was, I guess, the most advanced tools available than probably anywhere in the world. Because initially, measurement was a challenge, especially in a coal-fired industry.

Q. So let's put mercury aside for the

moment.

You definitely mentioned some mercury measurement tools.

What tools did EERC have for measuring the other species in the gas phase from a coal-fired plant?

A. If you're talking, like, the primary tool for pollutants, such as SOx and NOx and PM, I mean, they had all the tools for that, because they'd been doing research for years in terms of those pollutants.

Q. Sure.

A. So they had all the instrumentation analysis to do any of that.

They had the analysis to, you know, analyze ash. I mean, they -- the lab was pretty fully equipped with, you know, all those tools and analytical capabilities.

Q. Did you, yourself, measure SOx or NOx while you were at EERC?

A. Not myself, no.

Q. Okay. Did -- so let's talk about other species that might be in the gas phase.

Certain coals have halogens in them, correct?

A. Correct.

Q. And what's your understanding of what a halogen is?

A. Well, a halogen, at the time, was primarily chlorine. It wasn't understood till years later that the coals also had bromine in some small amounts.

But chlorine would be the halogen, you know, of understanding at that time. It's -- like, that's what coal contains.

Q. When did you first understand that coal also had bromine?

A. I mean, I don't really remember, but '04, '05, '06, years later when people actually started to focus and analyze for it.

Q. Is iodine a halogen?

A. Yes.

Q. Is astatine a halogen?

A. Yes.

Q. Is the Ts -- I guess -- it's tennessine a halogen?

A. I don't believe so. I mean, fluorine is. As far as I know, there's four. You know, there's fluorine, chlorine, bromine, and astatine -- and iodine.

Q. And iodine.

All right. Did you ever do any research with astatine?

A. No. That's kind of a man-made, so no.

Q. Okay. When did -- did you do any research with fluorine?

A. We had a project where it was measured in the early stages -- probably in the mid-'90s -- where it was a project underway to quantify different fluorine species in the gas stream from co-fired plants.

Did we do research on it? I don't recall actually doing anything much more than identifying that it was there and in what quantity or how it was being emitted, so ...

Q. Okay. And but you never -- am I correct, you never did research on adding fluorine to a coal combustion system, correct?

A. No. Correct.

Q. And I know you did some research on adding various chlorine species to coal processes, right?

A. Correct.

Q. And I know you did some research on adding certain bromine-containing species to coal

combustion processes, right?

A. Correct.

Q. Did you ever do any research on adding iodine-containing ingredients to coal combustion processes?

A. Yes.

Q. When was that?

A. I don't recall. I think we did some in February of '03 -- let's see -- '04. I don't recall. I know we did for sure some -- some testing of it at a full-scale power plant. I want to say in the old -- years later, '08/'010 time frame, where we're at a power plant, where we added some.

Q. So you know you added iodine to a power plant in 2008/2010, correct?

A. I shouldn't define the time frame. I'm not exactly sure. It might have been in '014 or '015.

I just remember it was a large, you know, power plant. Jeffrey Energy Center is where we did it. So I mean, I remember doing it there.

Q. Do you have any reason to think you added iodine to a coal combustion system before 2008?

A. Only thing I recall, I thought we did one

test using a different form of iodine like an iron iodide or whatever.

I thought it was in the February '04 time frame, but that's about all I can vaguely recall of that.

Q. Okay. Do you recall where you added the iron iodide to the processes?

A. It would have been on the coal. I don't remember doing anything other than adding that to a coal.

Q. Got it.

But you're not sure when that was. Is that fair?

A. That's fair.

Q. So I want to go back to the measurement doing tools at EERC.

Did EER- -- so let's pick Cl, for example, and anything containing Cl. Did EERC have the tools to measure which Cl-containing species were in the -- were in mercury-containing gas?

A. At what point in that gas stream?

Q. At any point.

A. Method 26 is an EPA method that EERC conducted that attempts to measure different --

attempts to measure HCl and potentially CO2.

But there's a lot of questions on how accurate that speciation is using that method.

So can it measure quantity? Yeah, HCl has fairly well been proven for.

Q. Where in the process is Method 26 applied?

A. It's generally further downstream, a more cooler environment.

Q. Like, what temperature?

A. 300 degree F and below. Maybe 400 F below. I mean, you wouldn't -- again, you wouldn't do it at a combustor outlet. Gas would be way too hot. Transformations would probably occur as you extracted the gas. So I mean, you wouldn't get meaningful information at that point.

Q. All right. Did you personally use Method 26 when you were at EERC?

A. I personally did not. But there were projects I managed that did.

Q. Did EERC have any tools to measure the presence or absence of Cl-containing species inside the combustion chamber?

A. To my understanding, there is no such tool available.

Q. Did EERC have any tools to measure the presence or absence of any halogen-containing species inside a combustion chamber?

A. I understand there are no such -- no such tool exists.

Q. And then if you look at the outlet of the combustion chamber, does that have a technical term to it? Or do you just call it "the outlet"?

A. Well, you know, the combustor outlet is generally -- and, again, this is my experience from Black & Veatch -- generally defined at the end of the radiant zone, meaning before it enters the consecutive path. In other words, where is the combustion expected to be complete? So that's kind of the combustion zone or combustion region.

And then beyond that is, you know, really the flue gas that goes through the convected pass and through the other various equipment down stream thereof.

Q. Is there any flue gas inside a combustion chamber?

A. Well, a combustion chamber certainly contains some flue -- well, I can say, we generally refer to it as "combustion gases." Because you're -- there's so many different

reactions going on within the combustion zone. Many of those haven't reach any final state.

So I mean, depending upon where you pulled out a gas and tried to analyze it, you get totally different results, probably 1 foot -- you know, one further -- 1 foot further downstream because the coal hasn't fully converted, say, to CO2, for example. And that's happening as it passes through that combustion zone.

Q. Other than Method 26, did EERC have any other tools to measure the presence or absence of halogen-containing species at all?

A. Well, they had a lot of analytical capability. But most of those techniques are extractive and preserving the nature of -- can you measure total quantity? Yeah, probably. You can take ash and measure quantity in ash.

If you ask the question as to the species, it gets more difficult because it's destroyed, so to speak, when you analyze it. You can measure that elemental -- total elemental, but beyond that, not.

Q. So I take it -- a more specific example, did EERC have any tools to measure the presence of HCl versus the presence of Cl2 in

mercury-containing gas?

A. Other than Method 26?

Q. Correct.

A. They probably had some tools. Like, again, they had LC-MS. I mean, they had a lot of analytical capability. So did they have tools probably available? Yes.

Q. Do you know what those tools are?

A. No, it's beyond my chemistry background.

Q. Did you ever try to differentiate the presence of HCl in mercury-containing gas as compared to Cl2 in mercury-containing gas?

A. No.

Q. Did you ever, yourself, ever try to determine the presence of HBr in mercury-containing gas as compared to Br2 in mercury-containing gas?

A. There was an attempt made using Method 26. Method 26 is an EPA method for measuring -- it's an approved EPA method for measuring HCl primarily.

As such -- as part of that method, there's impingers that should measure CO2. That's always been questionable in terms of the accuracy. That's my understanding.

So we used that method to try to quantify HBr or Br2, which, again, is not an approved method, but it's an acid gas, so it passes through an impinger. So we should remove it. Later on we actually worked with a company called Ohio Lumex to develop a serve-and-try method that would measure, you know, basically bromine, assumed to be HBr.

Q. You said later on. When was that?

A. It was probably -- it was -- I don't know, I hate to give timelines, because it's been so many years ago. '07 maybe. It was a few years thereafter that the trap method had already been established for mercury. And then it was trying to extend that method beyond -- and actually, just bromine, it was actually to look at the different air toxic metals.

Q. Prior to 2007, were you ever able to ascertain the presence of Br2 in mercury-containing gas?

A. I wouldn't say definitively.

Q. And can you elaborate -- meaning you're not sure if it was present or not?

A. Well, it goes back to, again, using Method 26. And was there some measure there?

Maybe a slight amount, but that wasn't an approved method, per se.

So I can't say definitively the accuracy of that method or that particular for HBr or Br2 or any other form of Br protagonists.

Q. Do you know -- give me your best estimate of the date or month when you tried using Method 26 to measure Br species?

A. Yeah, I really hesitate to do that, because I don't recall.

Like I say, it was probably after '05, but it could have been in '08, '09. I really can't give you that date. I don't recall.

Q. Okay. Well, it was probably after 2005, you tried using Method 26 to measure Br species, but you're not exactly sure when. Is that fair?

A. True, yes.

Q. And the Method 26 you talked about, that's pretty far downstream of the combustion chamber?

A. Yes.

Q. You said it's about 300 degrees F?

A. Yeah, 400, 300. I mean, certainly further downstream.

Q. Okay. Did you ever try to ascertain the

presence of Br2 inside the combustion chamber?

A. No technique available.

Q. Okay. And do you know if anyone conducted a computer -- did you ever conduct computer simulations of gas species?

A. Yes, we did.

Q. Okay. Did you personally?

A. No, we had a different group that did modeling -- did the modeling of that.

Q. Who -- and was that Ed Olson's group?

A. No, at the time, probably it would have been under Tom Erickson. We had a program area -- one of the programs I managed that focused on doing modeling work in the early stages. We were looking at theoretical models and what they would predict.

Q. The theoretical models of what they predicted, were you looking at the actual chemical reactions occurring inside the combustion chamber or somewhere downstream of that?

A. Some of those models gave you, like, a profile of what might be expected at different temperatures. And, again, as the gas moves further into cooler regions, it would estimate -- they would estimate what the -- what the form or

species or reactions, you know, that would occur at the ending result thereof.

Q. Did you ever provide those models to the Department of Energy?

A. Some of those models are available. I mean, it's not models we developed. They were thermal equilibrium models that were available. I think one was called Fact.

There was some chemical reaction models that are available. We didn't develop those. We were using them to get a indication or sense of, given these reactions, what form one could expect.

Q. Do you recall doing that before 2005?

A. Yeah, we were doing that early on. 2000. Late '90s.

I mean, we essentially quit doing the modeling work because we started to realize that the predictions were a waste of time.

Q. Why were predictions a waste of time?

A. Well, because they, you know -- for example, if you have chlorine and mercury in a system, they would estimate all of the mercury to go to mercury chloride, which is an oxidized form of mercury.

But when you measured it in an actual flue gas setting, you found out that it's -- you know, 15 percent of it was oxidized and 85 percent of it was in the elemental state.

So the reactions didn't agree with what was being measured. And so the complex nature of the combustion system and the flue gas interactions downstream thereof adequately did not model and could not model the reactions that you've been speaking to in terms of chlorine and bromine and all that.

Q. So the simulations that you referred to, kind of, like, they were nice on paper but didn't match what was in the real world?

A. Correct. I mean, they may give you some insight. But, again, they didn't agree with the real world.

So -- and a lot of those models only look at gas phase reactions. And as research went on, it became pretty evident that the gas phase reactions weren't dominating, or the predominant interactions that were occurring. Because, again, in coal, you have many surfaces both in terms of heat transfer and in terms of ash. And they can't -- or couldn't model that and so on.

Q. Are you familiar with the research fields of study called either surface chemistry or surface science?

A. I'm not really all that familiar with it. I mean, I've heard of it, but ...

Q. Do you know that there are tools that can probe what's happening at solid surface?

A. Oh, there are some tools. The problem with -- my understanding -- the problem with most of those tools is they're -- they're not programmed or don't have the appropriate equations or reaction times for all of the constituents that are in the flue gas environment.

So yes, can it happen on a stainless steel surface? In the presence of oxygen and nitrogen, air?

Here's what happened: You have -- that doesn't happen at flue gas event where you have maybe a thousand other reactions that can happen, you know, a lot more other ingredients, and they're in adequate quantities for that. So a lot of those -- even those surface chemical models have a big shortfall.

Q. Did you yourself ever use any surface chemistry tools?

A. I didn't.
Q. Did -- did you use -- do you know what X-ray photoelectron spectroscopy is?
A. XPS, yep.
Q. And you know what X-ray diffraction is?
A. Yep.
Q. Did you use any of those tools?
A. Again, me personally? No. We were the first group to ever use XF and hexanes for mercury, for example.

Yeah, I mean, we used all those -- I call them specialized techniques. When I say, "I didn't do them," I mean, again, that was done -- some of that work was done by Ed Olson. It almost requires somebody with a Ph.D. degree.

Q. Sure. Okay.

And going back, though. Again, in terms of -- and maybe we'll cover this. But in terms actually looking at mercury-containing gas and measuring or testing, does it have, let's say, Br atoms versus Br ions versus HBr versus Br2 versus some other form of Br? Did you ever try to ascertain which of those were present in the gas?
A. I think I've answered that question.
Q. So tell me.

A. Well, again, we tried using different -- the Method 26. Other techniques that would be, like, what's collected on the ash. But, again, don't really get the species on that.

But you can do a little bit of that work by excluding certain species on a small scale. In other words, putting in HBr and see what's measure in the absence of, I think, Br2.

But, again, it's a direct measurement. It's challenging in a coal combustion system.

Q. And I was really more asking you about being able to differentiate the various species from one another, as opposed to just total Br.

Did you understand my question to be that?

A. Yeah. Yes.

MR. TOBIN: Okay. We've been going for about an hour. Let's take a break.

THE WITNESS: Okay. Five minutes, or ...

MR. TOBIN: Let's go off record.

THE COURT REPORTER: All right. We're going off the record at 10:03 a.m.

(A recess was taken from 10:03 a.m. to

10:13 a.m.)

THE COURT REPORTER: We're back on the record at 10:13 a.m.

BY MR. TOBIN:

Q. Welcome back, Mr. Pavlish.

I want to follow up with that Method 26. Are you sure it's Method 26 and not Method 29?

A. Method 29 is a multimetal measurement technique.

Q. Okay.

A. It's measuring that, trace elements or trace metals. It can measure mercury. My understanding is it does not measure acid gases. It's to measure mercury and other air toxic metals.

Q. Got it.

And when you use the term "acid gas," what are you referring to?

A. A compound or something that has an acidic characteristic. Using, you know, like, SO2 or HBr or HCl, which can form into, obviously, hydrobromic acid or hydrochloric acid or something.

Q. Okay. Have you heard the term

"hydrohalide"?

A. I've heard of it.

Q. Do you know what a hydrohalide is?

A. I generally understand that.

Q. What's your understanding of what a hydrohalide is?

A. It would be a halogen and a hydrogen. I don't know.

Q. That's my understanding too.

So would HCl be an example of a hydrohalide?

A. Can a hydrogen and chlorine -- I don't know.

Q. Is HBr an example of a hydrohalide?

A. Probably, but I don't know.

Q. Is HI an example of a hydrohalide?

A. Probably.

Q. Do you know, or --

A. I don't, no. This is the type of information that I would rely on from Ed Olson. That's his background, not mine.

Q. And I think you mentioned --

(Speaking simultaneously.)

THE COURT REPORTER: I'm sorry. Could we go off the record real quick to

work on your microphone position.

MR. TOBIN: Let's go off the record so we can fix this.

THE COURT REPORTER: Okay. We're off the record at 10:16 a.m.

(A recess was taken from 10:16 a.m. to 10:18 a.m.)

THE COURT REPORTER: All right. We're back on the record at 10:18 a.m.

BY MR. TOBIN:

Q. So, Mr. Pavlish, I think one of the things you mentioned about compounds having an acidic characteristic, I think you mentioned three examples, SO2, HBr, and HCl; is that right?

A. To my understanding, yes.

Q. And I think you said that when HCl comes in contact with moisture, it can form hydrochloric acid; is that correct?

A. That's my understanding as well.

Q. And I think you know hydrochloric acid is pretty nasty stuff?

A. Oh, yeah. Yeah.

Q. Hydrochloric acid is very toxic?

A. Yep.

Q. If a person breathes hydrochloric acid,

it could form -- withdrawn.

If a person breathes gaseous HCl, it could form hydrochloric acid in their lungs and kill them?

A. Anything with HBr.

Q. If a person breathes -- withdrawn.

HBr is a gas, correct?

A. Yes.

Q. HBr is an acidic gas?

A. Yes.

Q. Would you expect that if a person were to breathe in HBr, it could -- the moisture in their lungs would convert it into hydrobromic acid?

A. That would be my understanding, yes. In other words, yeah, it's toxic. It's something that you have to be very careful about in terms of handling and transporting it and even using it, yes.

Q. Did you ever -- withdrawn.

Did you ever handle HBr?

A. Did I personally? No.

Q. Did anyone in your research group handle HBr?

A. Ed Olson.

Q. Do you know when Ed Olson worked with

HBr?

A. Throughout that time period. I mean, he was using different gases -- Br2, HBr -- in a lab setting.

Q. Do you know how HBr is transported?

A. I can presume. I don't know exactly. But I'm sure it's in a contained vessel, whether it's pressurized or not, I assume.

Q. Do you know how Br2 is transported?

A. I assume it'd be similar. Br2 is as toxic -- maybe even more so -- than HBr.

But, I mean, again, the handling and the care and the transport, it's toxic -- highly toxic. So same concerns.

Q. If I refer to Br2 as "molecular bromine," does that mean the same thing to you?

A. Yeah, I mean, Br2 can be molecular, diatomic -- or diametriclar, or whatever you might call it, yes.

Q. Okay. And I think you mentioned Ed Olson may have mentioned HBr and Br2 in a lab setting; is that correct?

A. Correct.

Q. What did you mean by "a lab setting"?

A. Probably be more like a -- an office with

various analytical and test equipment.

Q. And do you expect that if Mr. Olson were using -- withdrawn.

Did you actually see Ed Olson using HBr or Br2 in a lab setting?

A. I just seen the results from some of the experiments that he had done.

Q. And do you expect if he were using HBr or Br2, it would be in some kind of a fume hood?

A. I assume so, yes. I mean, the lab setting had all that, required by the State. It had all that equipment in place.

Q. The lab setting was an office building?

A. No, it was -- there was a separate lab building. It was actually two of them, but one was more focused on analytical -- more routine analytical was done.

And then there was also lab -- labs available, and Ed Olson had his own lab because he'd been there many years and had done research on many different topics.

Q. Was Ed Olson's lab part of the pilot facility at EERC?

A. No, I mean -- well, it did -- I mean, overall, it was part of the facility -- part of

the EERC facility. The pilot facility was kind of on one end, and the labs were kind of more on the other end. So there were was some separation between the two, and part of that was done for analytical reasons and contamination reasons, et cetera, et cetera.

Q. Okay. So the lab facility and the combustors were in separate areas?

A. Correct.

Q. Did you see Ed Olson experiment with Br2 in the combustor?

A. No.

Q. Did you see anyone applying Br2 to anywhere around the combustor?

A. No.

Q. Did you see Ed Olson applying Br2 to coal?

A. No.

Q. Did you see anyone apply Br2 to coal?

A. No.

Q. If someone came to the combustion area with a -- an open vessel of Br2, would you have distanced yourself from that because of the toxicity?

A. No, not necessarily. Again, precautions can be taken. And assuming they are taken, I

mean, adding it to coal, it's likely going to be formed by the coal. And once it hits the combustor, it doesn't matter.

So could it be done? Certainly. Precautions would need to be taken? Certainly.

Q. And you never saw it be done, that Br2 added to coal, correct?

A. Correct.

Q. There's something that's been hanging out here.

At the start of the deposition, I uploaded four exhibits to the Chat window.

Do you see those?

A. Make sure I can get to them. I can get to my Chat. Okay. I do not see the exhibits. All I see is a -- kind of a history of who's logged on.

Q. Let me find those again, then. And I'll upload again.

While I'm doing that, though, I think you said HBr, in the real world, at room temperature, is in a gas, correct?

A. Well, at some point, it becomes a liquid, but maybe -- again, I don't know if that's at room temperature, but certainly, at elevated

temperatures, it's a gas.

Q. Did you ever see anyone apply HBr to coal at the pilot facility at EERC?

A. No.

Q. Did you ever see anyone apply HBr to coal anywhere else?

A. Can't say that I have.

Q. You can't say that you have?

A. I don't recall seeing that, no.

Q. Okay. I'm uploading four exhibits to the Chat window. And just because we're taking a consolidated deposition across multiple proceedings, sometimes exhib- -- different documents get the same exhibit number, so I've put a little prefix -- a or b or c or d -- in the file name after the document just so we can tell it apart.

But do you see Exhibits 1001a, b, c, and d?

A. I do.

Q. Okay. Can you download them just so you have them on your desktop and available if you need them.

A. (Complied.)

Q. And while you're doing that ...

MR. TOBIN: For the record, Exhibit 1001a is U.S. Patent Number 10,343,114. It was labeled Exhibit 1001 in the -274 and -278 proceedings.

(Exhibit 1001a referenced.)

MR. TOBIN: Exhibit 1001b is U.S. Patent Number 10,596,517, which was labeled as Exhibit 1001 in the -280 and -281 proceedings.

(Exhibit 1001b referenced.)

MR. TOBIN: Exhibit 1001c is U.S. Patent Number 10,668,430, which was labeled as Exhibit 1001 in the -422 and -423 proceedings.

(Exhibit 1001c referenced.)

MR. TOBIN: And then Exhibit 1001d is U.S. Patent Number 10,589,225, which was labeled as Exhibit 1001 in the -424 and -425 proceedings.

(Exhibit 1001d referenced.)

BY MR. TOBIN:

Q. And, Mr. Pavlish, I appreciate your patience while I went through that.

Do you have the four patents

available in front of you?

A. I've downloaded them. Do you want me to load them all up or just one at a time, or ...

Q. Let's start with Exhibit 1001a.

A. Okay.

Q. This is U.S. Patent Number 10,343,114.

Do you see that?

A. I do. I'm getting it -- I'm getting it here. I've almost got it.

Okay. Yes, I do see that.

Q. If I refer to that as the "'114 patent," that -- you'll understand that?

A. I do.

Q. And Exhibit 1001b, if I refer to that as the "'517 patent," will you understand what I'm referring to?

A. I would.

Q. Exhibit 1001c, if I refer to that as the "'430 patent," will you understand what I'm referring to?

A. I would.

Q. And Exhibit 1001d, if I refer to it as the "'225 patent," will you understand what I'm referring to?

A. I would.

Q. Okay. You're named as an inventor on all four of those patents?
A. Correct.
Q. The other two inventors named on those patents are Michael J. Holmes and Edwin S. Olson; is that correct?
A. Correct.
Q. Is there anyone else you think should have been named as an inventor on those patents?
A. No.
Q. Do you agree that you're properly named as an inventor on the four patents?
A. Yes.
Q. Do you agree that -- is it "Mr. Holmes" or "Dr. Holmes"?
A. I think it's just Mr. -- he's got an MS or master degrees. I don't think he has a Ph.D.
Q. Okay. Do you think that Mr. Holmes is properly named as an inventor on the four patents?
A. Yes.
Q. And then last, do you agree that Dr. Olson is properly named as an inventor on the four patents?
A. Yes.
Q. Why is Dr. Olson named as the first

inventor on the patents?

A. I'm not sure.

Q. Did you, Dr. Olson, and Mr. Holmes work together on the inventions that led up to the ME2C patents?

A. Yes.

Q. Okay. And -- for shorthand, I may say the "ME2C patents."

Will you understand I'm referring to the '114, '517, '430, and '225 patents?

A. Sure, yes.

Q. Okay. And if you need to qualify an answer and say, "Well, it applies to only this patent but not that," will you let me know?

A. Yes.

Q. All right. Appreciate you doing that. I'm just trying to avoid asking the same question four times.

Okay. So were Dr. Olson and Mr. Holmes already at EERC when you joined in 1993?

A. Dr. Olson was. Mike Holmes was not.

Q. When did Mike Holmes join EERC?

A. Say three, four years later. So '95/'96 time frame.

Q. Okay. How would you explain the division of responsibilities for the research that led up to the ME2C patents between you, Dr. Olson, and Mr. Holmes?

A. Well, Dr. Olson had a chemistry background, Ph.D. in chemistry. So many of the questions and understanding chemical reactions, describing what might happened or could happen, was contributed primarily through Ed Olson.

Myself, Mike Holmes, both have -- had a fair amount of experience with coal-fired power plants, combustion systems, and so we focused more on the practical side, if you will, or the actual application --

Q. Um-hum.

A. -- how and where and those sort of things. And so we had a much more thorough understanding of the actual coal-fired power plant.

Q. Was Mr. Holmes also a mechanical engineer, such as yourself?

A. Yes, he might have been a chemical engineer. I'm not sure. Mechanical/chemical. And then he said he had a master's degrees, so I'm not sure if one was in mechanical and one is in

chemistry. I don't recall. I shouldn't say "chemistry." Chemical.

Q. All right. And did the three of you have research assistants that helped you in developing what became the ME2C patents?

A. Well, "assistance" in the sense that they helped conduct the tests. In other words, help run the PTC or help run -- well, in many cases, the lab testing was done by Olson himself directly.

I mean, we didn't need an assistant to do a lot of that work. But when we moved to larger-scale testing, I mean, obviously, we had several folks involved and help conduct and carry out the tests.

Q. You used an acronym. "PTC," what does that stand?

A. It's a particulate test combustor. It's a pilot facility within the EERC.

Q. Is the PTC the combustor where you and your team did the research that led up to the MEC2 patents?

A. Yes.

Q. So would you call the people who actually ran the tests -- would you call them "techs"? Or

is there a better term?

A. Technicians. Operators. The term "operator" was used quite frequently. I mean, they're operating the system.

Q. Okay.

A. In some cases, technicians were running instrumentation and so forth.

Q. Did you directly supervise technicians? Or were there -- or was there a chain of command?

A. A chain of command? Again, I managed the project. I didn't manage those people.

Q. So -- and I'd like to focus on -- because you've done mercury research for a number of years, so I'd like to narrow it down to a certain time period, if you could.

So let's say from the 2002 to 2005 time period. Can you explain to me the chain of command between you and the -- the technicians who were actually running the combustor?

A. Well, the way it was structured is you had operators, and they were managed by a lead guy. At the time, I believe it was Butch Riske. So he managed the operators.

The technicians were managed by kind of the cost center manager. There was cost center

set up for the different equipment. He would manage some of those people -- he would oversee, say, Butch Riske too in terms of coordination.

And so we would communicate with either the operator lead and/or the cost center manager and describe, essentially, "Here's the test we want to do on this piece of equipment," what is needed to support that test.

And then those two gentlemen, more or less, would go out and say, "Well, we're gonna get" -- "here's the people we have at our disposal or under us that would do" -- "that would actually carry out the test."

Q. So, again, from the 2002 to 2005 time frame, if you decided to run -- to test a certain flow rate or add- -- additionry of chemicals, from the tests that you got designed to the person pressing the buttons and loading the chemicals, how many -- describe the food chain for me, please.

A. Well, we'd usually have a test plan but not in all cases, depending upon the complexity of the test. So we'd put together a test plan.

As project managers, that test plan would be communicated to either the cost center

manager and/or both, the operator lead. In some cases, there was discussion or a meeting to both -- to go through it more thoroughly. In some cases, it was obvious as to what needed to be done.

And so then -- then that would be coordinated with the schedule that they had in terms of -- this PTC was used for other projects. So it'd be like, "Well, it's not available until X date." And you need five days or three days or whatever. And so they would get scheduled in by them.

And then at that time, the test would be executed. That would allow enough time for the instrumentation, whatever -- additives, sorbents, coal, different coals were being tested as well. And so that would all have to be coordinated and done ahead of time, obviously.

Q. So you would -- so let me know if I have this right.

So you would design a test plan for, let's say, coal additives and sorbent and coal. You would communicate that test plant to a cost center manger or operator lead. And then the cost center operator lead would communicate the plan

directly to technicians?

A. Technicians and operators, yes.

Q. Okay. Were there any other intermediary people in this path?

A. No, not generally. I mean, the general protocol was project managers would define with the client. Whether the client of DOE or an industrial partner, what was to be done, they were providing the funds to do it. And then that would be conveyed. And they would execute the actual test plan on the equipment. You know, they were the experts in terms of running that equipment. Because they ran them, like I say, quite pretty -- quite often, so ...

Q. Got it.

And I don't mean to cast any kind of value judgment in this question. Were you qualified to operate the pilot test combustor personally?

A. Not the combustor, no.

Q. Were you qualified to operate the sorbent injection equipment?

A. On quite occasions, we would be out there with the technician that would be running it.

Could we operate it? Yeah. I mean,

it's a simple system once you add the sorbent. It's turning a dial. But generally, that was also done in conjunction with a technician. Same thing with the additive. That could be done by us or any of the inventors, as far as that goes.

But as far as running the actual combustor, that was done by operators. And that was beyond, you know, what the inventors could do or would do.

Q. Would you ever communicate your test plans in terms of additives and sorbent and coals and times -- would you ever communicate that directly to the technicians or operators? Or would all this go through the cost center manager or operator lead?

A. No, sometimes that could be done directly, just depending on -- depending the nature of the project.

If we were doing what I'll call an exploratory project, meaning you don't know exactly what additives or sorbents or rates. It's more exploratory. In other words, you kind of learn as you go, or you kind of try things as you go.

And so under those types of projects,

you know, the project managers, i.e., the inventors, would be more involved. Because you learn something one day, and the next day you might do something slightly different.

Q. Um-hum.

A. The cost center manager was more there to manage costs, make sure that the funding was appropriately supporting the staff and the system so that it could continue to operate on an ongoing basis.

Q. In the 2002 to 2005 time plan, who was the cost center manager at EERC?

A. I don't recall exactly. I know Jay Almlie, but I don't know if he was the lead person at the time. I mean, Butch Riske was the operator. I remember that. A lot of the operators I don't recall, but I probably should. They weren't friends, per se. I mean, they were there to conduct tests. And, I mean, I certainly knew some of them at the time, but I don't recall at this point.

Q. All right. Well, sitting here today -- and I'm asking specifically for the operators that helped you work on the research that led up to the ME2C patents -- do you recall the names of any of

the operators?

A. I mean, I remember Don Toman. I think he was more on the analyzers, the instrumentation. Butch Riske I remember as the lead. Below that, not so much, no.

Q. I think you mentioned that there was mercury measurement equipment at the PTC; is that right?

A. Correct.

Q. So describe for me the process by which measurements were taken and communicated back to you -- let me ask a different question. I'm sorry. That wasn't very clear.

You mentioned developing a test plan and then working through two chains to get to the technical operators to actually have your plan run, correct?

A. Yeah, in some cases, it was just with the operator. The cost center manager wasn't always involved in it. But the lead operator was, because he needed to pull together the staff and equipment and all sort of things, so ...

Q. Got it.

And then there were also operators that ran the mercury measurement tools at the PTC,

correct?

A. Correct.

Q. Were you qualified to run the mercury measurement tools at the PTC?

A. I didn't feel like I was qualified to run them, no. Did I understand them? Yes. Did I understand how they worked? Yes. Did I run them myself? No. And there's a lot of nuances to actually running them.

Q. Just so I use the proper terminology, what was the name of the mercury measurement tools at the PTC from 2002 to 2005?

A. Primarily three. I mean, we used continuous mercury monitors, which monitored mercury in a continuous manner. And we had several of those.

We used Ontario Hydro Method, which we had proved out under a different project as -- to be, I guess, the reference method EPA eventually approved. We helped in that process, so we used the Ontario Hydro Method.

And then we also used Method 29, which was -- you could measure total mercury, but the speciation was questionable.

Q. Got it.

A. The Ontario gave you a better speciation.
Q. Is CMM the same thing as CEM?
A. It requires more of a qualifier. It is. When we say "continuous mercury monitor," that is a CEM.

If you say "CEM" by itself, that could mean, say, SO2. I mean, it could mean -- it's a continuous emission monitor, but it doesn't tell you what you're monitoring.

Q. I understand.
A. CMM does.
Q. Okay. So if I were to say "a CEM for mercury," you would understand that to be a CMM?
A. Correct.
Q. Have you heard the term "S-CEM"?
A. Dash?
Q. "S" for "semi"?
A. Dash? Oh. Yeah, I've heard of it. I think, in general, that means that you're monitoring mercury. But it's semi-continuous, meaning -- and most of these monitors are this way. Say you're monitoring total mercury. If you want to get elemental mercury, you have to switch. In other words, you can't get both species at the same time.

So they sometime refer to that as to semi-continuous, meaning, yeah, it is continuous, and it can be, if all you want to do is measure one or the other.

But if you want to flip and get them both, you have to flip a switch, so to speak, meaning you get one, but then you don't get the other.

Q. Does that principle you just described apply to the CMM that was at the PTC from 2002 to 2005?

A. Yes.

Q. When the C- -- when the mercury measurement at the PTC output data, was there a computer that they were connected to?

A. The data -- again, the data would get logged by the operator or technician that was running that system. And then that data file would get transferred over to, say, the project manager or the person that was looking at the data in terms of data reduction.

Q. All right. Do you remember the format of the data file that came from the mercury monitors at EERC?

A. I don't recall that. I presume it'd be

Excel, but it could be textual -- you know, text-based data.

Q. Would you be the one who would process those CMM files to look at the mercury measurements? Or was that someone else on the team?

A. It could be me. Or it could be someone else. I mean, if there's a lot of data, there'd be another researchers -- another researcher as part of the project that would take that data and then reduce it to a -- more of a simplified view of that data, making sure that -- you know, some of the data was probably erroneous.

I mean, you have to go through and get an understanding of whether that is accurate or not or reasonable or not or if the instrument was down or not.

So they would usually go through that, and then the project manager in most cases would see that reduced form.

Q. So I want to understand the process for scheduling at the PTC.

Am I correct that the PTC was used by a wide variety of industry people?

A. Yes.

Q. They could rent it out?
A. In a sense, yeah, rent it out or hire it, contract with it.
Q. Okay. And so -- again, I'm asking about the 2002 to 2005 time frame -- was the PTC pretty much booked on most days?
A. I wouldn't say booked on most days, but it was being run quite frequently.
Q. And there's been --
A. I mean, there's a period of time where between a run, there's maintenance required. So you can't book it, like, week to week.
It's -- it can do a week, and then you need, like, a week or two off to do maintenance, and then you can book it again. So it can't be run continuously, for example, for months and months without maintenance.
Q. Okay. That -- I think I understand what you're saying.
So other than maintenance issues or if, let's say, it was broken somehow, is it your expectation, from 2002 to 2005, the PTC was mostly continuously running?
A. Yeah, I mean, it was being run quite often, quite frequently.

Q. In 2002 to 2005, what's your best estimate of the percentage of time that the PTC was used for your projects as compared to other people's projects?

A. I don't know if I can give you an estimate. I'm -- I was aware whether it ran for us. But in terms of when it was being run for others, I'm not familiar with that.

Q. Well, what -- let's say from 2002 to 2005, what's your best estimate of the percentage of time that the PTC was being run for your projects?

A. 15, 20 percent. I mean, that's kind of a guess, though. And, again, I'm just kind of going off a recollection and specific to mercury. Let's say in that neighborhood.

Q. Okay. And I'm really just asking for your best estimate.

Like, you'd say 2002 to 2005, your best estimate is your mercury research was occupied about 20 percent of its time?

A. Yes.

Q. Okay. And then you understand that there were logbooks that were used with the PTC; is that right?

A. Yes.

Q. And what was the purpose of the logbooks?

A. The logbooks were documentation as to how the run actually was carried out. So there's a plan. You try to execute the plan. But very often the combustor would have issues or the instrumentation would have issues.

And so the PTC was a document that had entries by the operators or technicians to essentially describe, "Well, here's how the test was actually performed or carried out. Here's the problems that may have come up during the course of the week of testing, you know, each day." How did the unit operate? Was it shut down overnight? Was it run overnight? You know, did they come up on temperature so that -- you know, or steady state? You know, so that level of detail.

So that's -- again, the research or the project manager would be able to understand as to what difficulty or what problems came up so they can understand, again, the data that was produced as part of that test.

Q. So you know how in, like, a school notebook, you may have different dividers for different subjects? You may have a math divider

versus a English divider?

A. Never used those particularly.

Q. Back when people still had three-ring binders?

A. Um-hum.

Q. Was the -- but you understand that process, right?

A. Yes.

Q. Was the PTC lab notebooks operated like that, where one research book would have a notebook, and another research group would have a different notebook or different section of a notebook?

A. No.

Q. So was the PT- -- was the -- were the lab notebooks at PTC created kind of like an ongoing log?

A. Yes.

Q. So for example, Day 1 might have research from your group. And then Day 2 might have research from someone else's group. And then Day 10 might, again, have research from your group?

A. Yeah, other than the frequency would be farther apart. I mean, they wouldn't flip -- you

wouldn't do Day 1 with my project and Day 2 with theirs.

I mean, it's -- normally, that would -- they would take a week or two, again, for maintenance, to switch over. Different tests would require different instrumentation. So there's a definite period between projects, which might be a week, might be a month, maybe two months, depending upon, you know, the issues with the PTC or whatever.

Sometimes it's not even the PTC. Sometimes it's the operator pool, meaning the operators aren't available to run that equipment because they're running, like I mentioned, the -- there were several other pilot-scale units at the EERC. So they might be off running another pilot unit and not available.

So yes, it -- the logbook was maintained for the PTC, but in terms of why it ran or why it didn't run, or those sort of things weren't documented as part of that.

Q. Okay. But is it fair to say that -- let's say within 2002 to 2005, your research group and other research groups were using the same set of lab notebooks?

A. Well, again, the -- each unit had their own lab book. That was maintained in -- maintained by the operators. It wasn't maintained by the researchers or the project managers.

It was maintained by the cost center in that particular unit. And so that logbook was maintained by them -- or that entity.

Q. I'm sorry. I don't understand the distinction you're making from my question.

A. Well, I believe you said it was different researchers. And my understanding was you were referring to that the logbook was maintained by different researchers.

Q. Oh, I'm sorry.

A. And that is not -- was not the case.

Q. Okay. So I think what you're clarifying is that it was not the researchers such as yourself that maintained the logbooks, correct?

A. Correct.

Q. And it was not researchers like Mr. Holmes and Dr. Olson that maintained the logbooks, correct?

A. Correct.

Q. The logbooks were created and maintained by the actual technicians?

A. Yeah, and then the cost center. And then those logbooks were maintained and secured by the EERC, when you flip a coin, the administration or the legal group. In other words, those logbooks were maintained and secured not by the researchers but by that group.

Q. So is it the process that before a researcher -- withdrawn.

I used it -- when you used the term "researcher," you're talking about people like yourself and Mr. Holmes and Dr. Olson, correct?

A. Correct, or researchers working under us.

We generally did not refer to researchers that were actually running the equipment or the instrumentation. That's not in all cases. In some cases, there were a few researchers that could go either way.

But by far and large, it was technicians and operators that were conducting the tests. It was researchers or managers that were taking the data and then communicating the results to the client.

Q. Okay. So I think I understand. So, again, 2002 to 2005 time frame, did you, yourself, enter any data into the PTC logbooks?

A. No.

Q. Would you have any -- have had any reason to enter data into the PTC logbooks?

A. No.

Q. It would have been the technicians or operators who were the people that entered data into the PTC logbooks, correct?

A. Correct.

Q. And similar question for the other inventors. Dr. Olson and Mr. Holmes, would they have had any reason to enter data into the PTC logbooks?

A. They would have had no reason other than, maybe, some after-hour tests or some tests that weren't prescribed, that they actually -- they changed a rate on a, you know, on a sorbent injector additive -- if they were the ones actually making that change, they might have notated that.

If it was done with a technician there, the technician would have notated that. So no, no real reason for them either.

Q. Okay. So do you have any knowledge that Dr. Olson or Mr. Holmes actually did enter data into the PTC logbook?

A. I don't.

Q. Did Dr. Olson ever visit the combustor, or was he just in the separate lab?

A. He primarily spent most of his time in the lab. Did he go out to the PTC? Yes. Was he present often? No.

Most of his time was spent in his lab.

Q. So let's talk about the PTC logbooks, and let's make sure we're talking about the same thing. I think you know logbooks are in this case. I think you've written about them, and you've reviewed them.

That's the logbooks we're talking about, right?

A. Correct.

Q. Okay. Is it -- would the PTC logbooks be kind of left on a table by the PTC? When someone goes to use it, they would write down what they're doing?

A. I don't know if they were just left anywhere. I think they were held someplace.

Again, I didn't observe the actual recording. I don't know exactly what that protocol was. Again, it was maintained during the

test, you know, by Butch Riske, the operator lead or the cost manager, and I don't know exactly what that protocol was.

Okay. It's over -- here if you want to put an entry, you have to come down from the combustor and put it here. Or I assumed that was the case. I don't think they carried a logbook around. Because, you know, they were doing the tests. They needed their hands for other purposes.

Q. That's fair.

So do you have any firsthand knowledge as to how the PTC logbooks were stored and maintained?

A. Again, my understanding of how they were stored was they were stored securely so that other folks -- other clients couldn't see, you know, somewhat in a confidential manner, because many of the tests that were done were through CA agreements.

And so those logbooks, you know, were maintained in a somewhat confidential, secure manner so that other folks wouldn't have access to them both internally and externally.

Q. I think you said "CA." What does that

stand for?

A. Confidentiality agreement.

Q. Ah. Thank you.

So let's say during -- not "let's say."

During 2002/2005, for the test that you instructed, technicians or operators would record the parameters they said or what they observed on the machines. Fair?

A. Yes.

Q. Okay. And then at some point later, would you review those lab -- those logbooks?

A. Again, depending upon the nature of the projects. Simple projects, probably not. You know, there's -- we ran the test. Here's a -- here's how -- in general -- we generally knew how it went. Except if there were problems, they would tell us. And then you'd get the data.

And so on a simple test, you probably had no need to review the logbooks.

Under more extended or complicated tests, especially if you had a question about the data, if you looked at the data and said, "Hey, there's a gap here," or "The data doesn't make any sense," then you would say something -- what the

unit probably or the injection systems probably went or the instrumentation, something, you know, wasn't quite running right.

And so you go look at -- you could request to look at the logbook and say, "Okay. During this time period, what's documented in terms of how did the test actually go?"

Q. Now, within a given logbook could be some of your confidential research and some of the confidential research of other groups, correct?

A. I'd say yes and no. Because I know there were multiple logbooks. In other words, there wasn't just one logbook for ten years.

Q. Sure.

A. So there was a logbook. And when it got filled, it -- you know, it got stored away. If it was confidential information, you wouldn't have access to, unless you were privy and you were part of that project.

You -- generally, number one, you'd have no reason to access it. Two, if someone else tried to access it, they wouldn't be allowed to access it, because it would be under a CA agreement.

Q. Well, that's what I was trying to get at,

so let me break that down a little bit.

The logbooks were filled out sequentially by time; is that right?

A. Correct.

Q. Pretty much an operator would write a date on the bottom, time on the left, and what happened, correct?

A. Correct.

Q. And then a few minutes later or an hour later, the next step, they would write another -- handwrite another line and entry, right?

A. Right.

Q. And then when an operator or technician would finish one page in the lab notebook. They would turn to the next page and start filling that out sequentially, yes?

A. Yes.

Q. Okay. And then when a lab notebook was -- and I said "lab notebook." I meant logbook.

Did you understand that?

A. Yes.

Q. And when a logbook reached the end of the pages in that particular logbook, someone would start a new logbook?

A. Yes.
Q. Do you recall if the logbook covers were given some kind of a title or sequence to allow the keepers of the logbooks to put them in order?
A. I don't recall that.
Q. Is it you don't recall, or it's just not something you would have had a need to learn about or check into?
A. Yeah, there's no need to really know that, I guess.
Q. Okay. Do you know how many pages were in each individual volume of a logbook?
A. Not exactly, no. I mean, more than 10. 30, 50. I don't think it was a thousand. I mean, I've seen the books, and I mean -- they're maybe a half inch thick or less.
Q. Okay. When did you see the books?
A. On different projects. I mean, like I said, we'd see them not just on projects that we're involved in this invention but other projects that would have been done as well. I mean, generally green in color. Some labeling on the front page I didn't pay attention to.
Q. So what was the process -- withdrawn.
So, again, I think you mentioned that

different companies had different confidentiality agreements with EERC?

A. Yes.

Q. And you certainly were not privy to all that other companies were doing, correct?

A. I mean, we focused on -- we were privy. EERC has many employees, yeah, but we were generally aware of many projects. I wouldn't say we were aware of all the projects. But when testing was going on or projects came in, I mean, we were aware of many of those projects. But we weren't intimately involved with them.

Q. Okay. So, again, going back to the process -- and I'm focusing on the 2002 to 2005 time frame, because that's what really matters here.

The technicians would record their action items -- or withdrawn.

If a technician turned on a valve, the technician would write, like, "Turn on valve" at this time, correct?

A. Correct.

Q. Or if the technician, let's say, turned off the carbon injector, the technician would write "Turn off carbon feeders"?

A. Correct.

Q. And then when the technician turned back on the carbon feeders, the technician would write "Turn on carbon feeders," yes?

A. Sure.

Q. And technicians would write how much or what flow rate they set for various quantities, yes?

A. Yes.

Q. And then after a technician was done, there would be no reason for you to actually review those line item entries, unless there was some kind of a problem, right?

A. Yeah, I'd say that's a fair statement.

Q. Would the technician summarize what they did in some kind of a report and send it to you?

A. Usually, what we would see more was the data. In other words, if we were focused on mercury, yeah, we want the data from the analyzer.

Again, the researcher would get that. When I say "researcher," someone working under me. Would I get them directly? I generally didn't request them.

I mean, they would go to my researcher. He would take the data, as I

explained before, go through the data, and try to make sure it makes sense.

If there were issues, try to resolve those and then present kind of an overview of what those test results meant -- or what the data showed.

Q. Okay. So between when a test was actually conducted and with the PTC and when you were able to say, "Oh, yes, this test was a success," or "This test was a failure," what was the typical lag time?

A. That would be dependent on the urgency and the availability of the operator/technicians. I mean, if they immediately got pulled off to another test, it would take longer, because they wouldn't have time to pull that data together and send it up the chain, so to speak.

So -- and so it's highly dependent. I mean, it could be a week. Could be a month. Again, depending upon what other activities were ongoing at the time.

Q. Between -- I'm focusing on 2002/2005 time frame. And the mercury research between when a technician actually burned coal and used carbon, at that level, again, the technician would then --

or someone would be taking mercury measurements, yes?

A. Yes.

Q. And then at some point in time, that person who took the mercury measurements would need to send the raw data to someone else, right?

A. Correct.

Q. That someone else is the operator lead?

A. Well, generally, that data file would go to the researcher.

Q. Got it.

A. The condensed -- in other words, all the details -- again, of an instrument, there's a lot of details -- but the focus was on, you know, the mercury results, the measurement itself, and that would go to the researcher.

Q. Would the technician record mercury results in the logbooks?

A. Generally not. Maybe occasionally. You know, if it was like, "Hey, this is what I observed." But for the most part, it would go to that -- his file or whatever. Because there'd be a lot of entries, especially on a continuous mercury monitor. I mean, if you were to report that, you'd get them, like, way too often. So

they generally weren't recorded.

But I cannot say that they were never recorded. It might have been an entry where it said, "Okay. Yeah, this was what was observed at this point in time."

Q. Do you have any particular entries in mind?

A. No, I don't.

Q. So how big -- how big were these data files with mercury measurements?

A. You're pulling continuous measurements. So I mean, there's time averaging. You know, usually you'd say, "well, I don't want a" -- "you know, I want to a time average number of every minute or every three minutes or every five minutes." And then that's what you would get. It would be a reduced version of that file with that data.

Ontario Hydro data, that's, you know, a totally different story, because that's a wet chemistry method. And so those impingers have to go to a lab. Then they have to be analyzed by the lab. And so -- but the time frame on that data is obviously longer than, say, information from a CMM.

Q. So talk about the CMM, though. Are we talking about megabytes? Gigabytes? What's your best estimate in 2003/2004 of the size of these files?

A. I don't think they -- certainly gigabyte -- or not "gigabytes." Could they be a megabyte? Yeah. I mean, certainly more than kilobytes.

Again, depending upon -- is it a week's worth of data, or is it an hour's worth of data, and how long was the test, and those sort of things, so ...

Q. And some of the tests that led to your patents would go a week or so apiece. Is that fair?

A. Yeah, I mean, the summer that led to the invention, I think we did three -- three weeks of PTC runs.

Q. Did the technicians send you the mercury raw data -- withdrawn.

Were the technicians instructed to send the raw mercury data on a daily basis or on some other basis?

A. Probably on some other basis. I mean, if it was something that was -- that we really wanted

to know, sometimes Ed would walk out there to the lab and say, "Okay" -- you know, talk to the technician directly and say, "Okay. What have you observed?"

I didn't get the data, but I got, you know, his observation of what he'd seen.

And so it'd be, okay, I have an idea of how well it worked or it didn't work.

Q. Um-hum.

A. I can plan or not plan for the next day or the next week or a month from now. So I was getting some of that information -- and when I say "I," researchers too. But some of that information's -- if you want to call it instantaneous, but it wasn't instantaneous, but in a fairly short time frame. But the actual data itself we didn't follow. And what would be --

Q. Did you --

A. What would get reported would be, you know, not what you observed but from that data file.

Q. Do you recall any specific tests where you got instantaneous feedback?

A. Oh, I think during -- during the summer, that first series, I mean, we would get them daily

or every other day, you know. And if I didn't do it, I'd have the researchers, whoever's working under me, "Hey, can you go talk to these folks and get a general view of what" -- "how yesterday went?"

"Well, yeah, the combustor had a problems, so we didn't get any data."

Q. Um-hum.

A. Well, that was encouraging, but I mean, that's how the tests go.

Some days it was "Yeah, it ran good," and "We were able to conduct test XY. And here's in general what was seen."

Q. Did you ask --

(Speaking simultaneously.)

A. -- get some of that feedback, you know, more -- more regularly.

Q. Do you still have any of those raw data files of the mercury measurement from the 2002 to 2005 time frame?

A. I don't have any of those. I'm not sure I ever got them, to be honest. Like I said, if they went from -- from the technician, it would have been to a researcher that then reduced that data and gave me a bigger view of it.

Q. Do you remember the name of the researcher that would have received the mercury measurements from your tests in 2002 to 2005?

A. It would have been different ones likely. It wouldn't even have been the same one.

Q. Do you remember any of their names?

A. Ye Zhuang. But I think he was hired later on. But, yeah, out of that, no, I don't.

Q. What was that name? Ye Jung?

A. It's Ye Zhuang.

Q. Okay. And that was after 2005, you think?

A. That was around -- yeah, I mean, '04, '05. It was in that time period, yeah.

Q. Okay. So, again, the process --

A. I don't remember exactly when he was hired on.

Q. Okay. But, again, the general process is that the mercury monitors would output raw data, and then at some point, would they -- at a time or got around to it, the operators would send that raw data file to one of your researchers. Correct so far?

A. Yes.

Q. And then one of your researchers would

process the data?

A. Yeah. Yes.

Q. One of your researchers would then summarize the data for you?

A. Yes.

Q. And that process between when the technician sends the mercury data and then your researcher reads it, processes it, and summarizes it for you, and then you actually need the time to read it, too, could that take anywhere from a few weeks to a few months?

A. Yeah, again, depending upon the urgency of critical -- you know, if it's needed, I mean, you could push that. But, yeah, I mean, it could certainly a week, two weeks, a month for that whole process to unfold.

Q. And if you were -- let's say anyone during that time was particularly busy -- and, again, 2002 to 2005 -- if, let's say, the operator was particularly busy or your researcher was particularly busy or you, yourself, were particularly busy, it could take a few months for you to be able to see the mercury results, correct?

A. The final, yeah. Again, as I noted

earlier, I mean, if it was what I would call critical information.

If we were doing exploratory work, I mean, the information would come quicker by observation, meaning I -- either I or the researcher would just physically go out there and talk with the technician --

Q. Okay.

A. -- and get his observation of what happened -- or the results were. And so that could come quicker.

Q. And to know if a exploratory process was really working, what kind of mercury numbers would you expect to see? Like, a -- what percent reduction?

A. Well -- yeah, I mean, we -- we were -- we had an inlet and outlet monitors. And so, again, depending upon what material was being tested or whether a one-step, two-step. You know, we tested a lot of different sorbents too.

So it might be per lignite coal, you know, we were probably seeing 30/40 percent removal. And so if you tested another sorbent and you seen, say, 50 percent, you would say "Gee, that was an improvement." And maybe that's the

direction you might want to go, because that particular sorbent seemed to work better.

When we got into additive testing, it was more, well, we put the additive on the coal, and now we have a different sorbent. What did we see? The next day we might change the rate, or we might change a different type of our activated carbon and say, "Well, that worked better" or "Didn't work as good." You know, so that was in general the process we would go through.

Q. Was your target 70 percent mercury removal?

A. It really wasn't a target initially. The target was -- and this was focused on lignite coal, because we were working with the lignite industrial group. In other words, folks that were burning lignite coal in their plants. And so some of the earlier testing showed, you know, maybe, like, 30/40 percent, and so really, the goal was "What can we do that will do better than that?"

Q. Um-hum.

A. And so if he got 50 percent, that might be "Hey, that's better." Was the goal -- the goal would be 90 percent. You know, the goal was "Hey, let's do the best we can at that time, because we

weren't certain as to what the regulations were going to be." So the goal was "Yeah, let's get 90/95 percent." But how do we get there, you know?

Q. One of the names I think you mentioned earlier was Thomas Erickson?

A. Yes.

Q. Do you know if he himself recorded any entries in the PTC logbooks?

A. I doubt he did.

Q. What was his role in connection with the PTC logbooks?

A. Well, he served as director at some period of time. And he served as assistant for some period of time. He served different administrative roles throughout that process.

Earlier to that, he was a researcher, and I worked with him when I first hired on. And I was working with him. He focused on modeling work. But as time went on, he moved more into the administrative role. And I stayed as -- more as a researcher.

Q. So let's focus on 2002 to 2005. Do you know what his connections to the PTC logbooks would have been?

A. I don't really recall. I don't know, at that time, if he was overseeing some of the IP. He certainly was into the administration part, not doing research, but administrating, either assisting the director or somehow -- I meant -- I call it that circle.

But -- because they had the IP director, assistant director, the director themselves, so that whole group can communicate. We didn't have much interference with -- I shouldn't say "interference" -- interaction with that group on a day-to-day basis.

Q. So, again, from 2002 to 2005, do you know if you had any kind of connection to the PTC logbooks?

A. Other than what administratively may have recorded them to be, that I can't speak to.

MR. TOBIN: Okay. Let's go off record.

THE COURT REPORTER: All right. We're off the record at 11:18 a.m.

(A recess was taken from 11:18 a.m. to 11:32 a.m.)

THE COURT REPORTER: We are back on the record at 11:32 a.m.

BY MR. TOBIN:

Q. Welcome back, Mr. Pavlish.

Something I saw in maybe one of your earlier résumés is you are a member of the Air & Waste Management Association?

A. Yes.

Q. Do you abbreviate that as AWMA?

A. Yes.

Q. Are you still a member of the AWMA?

A. Yes.

Q. What is the AWMA?

A. I don't know. As it sounds, Air & Waste Management Association. They focus on conferences, articles, publications, you know, that deal in the air and waste area.

Q. Is one of the subcategories of information that AWMA people are interested in -- is it mercury removal?

A. It used to be.

Q. When did it stop? When did the AWMA stop -- lose interest in mercury removal?

A. Probably when it was no longer a hot topic.

Q. When was mercury removal no longer a hot topic?

A. Well, to me, it's always a hot topic.

But for them -- for them probably -- I mean, during the earlier time frame, like, 2000, they had their own conference, which I attended and presented at.

But as the years went on, you know, that interest started to drop off, because the R&D started to drop off, because technologies were developed and proven, so to speak.

And so then they shifted -- in other words, they weren't getting the attendance they had hoped for. And so they gradually moved out of that area.

Q. So let's take -- in 2000 to 2005, was mercury research still a hot topic?

A. Yes.

Q. In 2000 to 2005, did AWMA have conferences?

A. Certainly earlier on. I mean, we also -- when I say "we" -- the EERC put on an air quality conference. And so there was competition in terms of attendance and focus. And so we focused primarily on mercury.

I think we started that conference, I want to say, in 1998. And so about the same time

frame as they were having conferences, we started to have a specialty conference on mercury. And so the attendance started to go more towards our conference and less towards theirs, and that happened, you know, during and throughout that period of time.

Q. The Air Quality Conference was a specialist conference on mercury?

A. Yeah, we called it a specialty conference on mercury which focused exclusively on mercury research. And, really, more exclusively on mercury research as it pertained to co-fired power plants.

Q. In the earlier 2000s -- 2001, 2002, 2003 time frame -- did you attend the AWMA conference?

A. I know I attended some of the early ones. I don't remember the exact dates, but certainly the earlier days, yes. I remember presenting at some of those. And like I say, then, eventually, we had our own conference, and so the emphasis shifted to presenting at that conference.

Q. Okay. I'm gonna get to the Air Quality Conference.

Sticking with the AWMA conference for a little bit, can you give me an understanding of,

just ballpark, how many people attended these kinds of conferences at AWMA?

A. Initially -- again, it's a conference. It's broader than, say, mercury. So if you can rephrase your question as to how many attended the mercury versus how many attended the entire conference.

Q. Well, that's a fair -- that's a fair distinction. Let me ask it both ways, please.

So starting with the -- withdrawn.

Did the AWMA conference have different sections within it?

A. Yes.

Q. Would you call them -- did you call them sections or task groups or work groups or what?

A. Just different sessions, if you will.

Q. That's the word I was looking for.

In the earlier 2000s, what's your best estimate of the number of people, about, that attended the mercury sessions at the AWMA conference?

A. I'd say probably in -- around the order of 50. 30 to 50.

Q. Okay. And the overall AWMA conference in the early 2000s, what's your best estimate of who

attended that?

A. Probably hundreds. 3-, 4-, or 5-. I don't know.

Q. A few hundred, yeah?

A. Yeah.

Q. Okay. At the AWMA, would they -- you've received -- withdrawn.

You've received conference proceedings in the past, right?

A. Yes.

Q. And I think your Air Quality Conference would put out its conference proceedings on compact disks?

A. Proceedings that we moved more to presentations. You could call it proceedings, not written -- not written documents, per se. In some cases, it just became just presentations.

Q. Okay. So the presentations from the Air Quality Conference were delivered to people on compact disks?

A. Yes.

Q. Okay. And was it the regular practice that people who attended Air Quality Conference received compact disks of the presentations?

A. Yeah, I'd say so.

Q. Would it -- how long would it take you to send out the disks from after the conference?

A. Probably months.

Q. Okay. Like, a month or two?

A. Yeah, I'd say at least a month. Probably longer. More like two months and --

Q. Okay. That wouldn't have been, like, a year later?

A. No, I don't think it would have been that long. No, I would say months, but not years. Certainly not years.

Q. Okay. And --

A. And it was -- we wanted to get them out. Obviously, it was cutting -- cutting research, so you know, we didn't want to wait years, so -- but it did take some time to put that all together.

Q. All right. And by "some time," you mean, like, a month? Two months? Something like that?

A. Yeah, a month or two, yeah, in that order.

Q. Okay. At the Air Quality Conference were -- well, I'll come back to Air Quality Conference, so withdrawn.

For the AWMA conferences you attended, did they also send -- mail out compact

disks with the presentations or papers from the conference?

A. Yes.

Q. And would that typically take -- how long would it -- do you recall -- would it take to get a disc with the proceedings from the AWMA conference?

A. Probably similar. Two, three months. I mean, similar time frame.

Q. Okay. And you, yourself, received compact disks with the AWMA conference materials?

A. Yes.

Q. You also received compact disks with the Air Quality Conference materials?

A. Yes.

Q. What was the attendance like at the Air Quality Conference as between, say, 2000 to 2005?

A. It was fairly well attended. Hundreds.

Q. Hundreds?

A. At least.

Q. What kind of people attended the -- your Air Quality Conference?

A. Regulators, researchers, utilities. Our main focus was to draw in utility folks so that they could get an understanding of where the

research was.

The focus was to bring in researchers that were actually doing testing, not reviewing documents, but actually people that were doing the testing.

And then regulators to give kind of an overview of where the regulations stood or might be going.

Q. And do you -- is it fair to say a few hundred people attended each of the Air Quality Conferences in 2000 to 2005?

A. Probably 3-, 400. I mean ...

Q. Okay. Another conference I've seen in the 2000s is called a MEGA conference, cap -- all capital letters.

A. Yep.

Q. Did you attend?

A. Yes.

Q. Do you recall what years you attended the MEGA conference?

A. Same time frame. I mean, typical ones, I went to was AWMA, Air Quality, MEGA, and eventually the EUEC conferences. Those are the main conferences I went to. And I attended them, I'd say, almost every year if not every year.

Q. I'm sure you know that in certain -- that there are those conferences that are just really off in left field, not well-respected, and you get a few sporadic people attending. And then there are those conferences in the field that are well-respected, that you get the top researchers, that if you really wanted to know what's going on in a field, you'd go to those conferences.

Between those two ends of the spectrum, where would each of the four conferences you mentioned fall?

A. Well, probably biased, but I would say Air Quality was the best.

Q. Okay.

A. EERC. We coordinated and put that on.

The rest, probably equal. I mean, AWMA, when they were focused on mercury, was a good conference.

MEGA was broader. They focused on mercury but also focused on SOx and NOx, and so it was a broader audience in that sense. They still had pretty good papers and presentations on mercury. Maybe not as focused.

Air Quality was very focused. AWMA had focus. EUEC had sessions that were focused on

mercury. In the early days, they were pretty good.

I mean, the people that were really doing research went to those conferences. But, again, it was a broader -- I think it had eight, ten different sessions. So there'd be folks that didn't go for mercury as well.

So their attendance was larger, but the attending -- the people that attended the mercury was almost the same number of people, so to speak, or organizations.

Q. So would you consider -- I guess in the 2000 to 2005 time frame in the field of mercury removal, would you consider AWM- -- withdrawn. I'll put it in the proper order.

But in the field of mercury removal in 2000 to 2005, would you consider the foremost respectable conferences to be the Air Quality Conference and then the AWMA, MEGA, and EUEC?

A. Yes, other than the EUEC, I don't sure -- I'm not sure that was -- I don't know when that came on. Let's see. It wasn't around, I don't think, in 2000. It came a little later.

Q. Okay. When the EUEC conference started up, would you consider that a respectable

conference for mercury removal?

A. Yes.

Q. Did you present to any of the EUEC conferences?

A. Yes.

Q. Do you know if your co-inventors presented at any of the EUEC conferences?

A. Yes.

Q. Were you personally in charge of running the Air Quality Conference, or is that one of your co-inventors or someone else?

A. I was the -- I was tasked as being the technical coordinator. So I coordinated the technical program.

Q. Okay.

A. The logistics, the funding, where we stayed was done by other folks at the EERC. My focus was on putting together the technical program.

Q. So does that mean that for the Air Quality Conferences that took place -- for how many years -- withdrawn.

For how many years were you the technical coordinator at Air Quality Conference?

A. The whole time. I think we did 12 or 13

of those.

Q. So does that mean you were in charge of who got to present at the Air Quality Conference; kind of a thumbs-up/thumbs-down?

A. Not so much a thumbs-up/thumbs-down. We had funding -- DOE was involved in providing funding. We had other EERC folks. I was in charge of basically putting together the program and the focus.

In other words, do we want to a focus on mercury control? Yes. Who would be some good candidates to present? I would come up with that list. And that list would get discussed with DOE and other folks at the EERC.

And collectively, we'd say, "Yeah, we want this person. We want that person," and, so to speak, come together as to who would be accepted as presenters or posters.

Q. So would you have attended each of the sessions at the Air Quality Conference?

A. Yes.

Q. And you would have seen all the presentations at the Air Quality Conference?

A. Yes.

Q. You, yourself, presented at the Air

Quality Conference, right?

A. Yes, but let me clarify. I would have attended any mercury. I focused on mercury. There might have been a few papers that strayed away, but I would have attended all of those.

Q. That's a fair -- and I appreciate that. For any of the mercury session papers at Air Quality Conference, you would have attended?

A. Yes.

Q. Okay. And I think when mercury was a hot topic in the 2000 to 2005 time frame, did you kind of make the conference rounds, go to multiple conferences?

A. Yes.

Q. So did you also present at AWMA?

A. Yes.

Q. Did you present at MEGA?

A. Yes.

Q. At the AWMA conferences you attended, would you have sat in for each of the presentations in a mercury session?

A. I would say yes. Most of them for sure.

Q. At the MEGA conferences you attended, would you have sat in at each of the presentations for the mercury sessions?

A. I would say most of them, although I may have attended some SOx and NOx and PM, but I certainly had a focus on mercury that I attended.

Q. It was certainly your intention that for each of the mercury sessions where you attended at AWMA, Air Quality, MEGA, and EUEC, you would have sat in on each of the presentations in mercury sessions. Is that fair?

A. Yes.

Q. Did you present at EUEC?

A. Yes.

Q. And the field of active mercury researchers, would you consider it a specialized field?

A. Yes.

Q. And, you know, something I didn't ask you, what was the attendance like at EUEC when you were there?

A. I don't know if it had a thousand. I mean, again, it was broader in scope. The mercury attendance was similar between, really, most of those conferences.

Q. But, I mean, ballpark estimate, if someone said 800 people attended an EUEC conference, would that seem about right?

A. Yeah.

Q. Who are some of the -- and, again, I'm sure it's a select group of the active mercury researchers at that time.

Who were some of the other active researchers in mercury in the 2000 to 2005 that you would see at conference after conference?

A. Certainly, you'd see, like, Tom Brown and Tom Feeley, which were DOE. They were managing some of those programs. They were actually funding them so they would be attending. They weren't actually doing the research, but they were funding the research.

So EPRI -- so folks from EPRI, Ramsay Chang, Paul Chu, Charles Offin. Those folks would be there. Again, they mainly manage research, again, but they would be there reporting on it.

Q. Would you see any of the ADA people at these mercury conferences in the 2000 to 2005 time frame?

A. Yes.

Q. Who would you see from ADA who was a regular attendee at these conferences?

A. Sharon Sjostrom for sure. Mike Durham, likely -- or certainly. Jean Bustard. Travis

Starns. Those are the ones that come to mind. Certainly ADA researchers.

Q. So in the 2000 to 2005 time frame, you would have -- do you expect you would have attended presentations from Jean Bustard?

A. More for Sharon Sjostrom. Jean, I think, attended presentations made more by her.

Q. Okay. Do you know how to spell "Sharon Sjostrom"?

A. I could give it a shot. I know it's, like, S-j-o-m-s-t-r-o-m, Sjostrom. There's a "J" in there I know.

Q. Okay.

A. I don't know the exact spelling.

Q. It's the silent "J"?

A. Yeah, yeah.

Q. All right. But Sharon Sjostrom, in the 2000 time frame, was a regular presenter in these mercury conferences?

A. Yeah.

Q. Did you consider Sharon Sjostrom a respectable researcher?

A. Yes.

Q. She knew what she was doing?

A. Oh, they were more focused on testing, so

it's kind of researcher/tester-demonstrator. They knew how to inject a carbon and how to analyze the mercury.

Q. And do you know if Sharon Sjostrom attended any of your presentations?

A. I presume so. I mean, she went to the Air Quality Conference, and she was part that circle of mercury researchers or testers involved.

Q. Another person who was, I'm sure you know, involved in the case is Ed Cichanowitz.

Do you -- is that a person that you're familiar with?

A. Well, the name is familiar. I don't know if I can put a face to it, but the name is familiar.

Q. Was Ed -- how do I pronounce that name? Do you know?

A. No, I don't. I don't want to give it a shot.

Q. Okay. Was -- did Ed Cichanowitz attend any of these conferences where you were presenting?

A. Likely. I don't know for certain. I would say any of them, but specifically which ones, I probably wouldn't be able to define at

this point.

Q. Do you recall seeing any of his conference presentations?

A. I think at one -- certainly one or two. More in review or sitting in on.

Q. Do you know what Ed Cichanowitz's role was in mercury removal in 2000 and 2005 time frame?

A. Not his primary role, no.

Q. Do you know in any role that he played?

A. Not that I can recall.

Q. All right. Did Steve Nixon present at any of these conferences in 2000 to 2005 that you're aware of?

A. Yeah, he seemed like he came a little later onto the scene. More, like, in 2003, '4. I don't recall any presentations, say, in 2000, 2001, 2002.

Q. Do you recall reading any of Dr. Nixon papers?

A. I remember sitting in some of his presentations and some of his papers, yes.

Q. Did Dr. Nixon seem like he knew what he was talking about in terms of mercury chemistry?

A. Not initially.

Q. You didn't like his papers?

A. It's not that I didn't like him. I remember the first time I met him. It was sometime in '03/early '04, sometime in that time frame, and his presentation was focused exclusively on gas phase oxidation of mercury, and we ran a unit at that time that -- gas phase oxidation, you couldn't use that approach to predict the oxidation of mercury, as I explained earlier. Homogeneous, simple -- I say "simple."

Even if you threw in 20 equations, you'd still get it wrong. And that was kind of what he presented in issuing, because I remember talking with him after that because I said, "You need to focus on heterogeneous reactions if you're going to improve your model," of which he did do. I mean, following his -- his following presentations got much better. But not initially.

Q. I think maybe this is -- is this where you talked about earlier that it's nearly impossible to predict what's going on in the gas phase of a combustion chamber?

A. Yes.

Q. Sorry. Let me finish.

By "predict," I mean, like, run a

computer simulation of?

A. Yes, correct, especially if you're focused on gas phase reactions.

Q. All right. One other name I'm sure you're familiar with is Bernhard Vosteen.

Is that a person you know of?

A. It is.

Q. Did Bernhard Vosteen attend the same conferences you did?

A. Certainly later on. Don't recall early on. But later on, yes.

Q. Did you come to learn of Dr. Vosteen's work with mercury?

A. I did.

Q. Did you attempt any of Dr. Vosteen's presentations on mercury?

A. I did.

Q. Did you have any site discussions with Dr. Vosteen about mercury?

A. Again, probably later. On maybe in the '05/'06 time frame or '07, but not in the old 2002, 2004. I believe I became aware of some of his work in the 2004 time frame.

Q. How did you become aware of Dr. Vosteen's work in 2004?

A. Some paper or something we ran across.
Q. Do you have any better recollection or more specifics than that?
A. I don't. I just remember becoming aware of him at that time.
Q. At -- and this is in 2004?
A. That's what I -- my best recollection would be in that time frame.
Q. Do you remember why the 2004 date sticks out?
A. Well, part of it is I know we were in the process of putting together the provisional unit. Probably came about during that time as to, okay, yeah, he's doing this work out here. Who is he? What's he doing? Because that way he's listed as a reference in the provisional. But other than that, I -- that's probably when I became aware of it.
Q. In 2004, what did you understand about Dr. Vosteen's work?
A. My understanding, he was doing some work by adding in a bromine additive to the combustor, and that was to promote oxidation for removal of mercury in a scrubber.
Q. Do you know what bromine additive

Dr. Vosteen was adding to the combustor?

A. At that time, probably not specifically.

Q. Do you know -- did you know, in 2004, whether Dr. Vosteen was adding any kind of bromine additive to coal?

A. Yeah, I would say that at that time, we did. I was aware of that, yes.

Q. And in 2004, you knew that Dr. Vosteen was adding bromine additive to coal, based on reviewing some of his work?

A. Probably some paper or something that came out from the literature search on whatever. "Okay. Here's the paper. He's doing this."

How much time I spent on that, I don't recall if it was half hour or five minutes. But I do recall becoming aware of it at that time.

Q. Did you ever come to learn what sort of bromine additive Dr. Vosteen was using?

A. Per his publication and application patents that I've read. Yeah, some of his examples speak to specific compounds that he was -- that he was actually adding.

Q. What specific compounds was Dr. Vosteen adding to coal?

A. Well, he mentioned sodium bromide in one

of his examples, that he added sodium bromide. So I mean, the only example he has in his publication that speaks to co-fired plants as -- he was adding sodium bromide.

Q. Had you heard the term "KNX"?

A. I have heard of that.

Q. What is KNX?

A. I don't really know what it stands for. It's -- I believe it's an Alstom. And then I don't know if it's a product name, name for a technology. I mean, I know kind of generally what it refers to, but I'd tie it more to Alstom, I guess.

Q. What's your best understanding of what's in KNX?

A. My best understanding is it's -- they licensed something from Vosteen, so I assume it's bromine. It's a bromine additive.

Q. When did you come to learn about KNX?

A. After '05.

Q. Who is Alstom?

A. Alstom is a -- I believe they are a large supplier of air heater equipment -- air preheater equipment. So they provide different equipment to -- for a power plant -- to build a power plant.

Q. The sodium bromide that Dr. Vosteen was using, do you know what state of matter it was?

A. Are you referring to what form?

Q. Yes.

A. I -- I don't know if I knew at that time, but eventually, yeah, it was calcium bromide that I learned at some point.

Q. Okay. Do you know whether Dr. -- the -- I think you mentioned that in 2004, you knew that Dr. Vosteen was applying some kind of bromine compound to coal, correct?

A. Um-hum.

Q. Do you know if that bromine compound was a gas? A liquid? An aqueous solution? Something else? A solid?

A. Solid.

Q. Dr. Vosteen was applying solid sodium bromide to coal in 2004?

A. Yes.

Q. Okay. Do you know whether he was applying solid bromide to coal before 2004?

A. Probably not, no. Don't recall that, anyway. I wasn't aware of it till in that 2004 time frame.

Q. Got it.

So Dr. Vosteen may have been applying sodium bromide to coal before 2004? You just didn't learn about it until 2004?

A. That's a fair statement.

Q. Okay. And in your test at the PTC, you also applied sodium bromide to coal, correct?

A. Correct.

Q. Is sodium bromide NaBr?

A. Yes.

Q. And the sodium bromide you applied to coal, was -- was it in solid form?

A. Powder form.

(Speaking simultaneously.)

Q. So sodium -- I'm sorry?

A. Yes.

Q. Okay. The sodium bromide you applied to coal was a powder?

A. Yes.

Q. Was the sodium bromide you applied to coal dissolved in water?

A. No, we mixed it in with the coal.

Q. In what form was the coal when you mixed sodium bromide into it?

A. Solid -- I mean, coal contains some moisture, but it was in a solid form --

Q. Was the coal --
A. -- pulverized form.
Q. Thank you. That's what I was asking.
So when you mixed sodium bromide to coal, you applied it -- at the PTC, you applied powdered sodium bromide mixed with pulverized coal; is that right?
A. Yes.
Q. You did not apply aqueous sodium bromide to pulverized coal; is that also correct?
A. Correct.
Q. And you understand "aqueous" just means dissolved in water, correct?
A. Yes.
Q. Okay. And when sodium bromide is put in water, it becomes like a saltwater, right?
A. Correct.
Q. In the 2002 to 2005 time frame, did you use sodium bromide in any other state of matter, whether solid, liquid, gas, other than the powdered sodium bromide you just discussed?
A. Just powered form -- or solid form.
Q. Okay. So for example, did you ever experiment with some kind of an organic solvent for the sodium bromide?

A. No, it wasn't necessary. I mean, whatever form you put on the coal, it doesn't matter what the form number -- what the form of bromide is or bromine that you're putting on the coal, because under combustion, that form changes. So it doesn't matter whether it's aqueous, solid, organic, inorganic. It really doesn't matter once it hits the combustor.

Q. You mean it doesn't matter to the end result; is that right?

A. Yeah, I mean, everything -- once it hits the combustor, whatever form you put in is not the form that's downstream of the combustor.

Q. Okay. Did you ever test potassium bromide?

A. I don't know pota- -- I think we tested iron bromide. I don't know if we tested potassium bromide.

Q. When did you test iron bromide?

A. I think we did a Shore test in February of '04.

Q. So would that have been recorded anywhere?

A. Possibly in a logbook.

Q. Would you have reported that to any of

the funding agencies, that you tried iron bromide?

A. Again, not necessary. I mean, any form of bromine into the combustor, we could have said any form of bromine, so it didn't matter.

Q. And I understand that. I'm just really just trying to figure out the specific things you used to test.

So am I correct that you did not report iron bromide to the funding agencies?

A. I don't believe we did.

Q. Okay. Did you -- in the 2002 to 2005 time frame, did you ever test calcium bromide?

A. Tested calcium chloride? I don't know if we ever tested calcium bromide. I don't recall -- I don't recall doing it, but ...

Q. Okay. I didn't see a reference to it. That's why I'm asking if maybe you recall.

So you don't recall testing calcium bromide, correct?

A. I don't.

Q. Sorry. That was "I don't"?

A. I don't.

Q. Okay. Do -- other than powdered sodium bromide, do you recall applying to coal any other form of bromine-containing ingredient?

A. Other than the iron bromide, I don't believe so. Again, the aqueous form was harder to handle, and really no reason to do it. So I don't recall of testing anything between -- besides those two.

Q. All right. And if the aqueous form of sodium bromide was hard to handle, then hydrogen bromide would have been even harder to handle, correct?

A. Correct.

Q. And Br2 would have been even harder to handle?

A. Correct.

Q. So, again, between the span of 2002 to 2005, the only bromine-containing ingredients that you experimented with applying to coal was powdered sodium bromide and possibly iron bromide?

A. Correct. I'll preface that that during that entire time frame, I wasn't the only one doing, you know, mercury testing. There were other researchers. Once the invention came to be known within the EERC, other projects were using bromine as an additive.

Q. Okay. But -- and I'm just asking about your personal knowledge --

A. Yes.
Q. -- what you know about.
A. Yes.
Q. When did your invention come to be known within EERC?
A. Within EERC? In the August 2002 time frame. So August of 2002 is when we first did tests with sodium bromide on coal in conjunction with activated carbon.
Q. Okay. Were you able to find any documentation of sodium bromide on coal with activated carbon from August of 2002?
A. Just a document that I'd put together, that was presented to the Research Advisory Committee on September 9th of 2002 to talk about ongoing and future research to secure funding to pursue additional research.
Q. And that Br that -- where you're talking about bromine and sea ice?
A. That's -- that was the preface, but we're already talking about understanding bromine and the interaction of bromine between NOx and SOx. The potential interference or interaction with NOx and SOx in a real flue gas environment. That's really where we were describing, the use of the

bromine.

Q. Got it.

And you know you prepared a few declarations for these proceedings, right?

A. Correct.

Q. Do you have those handy? I can also --

A. I have the declarations, but I would prefer you just download them so I don't have to --

(Speaking simultaneously.)

Q. Yeah, I --

A. -- root around in my machine to find them.

Q. That's totally fair. Let's do that.

Give me one moment to send those to you, please.

A. (Complied.)

Q. Okay. I am sending to you two exhibits. They were both originally marked 20- -- Exhibit 2046. And publicly filed.

Just for purposes of today, I've labeled Exhibit 204- -- -46a as the declaration you signed on December 12th, 2025, and Exhibit 2046b as the declaration you signed on January 20th, 2026.

(Exhibits 2046a and 2046b referenced.)

BY MR. TOBIN:

Q. Do you have the files?

A. I do.

Q. Okay. Why don't we go through those. Let's do Exhibit 2046a first, please.

And, you know, before I do that -- because I know I'm going to forget -- are you still in touch with any of your co-inventors, either Mr. Holmes or Dr. Olson?

A. I haven't spoke with Dr. Olson for many years. Likewise with Mr. Holmes. I think I ran into him once two, three years ago.

Q. Okay.

A. We had some casual conversations on fishing.

Q. All right. Very good.

So do you have Exhibit 2046a open?

A. I do.

Q. And if you look at paragraph 2, it says that this declaration you made was for purposes of the '114 patent and the '517 patent?

A. I see that.

Q. If you look at .pdf page 33, which is also exhibit page 33, you signed Exhibit 2046a on

December 12th, 2025?

A. I'm getting down there. But I remember signing it. I'm just trying to get to that. You said page 23?

Q. 33.

A. 33. Yes, I do see that.

Q. Okay. If you look at the top of -- are you using Adobe .pdf reader?

A. I am.

Q. Okay. If you look at the top -- I guess it's in the metadata -- it says, "Declaration under 1.3 -- -132 sample."

Do you see that?

A. Yeah, I don't see that.

Q. You don't see that?

A. I said -- this appears to be the wrong document.

Q. No, I mean, all the way at the top of the window of your screen.

A. Oh, way up there. Yeah, I see (as read) "EX100a" -- in parentheses -- "(U.S. 10343114)."

Q. And look a little bit higher up. Do you see it in the title -- anything in the title of the .pdf in the tab?

A. (As read) "Declaration under 132" -- I

can't read it all, but ...

Q. It says, "Declaration" from -- "Declaration under 1.132 sample."

Do you see that?

A. I do, yeah. I had to zoom in on that. Okay.

Q. Do you have any idea what that means?

A. I really don't. I mean, obviously, it's a declaration. In terms of "1.132 sample," I'm not quite sure what that means.

Q. Okay. No moment.

Why don't you open Exhibit 2046b, please.

A. 2046b?

Q. Yes.

MR. TOBIN: And for the record, 2046 -- withdrawn.

2046a was filed as Exhibit 2046 in the -274, -278, -280, and -281 proceedings.

And what was labeled here today as 2046b was filed as Exhibit 2046 in the -422, -423, -424, and -425 proceedings.

BY MR. TOBIN:

Q. That's for the record, not for you.

You see on paragraph 2 -- what's labeled Exhibit 2046b, it refers to the '430 and the '225 patents?

A. (Examined exhibit.) Yes, I see that.

Q. And then on paragraph 33, you signed the declaration on January 20th, 2026?

A. Yes.

Q. Was it your intention for the two declara- -- and I'm not talking about the -- withdrawn.

Do you see at the end of each declaration, there's, like, 100 pages of a table?

A. I do.

Q. Okay. So I'm not asking about that yet.

But do you see how before that both declarations are 59 paragraphs long?

A. (Examined exhibit.) I do see that, yes.

Q. Okay. And then other than maybe changing out the patent names, is it your understanding that these two declarations are almost identical?

A. Yes.

Q. Okay. And is it fair to say you used the first declaration as a starting point for your second declaration and then just swapped out a few of the patent numbers?

A. That'd be fair to say.
Q. Okay. So I'll probably focus more on the 2046a declaration. But you would expect, again, from paragraphs 1 to 59, the content is identical to the 2046b declaration, right?
A. Correct.
Q. Okay. So I want to follow up with something you mentioned, I think, in August. I think you used the date of August of 2002?
A. Correct.
Q. Okay. And in paragraph 29 of your declaration -- do you see that? --
A. I do.
Q. -- you do not discuss here adding a Br ingredient to coal, do you?
A. Not explicitly, but certainly by -- in paragraphs where we say "or other."
Q. But it does not say "Br," correct?
A. Correct.
Q. It does not say "iodine," correct?
A. Correct.
Q. It does not say "astatine" or "fluorine," correct?
A. Correct.
Q. I want to take you to paragraph 9 of your

declaration, if you could, please.

A. (Complied.)

Q. This is where you -- and it's on .pdf 3. This is kind of where you start the -- discuss the genesis of how the United States government started paying more attention to mercury?

A. Correct.

Q. And you talk about the Clean Air Act amendments of 1990, yes?

A. Yes.

Q. And the EPA established EERC in 1992?

A. Yes -- well, it established the Center for Air Toxic Metals.

Q. Oh, excuse me. The EPA established the CATM in 1992?

A. Correct.

Q. And then you were brought on board in 1993?

A. Yes.

Q. Did you actually work for the CATM?

A. Well, again, that's -- the CATM, the Center for Air Toxic Metals, is a funded program within the EERC.

Q. Okay.

A. So I worked for the EERC. The Center for

Toxic Metal was a program -- a research program within the EERC. Did I work on that program or that project? Yes. Did I work directly? I worked directly for the EERC.

Q. I understand what you're saying, and thank you for being precise on that.

Have you heard the abbreviation "HAP," for hazardous air pollutant?

A. HAPs, yes.

Q. Okay. For control of hazardous air pollutants, the Clean Air Act amendments required certain degrees of reduction in emissions of that regulated pollutant, correct?

A. Regulated pollutants, yes.

Q. And at some point, the EPA issued a Maximum Achievable Control Technology standards, correct?

A. That was the basis of the standard, yes.

Q. Do you abbreviate that as "MACT standards"?

A. It really became a CAMR standard, Clean Air Act Mercury Rule, but it was based on applying a MACT, which is the Maximum Achievable Control Technology approach.

Q. The MACT was based on the average

emission level achieved by controls on the best performing 12 percent of existing sources by category of industrial and utility sources?

A. That sounds right.

Q. When was this CAMR rule passed?

A. Well, it was supposed to become in effect in 2007.

Q. Okay. So the CAMR -- and you said "supposed to," but it actually got delayed?

A. Got vacated. I mean, got challenged in court, and obviously -- not "obviously." It never came to be because of the challenge -- the legal challenge.

Q. Okay. So can you -- let me know. I think you mentioned that 2000 to 2005 was a hotbed of mercury research; is that right?

A. Correct.

Q. Help put together the pieces for me between the Clean Air Act amendments or the CAMR how -- or if, those are what spawned that hotbed of mercury research in 2000 to 2005.

A. I'll try to be succinct.

The Clean Air Act amendments of 1990 required EPA to do studies on hazardous air pollutants. As part of that, they focused on

HAPs. They had to do one specific on utilities. So there's the two reports.

The one focused on issues related to utilities exclusively, which included not just mercury but selenium, cadmium, arsenic, lead, what was considered air toxic metals within that industry.

The report on mercury was the issue related to co-fired utilities and the concern of controlling mercury from that facility. Those facilities, those plants, in other words, on any and all plants burning coal that generate electricity come into that report.

And the outcome of that report was that mercury needed to be regulated -- or it was determined to be a footnote concern and was to be regulated. That report came out in '97/'98.

The follow-on to that was EPA announced that they were going to pursue regulations. The time frame laid out for that was roughly 2000 to 2004. So 2003 to 2004, they were going to promulgate. In other words, put out emissions. And subsequent to that, regulations, i.e., the 2007 Clean Air Mercury Rule, was to be promulgated. And then regulations are going to

take effect.

Q. And thank you for that. That's what I was asking.

So for -- you understand -- I think there's a difference between the EPA promulgating a rule versus a rule becoming enforced, correct?

A. Absolutely, yes.

Q. And when the EPA promulgates a rule, that's when they give -- know -- they say kind of like, "Heads-up, industry. This rule is coming your way." Is that fair?

A. It's probably a little more defined than that. In other words, if there's more structure to that. In other words, it may not just be one sense. It might be "We're gonna do it, and here's generally and more specifically how we're going to do it."

Q. Fair point.

But the EPA gave the industry notice -- several years' notice that said "Here are the rules we are proposing, and we may enact them several years later." Is that fair?

A. Yeah, that's a fair statement.

Q. And so did that spawn a flurry in the industry from 2000 to 2005 to figure out solutions

to remove mercury so that plants could eventually become compliant with the rules?

A. Yeah, it spurred inventive techniques -- technology to remove mercury from the co-fired power plants -- probably in the 2001/2002 time frame -- to -- really, by 2004, the expectation was that there'd be technology available. So it's a pretty short window.

I mean, initially, EPA assumed that technology that was being applied to incineration -- in particular NWCs -- would apply directly to co-fired power plants.

That became challenged by many researchers, including us, EERC, and DOE, basically stating that, "No, those technologies are not applicable to co-fired plants," because of many different reasons, but -- and so then the shift went from, "No, you can't apply these technologies" to "We need" -- "we obviously need technology."

And so that everybody -- not gonna say "everybody" -- all the researchers and everything are going to focus on mercury control technology specific to co-fired power plants.

And about the same time, EPA had

issued a ICR, Information Collection Request, which is what you kind of restated, the best -- average of the best 12 percent, so to speak. That's where that data came from. So that was about 2000/2001, when that information became available.

So yeah, the focus turned to coming up with technology but really coming up with technologies for low-rank coals. Because that data demonstrated that some of the plants burning bituminous coal, you put -- the scrubbers are able to get 80/90 percent mercury capture essentially by doing nothing.

Q. So what's your best recollection of the specific date when EPA promulgated the rule that spawned the flurry in the coal/mercury removal research industry?

A. I won't use the word "promulgation." I will use the word "announced."

Q. That's more technical. Please, so why don't you -- and thank you for that correction. I understand the distinction you're making. Let me ask a different question.

What's your best recollection of the specific date when EPA announced the rule that

spawned the flurry of research in the coal/mercury removal research industry?

A. That would have been in the 2000/2001 time frame. The ICR data came out in '99. They took some time going through that data, at least a year. So in the 2000 time frame, they would have had some of that information available. And so then that is what they based that -- their judgment on and determination on that regulation would be forthcoming, based on that information.

Q. Can you -- do you have a way to be more precise than 2000/2001 for when that ICR came out that really got the mercury research community in a flurry of activity?

A. Well, I mean, the ICR data became available in 1999, to my understanding and recollection. When I say "became available," that's when it was -- they required utilities to actually go out and measure mercury in their stacks and so forth and provide that information to EPA as part of the ICR request.

So that information was funneling in. And the compilation of that would have been, you know, later, '99 or, you know, the 2000 time frame when that data was coming in and they were

compiling it and making some of those determinations.

Q. In 2000 -- withdrawn.

So -- so is it really just a three- or four-year period when the bulk of this mercury research -- removal research took place?

A. The bulk of the innovation took place, yeah, from 2002 to probably not even about three years. Probably two years. I mean, and there's a lot of innovation that occurred in -- from '02 to '04. Going into '04, demonstration field tests were already starting. In other words, field test, meaning our demonstrating a technology that was invented, so ...

Q. Got it.

A. So that invention had occurred already. It occurred in '02 to '04 -- '02 to '04 time frame.

Q. So does the word "field test" mean demonstration of existing technology to you?

A. Yeah, that was -- DOE didn't want to call it demonstration for -- I don't know if for political reasons or regulatory limit reasons. They called it "field tests." They didn't call it "demonstrations." But essentially, that is what

it meant. You're gonna demonstrate it at large scale in the field to prove out the level of mercury reduction.

Q. Prior to 2002, let's say, there were certain plants that were already taking steps to mitigate mercury; is that fair?

A. I don't know if they were taking steps. I mean, it certainly learned -- like I say, if you're burning a bituminous coal, the ICR data -- because a lot of utilities probably weren't willingly analyzing or testing their stack emissions, so ...

But certainly, they became aware of that data that -- yeah, I mean, if you're burning bituminous coal and you have a scrubber, gee, you know, you're getting 80/90 percent removal.

Were they taking measures to improve upon that? They were perhaps looking into ways to do it, but I don't think they were taking measures to do it.

Q. What were some of the other -- the lower -- but you said -- withdrawn.

Bituminous you would say is a high-ranked coal?

A. Yes.

Q. Would you consider lignite a low-ranked coal?

A. Yes.

Q. What about anthracite? Is that a low-ranked coal?

A. No, that's a very high rank. That's higher ranked than bituminous.

Q. What about subbituminous? Would you consider that a low-rank coal or a high-rank coal?

A. Low-rank.

Q. So what existing mercury remediation techniques were low-ranked coal plants doing in 2002 to remove mercury?

A. They weren't doing anything, I mean, in that time frame. They were valuating, looking at potential. I mean, we had done testing, I mean, the two -- maybe even before 2000 -- looking at flue gas conditions that were representative of low-rank coals and tested different sorbents.

So -- but, again, in terms of what was being applied in the field, one was adding sorbents. They were looking at what could be done, what could be employed.

Q. Had sorbent injection been tested for removing mercury prior to 2002?

A. We tested sorbent -- different sorbents, activated carbons, and ESP, fabric filters, using lignite. And we were getting -- I don't know -- 40/50 percent removal. Better with a fabric filter. And that was also proven out in the ICR, that he units equipped with fabric filters got more mercury removal naturally. They didn't do anything extra. They just got better mercury removal.

So that was part of what came out of the ICR, although we had really known that by that time, because we'd done pilot scale tests using just sorbents, not additives or not -- you know, or not improved sorbents. Just plain solvents.

Q. By 2002, do you think that you and your colleagues at EERC were the only ones who knew about activated carbon injection?

A. No, I mean, activated carbon injection is pretty well-known throughout time. I mean, we certainly didn't invent the activated carbon injection, actually, the technique of doing that.

But, you know, that had been done -- I believe PAC injection, powdered activated carbon injection, was being employed at, again, incinerators -- waste incinerators probably in the

mid-'90 or '96/'97 time frame.

So the concept of injecting a powdered activated carbon certainly was known, you know, the concept of doing that or how to do it. Again, it was done at probably smaller scale, because utilities are large scale. Everything would have to be bigger.

Q. Sure.

A. And so maybe that hadn't been demonstrated, but the concept has. And we had been doing it, and others had been doing that.

Q. And the specific application for -- withdrawn.

Activated carbon sorbent can bind to a lot of different things beyond mercury. Would you agree?

A. Yeah, I mean, it's used for organic removal -- removing organic, for example, dioxins and furans. I mean, it's not -- wasn't designed at that time for mercury, but certainly, throughout the years, it had been used for other purposes, other contaminant removal.

Q. Or at least since the mid-1990s, activated carbon injection was being used, with one of its applications being from mercury

removal, right?

A. Yeah, at -- municipal waste combustors, which at the time, EPA came out with their announcement -- made the announcement that PAC would be used and could accomplish mercury removal to a high degree.

We wrote a letter and DOE wrote a letter and said, "No, it doesn't apply to co-fired utilities, because the flue gas composition is so significantly different that you can't apply to that technology directly to" -- "and expect to have the same level of removal as waste combustors."

Because the flue gas concentration is drastically different, and mercury concentrations are in order of ten or a hundred times higher. Bromine concentrations are higher. I mean, everything's different. And so all of that comes into play in terms of how effective that would be in a co-fired plant.

Q. At least in 2000 -- and I think you mentioned it was -- the IPR is -- or what -- IRP -- what's the abbreviation?

A. ICR.

Q. Excuse me. ICR.

But in the ICR that the EPA announced in 2000 to 2001, one of the options that the EPA told the industry to look at for mercury removal was activated carbon injection, right?

A. Well, no, they didn't tell -- they simply sampled a number of utilities in terms of what they were doing. In other words, if they had a scrubber to remove SO2, how much mercury were they getting removed?

The EPA did not instruct the utilities to add carbon and then see what their emissions were. They instructed them to say, "Tell us what is currently being done, what technologies."

Really, there wasn't technology. If you had a scrubber, it was SO2. But the co-benefit of that was you also got mercury removal. And that information came out off the ICR.

Q. What other --

A. Instructing them to employ activated carbon injection, that wasn't part of the ICR. Unless they were already doing it for other reasons, they weren't instructed to do it.

Q. And to be clear, I didn't use the word "instruct" in my question. Let me repeat my

question.

In the ICR that the EPA announced in 2000 to 2001, one of the options that the EPA told the industry to look at for mercury removal was activated carbon injection?

A. That's not correct. They told a of sample utilities that if they had been injecting activated carbon, they'd tell them to do it. But if they had been, for some other reason, they were to report the emissions based on coal type and configuration.

In other words, what's the configuration of the power plant. Do they have a ESP fabric filter? Do they have a scrubber? What coal are they burning? And then report the emissions associated with that combination.

Q. And 2000 to 2001, again, the EPA put in their ICR that one of the known options was activated carbon injection. Is that fair?

A. No, they didn't put that in as an option. What they got out of the ICR was data based on a sampling of units that burned bituminous coal, that burned low-ranking coals, bituminous, and that also burnt lignite.

Some of those plants are ESPs. Some

of those plants have fabric filters. Some of those plants had scrubbers. They tried to pick a variety of plants, so they didn't all have scrubbers, and they didn't all have ESPs. And so the outcome of that was what are the mercury emissions that came out of those different configurations.

Q. In 2000 to 2001, were any coal plants using activated carbon injection?

A. I don't recall. I mean, certainly, none of them were intentionally doing it, not for mercury control.

Q. Were they using activated carbon injection for other purposes in 2000 to 2001?

A. I don't recall.

Q. So let's ---and, again, 2000 to 2001 is still three to four years before you filed your provisional application, right?

A. Correct.

Q. And in the span between the ICR, in 2000/2001, and when you filed your earliest patent application, is it fair to say that that was three to four years of active research in the industry?

A. 2001 to 2004 became very active. Really, 2002 to 2004 is really when it became highly

active. Up to then people were securing funding and getting ramped up for that research.

Q. DOE is Department of Energy?

A. Correct.

Q. Within the DOE --

MR. NEMUNAITIS: If you're getting close to a stopping point, I'd like to take a lunch break soon. I think we're up at the one-hour mark. Yeah.

THE WITNESS: I'm fine with going on.

MR. TOBIN: Give me about three more minutes, and let's take a break, if that's all right.

BY MR. TOBIN:

Q. Within DOE is NETL?

A. Correct.

Q. What does "NETL" stand for?

A. National Energy Technology Laboratory.

Q. In 2000 to 2001 time period, did DOE -- is it "DOE/NETL" or "DOE-NETL"?

A. I think it's dash. It's a department or lab within DOE.

Q. Thomas Feeley worked at NETL?

A. Yes.

Q. In 2000 to 2001, did DOE announce that funding would be available for industry to conduct mercury research?

A. It was in the '01/'02 time frame where they were gearing up for these field tests, but they had initiated some other projects, i.e., the one that was referenced as the Starns reference.

That testing was done earlier. But that testing was really to demonstrate that mercury control under lowering coals is difficult. They wanted to have data to prove that, but there was already data out there that showed that.

Q. Is it fair to say that DOE-NETL funding spawned in a flurry of research in 2001, 2002, 2003?

A. Yes.

Q. And, in fact, the research that led to these patents was funded by the DOE-NETL, right?

A. Correct.

MR. TOBIN: Let's take a break.

THE COURT REPORTER: All right.

We're off the record at 12:37 p.m.

(A lunch recess taken from 12:37 p.m. to 1:14 p.m.)

AFTERNOON SESSION

THE COURT REPORTER: We're back on the record at 1:14 p.m.

EXAMINATION (CONTINUED)

BY MR. TOBIN:

Q. Welcome back from lunch, Mr. Pavlish.

Do you still have your declaration in front of you?

A. I do.

Q. Okay. Let's open up the 114 and 517 declaration -- I mean, the question should apply to both.

I think with where we left off before lunch was that the research that you and your team performed that ultimately led to the ME2C patents was funded by DOE-NETL; is that correct?

A. Yes.

Q. I'm at Paragraph 19 of your declaration. But am I correct that in February 2002, you received a commitment for a first round of funding?

A. I apologize. I'm trying to get there.

Q. No problem. Page 9.

A. Yeah, I'm -- yeah, I see that. November 19.

Q. Let me reask the question now that you're at the right place. By February 2002, the EERC obtained a commitment from DOE to provide funding for your carbon based sorbent project?

A. Correct.

Q. How much was that grant for?

A. I don't recall the exact number, but it was a million plus.

Q. And oftentimes grants will be for a certain time period of funding; is that right?

A. Correct.

Q. How long was your funding for in the first funding from DOE?

A. I don't recall that exactly, but I'm sure it would have been a year plus.

Q. It wouldn't have been five years, right?

A. No, no.

Q. And I guess -- let me be specific. I'm talking about Grant Number DE-FC26-98FT40321. Is that what you understand to be the first round of funding from DOE?

A. Specific to this testing. We had other DOE funding prior to this, certainly. And we've had ongoing -- he or she had ongoing funding from DOE for 20, 30 years. But specific to this

testing, that was the agreement.

Q. And one of the goals -- withdrawn.

That long grant number that ends in -98FT40321, you call it JV Task 45?

A. That was -- yeah, that's just a terminology within -- how EERC tracked different funding activities through DOE. I mentioned -- other products funded by DOE, so ...

Q. What does "JV" stand for? Do you know?

A. Joint venture.

Q. What does the 45 refer to?

A. Probably just Number 45 of the different projects that are funded through DOE and the joint -- the JV means that we have industrial partners. It's a joint venture.

Q. Who is your industrial partner for JV Task 45?

A. I don't recall all of them, but this task was specifically aimed at coming up with technology for lignite-fired utilities. So I'm sure I know Basin was. Minnkota. All of the North Dakota utilities were on board. I think we also had SaskPower Canada. Five or six different partners that provided some level of funding in conjunction -- or in addition to the DOE.

Q. Was the ADA one of the research -- one of your research partners?
A. No.
Q. Again, in -- did you submit -- did -- was there an RFP involved in this process?
A. No.
Q. Did you submit a proposal to DOE to get the funding in JV Task 45?
A. I would assume so -- presume so, yes. We had to find something and -- a proposal to get that funding.
Q. And when was the last time you saw that proposal?
A. Probably the time it was submitted.
Q. Okay. Do you know if the funding for JV Test 45 still exists?
A. No idea.
Q. Certainly not something you have access to, right?
A. No.
Q. Okay. "No" as in you don't have access to?
A. I don't have access. I don't.
Q. Okay.
A. I don't know how long they keep their

records.

Q. Okay. Do you recall, were you one of the authors of the proposal to get JV Test 45 funding?

A. I'm sure I was.

Q. Do you know who else was an author?

A. Probably Mike Holmes, one of the co-inventors. I know him and I were heading up this lignite initiative, trying to come up with mercury control technology specific to lignite energy -- lignite-fired coal -- lignite coal-fired plants. So him and I were heading that up.

Q. Is there a formation or basin in the area that was providing for lignite coal?

A. Yeah, it would have been through our industrial partners of the fort region area of North Dakota, primarily coming out of North Dakota.

Q. In order to receive DOE-NETL funding, did you have to provide any deliverables?

A. A report.

Q. What was the requirement of reports that you had to provide DOE-NETL to your funding agreement?

A. Just document testing and results.

Q. How frequently would you need to submit

reports to DOE-NETL in this JV Task 45 project?

A. This one? Probably -- I'm not certain. But probably would have required quarterly. If it didn't require quarterly, then there will be, like, a review meeting and eventually the final report when the project is near finished.

Q. Was that typical of DOE grants, at the time you were familiar with, where you had to provide a report and then a final report when done?

A. Yes, that was typical, pretty common.

Q. Do you remember who your contact was -- withdrawn.

Would you be the person who would actually send the reports to DOE-NETL?

A. The official transfer would probably go through our legal group. But would I be an author, yeah? Would I review it and finalize it? Yes. I personally wouldn't be the one to transfer the document.

Q. So you wouldn't hit the "Send" button on the DOE reports?

A. Correct.

Q. But you were heavily involved in them?

A. Correct.

Q. And would you check that the reports -- before sending to the DOE-NETL, would you check that the reports were accurate, complete, well-written, all that?

A. Yes.

Q. And if they weren't, you would fix it before sending, right?

A. Yes.

Q. Do you remember the contact at DOE-NETL who'd receive your research reports?

A. Well, probably at this time, it was Tom Brown. We'd been working with Tom Brown, and that eventually became Tom Feeley. Tom Feeley took over the work that Tom Brown was doing.

Q. Now, what was required to be included in reports you would send to DOE-NETL?

A. There wasn't any -- to my understanding, there wasn't a specific requirement, other than to document, you know, in a sense, what did you have in your proposal and, in a way, what did you promise in way of testing.

Sometimes it was exploratory, so it would be broadly defined. But pretty much, you know, exactly that. What did he test? What were the results? And a conclusion usually, or summary

as to what the overall project revealed.

Q. Okay. And is that answer where you would provide tests, results, and conclusion -- is that typically what would be included in the DOE -- in the report you sent to DOE?

A. Yeah. Yes.

Q. And so what kind of results would you send -- or excuse me.

What kind of test data and results would you send to DOE in your reports?

A. Well, it was, you know, somewhat judgemental on our part in terms of exactly what level of detail. But the focus would be on, well, what's the goal of the project?

If it was this case, obviously, mercury control. Coming up with technology to reduce mercury for lignites.

Generally, you would have in there, you know, what is the coal? What's the properties of the coal? The test, you know, how do you do PTC? Explain that a little bit. The results, they are CMM results or Ontario Hydro results. That information would go in there to document, again, the test results.

And then if there was any ancillary

information like SOx or NOx, if it was relevant, could be included. Or if you're looking at what's in the ash, that could be included. So, again, it depends, I guess, on the emphasis of the project. And then, like I said, generally, try to include some sort a summary or conclusion.

Q. What was the emphasis of the JV Task 45?

A. The emphasis and focus on this was to come up with develop -- develop tests, research mercury control technologies applicable to units, coal units, firing lignite coal. And the end goal was to try to, you know, develop a more effective control approach.

Q. Was there a certain benchmark you were provided by NETL as to what mercury targets they wanted you to achieve?

A. Not at -- not at this stage. I mean, eventually, it became more defined. But at this stage, it was -- you know, we had a general idea of what we could achieve. Like I said, I mentioned 40 -- I mean, so the goal really is can you get 60? Can you get 70.

But there was a requirement that the -- the project didn't fail, you know, if 70 percent wasn't achieved. So it was more what

could be developed? And how far can you push that? And can you get 90? Or can you get 80? 60? 70? Something better than 30 or 40?

Q. Okay. But if let's say the -- why do you say "better than 30 to 40"? Where are you getting that number from?

A. Well, it kind of came from some of data we had already done. We did some testing already before we got to this point. And this is why we were focused on activated carbons was we'd done some testing. And for lignite fired coal, again, in our PTC, it showed not very good removal.

Now, if you had a baghouse, different story, but that's another whole discussion. But inflight capture using an ESP was very limited.

Q. Okay. But at least by February 2002, it was known you could get 30 or 40 percent mercury removal of lignite using -- from lignite using an ESP?

A. Yeah, with -- again, that was different fuel, different coal. That's a general -- general number. I mean, some a little better. Some a little worse. Some are down to 20, so there was a range there.

Q. By February 2020- -- excuse me.

By February 2002, what kind of mercury removal were people able to get from lignite coal using a baghouse?

A. Ummm.

Q. Withdrawn. I'm sorry.

By 2002, what kind of mercury removal could people get from lignite coal using a baghouse with activated carbon injection?

A. Most of that information was just becoming available, so I would say no one.

Again, I refer back to that ICR data. There were no units tested as part of that data-gathering process for a unit that burned lignite, that had a fabric filter. Because those units don't have fabric filters.

Q. Okay. And, again, that's by 2000 -- your answer was by 2001, correct?

A. Yeah, but even going into 2002, I mean, some of those tests were starting, but I mean, they were just beginning. The information wasn't necessarily out there.

Although, like I said, we had done some testing. We had shown that a fabric filter was more effective. I mean, and that was part of the reason and the urgency expressed by our

partners was, you know, we don't want to have to put in a fabric filter and spend a hundred millions of dollars just to capture mercury. And so the focus really was we need a low-cost technology that includes sorbent injection, because that's low cost and easy to implement. So --

Q. How did you --

A. -- pushing pretty hard for that approach.

Q. How did you first learn about activated carbon injection in the context of mercury removal?

A. Oh, boy. We'd done a lot of testing in the late '90s, '98, '97. I mean, we had been doing bench-scale tests with different sorbents, including activated carbon. Again, bench scale isn't the same as in-flight or PTC testing, but -- so I became aware of many different sorbents in that time frame.

Q. So do you recall from whom you became aware of activated carbon injection for mercury removal in the '90s?

A. I wouldn't say "activated carbon injection," but I would say, you know, using an activated carbon and how it may remove mercury.

And we were doing some of those tests under smaller scale.

Now, that didn't involve activated carbon injection into a flue gas and rely on inflight commotion to capture. It goes on a fixed bed. And so, again, it was using different sorbents, but not the same environment -- well, a simulated environment.

Q. And the answer you gave was, like, around 1997?

A. Yeah, I think in '97, I remember we published a graph that showed the interaction between SO2 and NO2 and the significant, dramatic impact it had on mercury capture in -- on the activated carbon in a simulated bench-scale test.

Q. Take a brief detour from this DOE-NETL.

A term used earlier was "PAC," or "powdered activated carbon." Do you recall that?

A. Yes. Yes.

Q. Are there different kinds of activated carbon that are not powdered activated carbon?

A. Yes, there's certainly granulated activated carbon, and that kind of falls in the category of, say, pelletized. You're actually creating, like, a pellet of carbon, much larger

obviously in size.

You know, PAC refers to, you know, a powdered activated carbon. And I might say that the reason -- there's a reason why in the utilities industry we refer to ACI, activated carbon injection, more so than PAC injection.

And the reason for that was back in 2000/2001, when EPA basically came out and said you could apply PAC injection, that we'd had experience and the consideration to co-fired industries. We immediately respond -- and DOE did as well -- and said, "No, that doesn't work."

And at that time, we changed the subtle difference between PAC injection and started calling it "activated carbon injection." So generally, when you talk about carbon injection in the utility industry, you refer to it as "ACI," whereas in the incinerator, you generally call it just "PAC injection."

In both cases, you're injecting a powder. It's a subtle difference, because it was recognized that the carbons that were used in the incineration area would likely not be the same carbons that you would use, you know, in the co-fired power industry.

Q. Okay. And did you ever experiment with granulated activated carbon as part of the DOE-funded mercury removal research?

A. No.

Q. You only tried the powder form of activated carbon, right?

A. Yes.

Q. And when we talked about activated carbon injection, during the course of your research, in 2002 to 2005, where in the process did ACI occur? Like, where along the combustion chain?

A. Most cases upstream on the particular control device, so that would be some distance upstream, whether that's a fabric filter or ESP.

And then in some cases, there's also an air heater that sits in between the PM device and the boiler. And so in some cases, you would actually inject upstream of the air heater just to get some additional resonance and contact time.

Q. Which one of those two options did you try in the 2002 to 2005 time frame?

A. We tried both. I mean, we focus on just upstream of the -- of the PM device, primarily because our PTC, while it does have some heat exchanges, it doesn't truly have, like, an air

heater similar to, like, a full-scale boiler.

So we did a lot of testing on the PTC. And that was upstream of the PM device.

Q. Did -- did your -- am I understanding that your -- that PTC did not have an air preheater?

A. Not -- it did, but not in -- not in the same, you know, way as, say, a full-scale boiler. I mean, it did have one to cool the gases down. But it would have been very difficult for us to inject our sorbent, like, halfway in between the heat exchanger.

Q. Did you ever try injecting your sorbent upstream of the combustion chamber?

A. Rephrase -- or can you reiterate your question, please.

Q. Yeah, did you ever try injecting your sorbent upstream of the combustion chamber?

A. Are you referring now to an activated carbon sorbent, correct?

Q. Yes.

A. No.

Q. Why wouldn't you inject activate carbon sorbent upstream of the combustion chamber?

A. Well, I mean, if you -- activated carbon

is pretty similar to coal. It just has less volatiles, so if you put it into the combustor, it's just going to burn. It's gonna combust.

Q. Oh, and just make CO2 and --

(Speaking simultaneously.)

A. Bringing carbon downstream, so it'd just be CO2 and whatever else it creates.

Q. Oh, okay. So you would only have injected the activated carbon downstream of the combustion chamber at various points, but would it be kind of silly to put activated carbon injected upstream of the combustion chamber?

A. Yeah, I'd say if you're using just activated carbon and you're injecting that in the -- I don't know why you would do it, unless you want to get rid of a waste product.

If for some reason you would have activated carbon that you want to get rid of, you can put it in a combustor, and it -- it'll burn it. You know, it'll destroy it or combust it.

Q. Okay. Kind of like throwing it in the garbage?

A. Yeah, better than that, because in the garbage, it may have other environmental effects, whereas if you put it in a combustion, you pretty

well destroy it.

Q. Okay. It's no longer sorbent at that point, right?

A. Correct.

Q. Are you familiar with something -- so we talked a few -- about a few types of activated carbon.

Are you familiar with something called "B-PAC"?

A. Yes.

Q. What is B-PAC?

A. Brominated powdered activated carbon.

Q. Do you know who came up with the idea for a B-PAC?

A. Depends on who the -- who you look at in terms of patents. You know, Nelson has a patent on B-PAC. NORIT or Cabot obviously produced it in large quantities.

There was different suppliers of it. Who actually came up with that term -- I mean, we tested -- you know, we came up with our own B-PAC as well as part of our exploratory research.

But who actually coined that term I'm not sure.

Q. What is the advantage of using

brominated -- can I call -- if I say "B-PAC," do you understand that I just mean activated carbon with some kind of bromine halogen already stuck to it?

A. I would understand that, yes.

Q. Okay. What are the advantages of using B-PAC?

A. Well, there's a few. One of the advantages, it's more of a -- I guess a conventional approach. In other words, solvents -- particularly activated carbons -- have been known for years to be injected. They know how to do it. And so one of the advantages, it follows more with the conventional wisdom or knowledge, if you will, of how to do and what to do. So it's one advantage.

The other advantage is you can pretreat. In other words, you can load or absorb or -- like, how -- whatever term you want to use -- onto the sorbent in the absence of all other -- we'll call them contaminants, which would exist in a flue gas environment. So you have a much more controlled process. You have much more time.

Usually, these are done in air, so

you're dealing with oxygen and nitrogen. You don't have, you know, NOx or SOx or everything else that might compete.

And so you're able to very much control the time and the temperature and the environment to more adequately -- or accurately, you know, load up that carbon with the -- you know, with a bromine.

Q. What are the disadvantage -- withdrawn.

And all those advantages you just told me about, were those known by 2004/2005?

A. Yeah, I mean, I would say people have pretty good idea. I mean, again, following conventional wisdom, people know how to impregnate sulfur on carbons. People know to impregnate iodine on carbons. So to impregnate or treat, you know, a carbon with a bromine, I mean, yeah, I think the general process or know-how would follow -- you know, granted, maybe the condition changed slightly, but it would follow that thinking.

Q. So in the 2004/2005 time frame, what would be the disadvantages to using B-PAC as opposed to, let's say, your two-part process?

A. Well, one of the primary differences --

and I don't know if it was recognized early on. But, you know, bromine is very corrosive, as we've talked already about. So if you load up a carbon heavily with, say, HBr or Br2 and then you store it, so you put it in a silo. The silos are huge. I mean, two trainloads. I mean, they're huge.

Q. Oh, wow.

A. And you also have blowers and transport lines and control valves. And so all of that equipment then gets exposed to any material that has bromine on it. And if there's any cold spots or any water that can get into those systems, it's gonna form, like we've talked about, this hydrobromic acid. And it's going to eat out, so to speak, corrode away those materials.

And so that's a disadvantage of pretreating versus a two-part, where there's other disadvantages of that too. But, I mean, you don't have the storage -- you're storing a plain carbon. And then you're -- you know, you're performing that process in the flue gas, a much different process. But you're not storing a bromine-containing material in a silo in a blower and transport lines, et cetera.

Q. Was another known disadvantage of B-PAC

compared to regular PAC that B-PAC was more expensive?

A. Well, I think that was to -- it was certainly more expensive than plain carbon. Because you're adding, you know, bromine to it. And there's a process to do that.

You know, at the time, was it more expensive than our two-part process? Well, those economics were being worked out. We certainly felt that we had a technology that was more cost-effective.

But, again, other suppliers would probably argue the opposite, you know, that they're more cost-effective, but that was proven out over time.

Q. I want to turn back to the DOE-NETL work and, again, the JV 45. And is -- and I forget if I asked this or not.

But you tried to be thorough in the reports, present all the test data you had, the results you had, and the good summary?

A. Well, we probably -- we provided -- I always call it, like, the final endpoint. In other words, we tested a different rate and so forth.

But in the end, it's like, "Here's this rate. And here's what was accomplished, the reduction we observed, or whatever, at that rate." And so that's what got reported.

Q. Okay. And the measurables that you provided to DOE, I mean, you wanted to show them what mercury removal you obtained. Is that fair?

A. Using different approaches.

Q. And so you -- in submitting reports to the DOE-NETL, if you had mercury data for a particular test matrix, you would have provided it to the DOE, because that's an important piece of the report, right?

A. Well, again, under the proposal, there's certain requirements in terms of tests. When you talk about exploratory, there's less requirements.

I mean, like, the after-hour tests that we did, you know, in August of 2002, not required to be reported. You know, we didn't include any of that in a proposal. None of that was in discussion.

So these after-hour tests were -- basically, the unit and everything was already running. Could we try something else that would work? And so some -- not all test results got

reported, in that sense.

Q. Okay. But for the test results that were reported, if you had the mercury measurements, you would have provided them so the DOE can see if this test is working or not working, right?

A. Well, again, to reiterate, you know, the after-hour tests, we had the data. I mean, we've seen the results, but we didn't report it because it wasn't part of the thrust of the program.

Q. I do want to ask you about after hours. I mean, would you personally be working at the combustor at night, or kind of the -- were the techs doing it?

A. We started out trying to run a more normal day. But as we got into the test program, there was just a lot of issues that kept coming up. The analyzer didn't work. The coal that we burned slagged up. Well, and all those caused delays.

So we went to almost a 24-hour test period, so that during the day, we couldn't do any testing because we -- took us just that much time to get the unit to -- to kind of, like, line out. And so sometimes we'd start testing at 4:00.

And then we had a certain objective

for that day to get done. Some days we were done by say 2 or 3:00, because everything worked well. And so then everything was running, and that's when we would try to do some of these unusual things.

Q. Were you personally, like, at the combustor late at night running the tests, or were the techs doing it?

A. I wasn't -- the operators and the techs were running the equipment.

Q. Okay.

A. I would be there. Mike Holmes would be there. We'd be the ones saying, "Well, can we try this? Can we try that?" So we would be present, but again, most -- they were running the actual equipment. We were more or less guiding, you know, "Let's put this in here and try it at this."

Q. All right. Let me give you a different document that -- it's Exhibit 2032 across the proceedings, and let me get it into the window for you.

(Exhibit 2032 referenced.)

BY MR. TOBIN:

Q. Let me know when you have Exhibit 2032 open, please.

A. All right. I think I've got it open.
Q. Great.
Exhibit 2032 is a final report for JV Task 45?
A. I don't think it's the final. It might be a quarterly.
Q. If you'd look right below the title.
A. (Examined exhibit.) Yeah, it could be the final quarterly of this. I'm trying to look at the period there. I don't -- I think there was a final report issued in February of '04.
Q. All right. So -- well, how about -- let me ask a different question.
Exhibit 2032 is a report to DOE-NETL for the JV 40- -- JV Task 45, correct?
A. Correct.
Q. Exhibit 2032, at least on the cover, has a month and year of October 2003?
A. Yes.
Q. Does that reflect the month the report was authored or the month the report was sent to DOE-NETL?
A. The month that -- month it was sent should have been October of 2003, and the period should have been as indicated there.

Q. Okay. So Exhibit 2032, is it fair to say that it summarizes measurements, test results, and summaries for testing your group did from February 1st, 2002, to March 31st, 2003?

A. Yes, that's what it should reflect. Yes.

Q. Can you point me to anywhere in October -- in the October 2003 report that mentions bromine of any form?

A. It probably mentions SEA 2.

Q. Can you point me to that?

A. (Examined exhibit.) I'm not sure it mentions SEA 2. That would have been before, so ... I don't think this report would include that, because this was before we did the testing.

Q. Okay. So you're not aware of anywhere in the October 2003 report that refers to bromine, correct?

A. Yeah, I don't think it would.

(Speaking simultaneously.)

A. It's in March when we -- we did the actual testing of the unit as far as putting it into practice in September of '03, so ... And if we would have referred to it, it'd have been SEA 2.

Q. And there's no reference to SEA 2 or

bromine in the October 2003 report, right?

A. I'm not seeing it.

Q. And, in fact, if you want to turn back to declaration, your Exhibit 2046, you can look at either one. I think this might explain it. Go to paragraph 26 of your declaration, please.

A. (Complied.)

Q. Are you there?

A. I am.

Q. And you say, at least in -- four lines down, "At least initially, our work focused on the use of chlorines (chlorides, chlorine, chlorine compounds, chlorine salts, et cetera) as the additive"?

A. Correct.

Q. If you look at Exhibit 2032 -- and you're welcome to search it for NaCl. And I see on page 49 -- excuse me -- page 73 of the exhibit, page 49 of the report. Let me know when you're there.

A. (Examined exhibit.) 49 of the report?

Q. Yes, and page 73 of the exhibit. I'm in Exhibit 2032.

A. Yeah. I'm almost there. There's 49. Yes, I'm on page 49.

Q. And for the test in the October 2003

report, you use NaCl and gaseous HCl, right?
A. Yes.
Q. NaCl is just table salt?
A. NCl?
Q. NaCl?
A. Yes, yes.
Q. The NaCl used was powered NaCl?
A. Yes.
Q. I think it says here that NaCl was added to coal, but HCl was added to the flue gas; is that right?
A. Yes.
Q. And, again, you added HCl to the flue gas because it was too toxic to add to the coal?
A. That wasn't really reason. I mean, the reason was to see if you could add, you know, HCl downstream of the combustor and still have it retain some enhancement or effect on the carbon.
Q. But certainly, you never tried adding HCl to coal, right?
A. No.
Q. And -- "no"? You never tried it?
A. Not to the coal.
Q. When it comes to combustion equipment, what is more corrosive of -- fluorine? Cl,

chloride? Br, bromide? Or I, iodine?

A. Each have different factors. I mean, one would probably say the chlorine, but I don't have really evidence, and that's not really a concern to utilities. At least, it hasn't been.

HCl, yes, because chlorine is in the boilers, manufacturers are pretty well aware of the chlorine content that they're designing the boiler for so they can mitigate, you know, corrosion and use the right materials. So chlorine, obviously, is fairly well understood in terms of being corrosive.

Bromine was assumed to be similar to chlorine. We were asked that question by our industrial partners, eventually. And it was, like, we don't know exactly whether it is more corrosive. Would we expect it to be corrosive? Yes. But would it be -- more or less, we -- you know, we didn't know -- you know, we actually put in a program or a project where we put in sacrificial coupons as well as we tested on a smaller scale to try to quantify whether or not bromine would be more corrosive than chlorine. But certainly, it would be corrosive.

Iodine, what was out in the

literature, at the time, was corrosive. But the main concern was the material embrittlement. That if you used iodine, it was known that it could embrittle and cause the tube services to be brittle and prematurely fail. Not necessarily be due to corrosion, but due to embrittlement.

Q. Do you recall, in your October 2003 report, reporting to the DOE concerns with corrosion, based on the NaCl you were adding to the combustor?

A. I don't recall if we reported it, but it certainly was well-known or common knowledge. And it was a concern to our sponsors at the time as to "You're going to put chlorine in our boiler. We already have it. We don't want any more." And then it was "Well, how much more can you put in?"

So it was a concern throughout the development and testing in terms of, you know, how much you would be adding.

Q. Is it fair to say that it is kind of a trade-off? There was some concerns with corrosion from halogens but potential benefits in terms of mercury removal?

A. Yeah, that's really what it came down to is how much of a corrosion risk.

If you want to quantify it as risk versus, well, how much are we gonna spend to control mercury if we have to put in a better filter?

We're going to spend hundreds of millions of dollars. Weigh that against using a two-part process where you're putting in, say, chlorine and bromine, but now you're able to remove 80 to 90 percent of mercury which -- costs you much less to do that than install other equipment.

Q. So the concern with corrosion was really just a matter of economic trade-off in that you -- yeah, you might have some expenses with corrosion on, if you put halogens on the coal, but you have a much bigger upswing in terms of cost savings in other areas?

A. I think eventually, that's what it came down to. Not initially. Initially, it was -- don't know about bromine. Don't want it in there. We have no experience in it. The risk was pretty great.

And part of it was because of the unknown. And part of it is because if you -- if you cause -- if you cause premature boiler tube

failure due to corrosion, you know, you're talking tens and hundreds of thousands of dollars for that repair too.

And then you're down -- you know, you're down for days and weeks, so it was very much a concern. It wasn't necessarily an even trade-off, initially. It was more do we have a technology that can -- that could be applied, that effectively removes mercury, and then it was do we want to quantify or take that risk.

Q. Where are concerns for corrosion in the combustion system greatest? Is in the hotter areas or the cooler areas?

A. Throughout. The boilers see it on their tubes, the convective paths -- I mean, these boilers have probably a million square feet of surface. There's a lot of metal surfaces throughout the entire boiler, so it's in the boiler and the water well area in the convective paths.

And then as the gas cools, it could happen in, say, the air heater where your temperature -- they call it dew point temperature.

But your temperatures drop at a certain point. Then some of these acids condense

out. And if they do that on the surface and there happens to be a cold spot or moisture available, corrosion obviously can occur so it -- pretty much throughout.

Q. In the -- over the course of your mercury research from 2002 to 2005, at approximately what temperatures were you operating the combustion chamber?

A. Well, we didn't measure the actual combustion temperature, but if you do calculations, it's 3-, 4,000 F. Because you're talking fireball temperatures. And then downstream of that, we had, you know, again, heaters to cool that down. We did a lot of our testing in the 2-, 300, to 350F range in terms of where we were injecting sorbents.

Q. Okay. So the combustion chamber itself was 3- to 4,000 degrees Fahrenheit, right?

A. Yeah.

Q. And that was certainly too hot to have sorbents in there. You get a fireball?

A. Yeah, after we had carbon sorbents, yeah, they just burn up.

Q. And then downstream there's a combustion chamber where you actually injected the activating

carbon sorbent. That was about 300 degrees F?

A. Typically. I mean, we can do a few experiments in hotter temperature, primarily to prove out, again, a temperature effect. The focus was on 300 to 350, in that range.

Q. In any of your experiments from 2002 to 2005, did you ever supply halogens through some kind of port in the combustion chamber itself?

A. Not directly into it. We did some HCl where we went right at the outlet of the combustor and then some distance further down. And that was just to see, again, a temperature effect, whether or not the HCl would get destroyed or not.

Q. But that was not in the combustion chamber itself, right? That was just downstream of it?

A. Pretty close to it. The top end of it.

Q. In any of your experiments from 2002 to 2005, did you try applying any kind of Br-containing ingredient directly to the combustion chamber?

A. Not into. It was on the coal.

Q. Okay. But never directly into the combustion chamber, right?

A. Well, I mean, the coal goes directly into

the cool. Yes, you could say directly into the combustion chamber, because it was in the coal.

Q. Did you ever apply Br-containing ingredients directly to the combustion chamber without the first Br-containing ingredient first touching coal?

A. No.

Q. And did you ever --

A. When I say -- I should rephrase.

That was in the 2002 to 2005 time frame, your question?

Q. Yes, is your answer still applicable?

A. In that time frame? Yes.

Q. Let me reask it to be more specific with my questions.

In any of your experiments from 2002 to 2005, did you try applying any kind of Br-containing ingredient directly to the combustion chamber without the Br-containing ingredient first touching coal?

A. No.

Q. In 2002 to 2005, did you ever apply B-PAC to the combustion chamber?

A. Yes.

Q. You burnt up the B-PAC?

A. Oh, I'm sorry. Combustion chamber? No. I'm sorry. No.

Q. Okay. So let me reask, in 2002 to 2005, did you ever apply bromine powdered activated carbon to combustion chamber?

A. No.

Q. In 2002 to 2005, did you ever apply any kind of halogenated activated carbon sorbent to a combustion chamber?

A. No.

Q. In 2002 to 2005, did you ever mix any kind of a halogenated activated carbon sorbent with coal?

A. No.

Q. Where did you buy your activated carbon from for the 2002 to 2005 testing?

A. Primarily, it was a carbon provided by NORIT, which at the time, a well-known carbon called FGD which was kind of the quasi-standard. Everybody was kind of using it to do their tests. So we tested that. And we were also developing -- I don't want to say "developing."

We had a client called Luscar where we were actually activating their coal, which was a more locally -- North Dakota coal, to create a

sorbent, and so we were actually making a sorbent with that coal. So there was three or four different carbons. The primary one that we used was the NORIT FGD, which is now Cabot, but ...

Q. Okay. All right. You said a term, "Luscar." Can you spell that, please.

A. L-u-s-c-a-r.

Q. Thank you. I would have misspelled that.

At any point in your research, did you ever measure how much halogen would stick to activated carbon when doing the two-step process?

A. Yes.

Q. What did you find?

A. An increase in chlorine or bromine.

Q. Do you remember -- and I'm asking specifically, so let me take a step back.

You used the 2-step process sometime from 2002 to 2005, and some form of BrCl finds its way to the activated carbon. Is that a fair description so far of the process?

A. Yes.

Q. At any point in time, did you pull that activated carbon out of the environment and actually determine what percentage mass was activated carbon versus what percentage mass was

halogen?

A. Not that easy to determine. We did look at halogen. Again, bromine, not a specific form of it, because it's kind of a destructive technique.

So we did look at is there some bromine or some chlorine being accumulated on the ash, and that was a "yes."

In terms of trying to separate out the carbon and the ash, pretty difficult.

Q. So were you able to determine whether in any of your tests there was, you know, X grams Br for every Y grams of activated carbon on the surface?

A. No. No, we didn't. We didn't do those calculations. We did, say, "Yeah, there's more there." But trying to correlate it in terms that you described, no.

Q. Okay.

And I'm really asking about the ratio of Br to activated carbon that's bound to the sorbent. That's not something you ever measured?

A. Well, not the ratio. We didn't measure it. I mean, we knew how much carbon we were pulling in, and we knew how much bromine we were

adding to the combustor. So you can come up with that ratio.

But if you're talking about how much was in the ash, that's a different -- you know, that's a different calculation.

Q. Well, I was more just asking -- so the ratios you could come up with, if I understand what you're saying, is how much Br you added to the system compared to how much activated carbon you added to the system. Is that the ratio you were talking about?

A. Correct.

Q. And I think you understand that not all of the Br sticks to activated carbon, right?

A. Correct.

Q. Some of the Br may stick to the fly ash?

A. It's possible.

Q. And some of the Br may stick to the chamber walls?

A. Certainly possible.

Q. So for any -- did you -- so did you ever measure how much of the Br actually sticks to the activated carbon?

A. Our best estimate was somewhere in the 40 to 70 percent range. So yeah, there was some. It

probably went out as emission like HCl. You know, all the HCl was captured.

Q. Right.

A. So some of it goes out as that.

I mean, that was one of the biggest challenges of the technology itself was how much of the bromine is actually gonna make it in a reactive form, you know, to the carbon.

You know, it may get consumed or scavenged out by other, you know, chemicals within the flue gas, calcium, sodium, many other things. So there may not be any left to react by the time it gets to the sorbent.

So that was obviously one thing we wanted to prove in a key part of the invention.

Q. So I guess -- and I think maybe you're referring to this, but so for ...

Okay. So at a high level, you know some of the bromine is sticking to the activated carbon, but you -- you did not seek to determine, again, for every hundred grams of activated carbon, how many grams of bromine were stuck to that carbon; is that right?

A. That's correct. I mean, to us, it may matter in terms of understanding, but the critical

aspect was can you put in a certain amount of bromine and get some reaction to show a significant improvement in mercury removal?

So even if only 10 percent ended up on the carbon but you removed an extra 40 percent of the mercury, it didn't matter, you know, 50 percent -- or if 100 percent.

So what we were trying to prove out was could you add a bromine-containing compound to the combustion chamber, have enough of it survive throughout the chamber and the flue gas to then interact with the carbon.

And to what degree that was needed was more a function of probability of contact, resonance time, contact time. And has, to a much lesser degree, how much of it was actually captured on the sorbent.

Q. That's just not something that mattered to the research. It's how much of the bromine was actually captured on the sorbent. Fair?

A. Yeah, it wasn't -- it wasn't critical to the invention. It's to try to determine how much bromine was actually captured on the carbon. It was to prove out there's enough there to create the reactivity and the reaction needed.

And obviously, some of it is being captured on the sorbent, but whether it was 70 percent or 100 percent -- we weren't trying to capture bromine, I guess. We were trying to capture mercury.

Q. I understand.

And then on a similar thing, when you were measuring mercury removal, were you trying to determine how much of that mercury was being removed by sticking to the sorbent as compared to how much of that mercury may have gotten stuck in a lime slurry versus stuck to fly ash?

Is that anything you sought to determine?

A. Didn't have lime slurry. On the system, we were testing primarily was in an ESP with no scrubber. So there was no lime slurry, no lime additive available or part of that system.

So it was just activated carbon. We tested with and without. And so there was a baseline where we would add NORIT FGD. We would see 40/50, maybe, percent removal. And we would have the bromine at varying levels. And we were able to achieve, say, 90 percent.

Again, how much of the bromine

actually was captured on the sorbent wasn't the goal or wasn't critical. The goal was can we enhance the reactivity, i.e., a sorbent enhancement additive. How can we increase or enhance that sorbent to capture mercury.

Q. Do you know whether, in any of your tests from 2002 to 2005, you obtained 70 percent mercury removal specifically on the sorbent itself versus from other aspects of the environment?

A. Yeah, I mean, we had continuous mercury monitors. I mean, mercury was being removed in the ash. The mercury was showing up in the ash. And we're measuring mercury in the ash, you know, and it wasn't showing up -- well, maybe 1 percent.

I mean, there might have been a small amount being collect on the surfaces, but not an appreciable amount or a measurable amount.

Q. Did any of your experiments use a spray dryer absorber?

A. We did have some tests with that as well.

Q. Did this -- what is a spray dryer absorber?

A. A spray dryer absorber is a scrubber that's meant to remove SO2. It includes a different device, another device. Within that

device, you're spraying in a lime slurry. So in other words, that alkaline slurry is sprayed into the flue gas. That alkaline then interacts with SO2.

That SO2 is then captured, for example, in a fabric filter, and so captured as part of the ash and that alkaline material you're spraying in. And then it's -- you know, it's removed.

Q. Does the lime slurry that gets sprayed in a spray dryer absorber also absorb mercury?

A. It can. I mean, it's a little hard to distinguish. Because if you're doing it in a fabric filter, which most cases that's what you're doing, the fabric filter, without the spray dryer, is going to do a better job of removing mercury. So you're looking at some incremental improvement upon that.

So some of that contribution is due just to the fact you have a fabric filter. There may be a small amount that's actually enhanced by using the spray dryer and the lime.

But there's other -- then you get into the question is is it being captured on the activated carbon, or is it being captured on the

alkaline material itself?

Q. That's a good question.

Did you ever try to figure out the answer to that?

A. Well, in a sense, yes. I mean, our conclusion was you needed activated carbon. That the lime slurry or the calcium -- if you want to call it a calcium-based sorbent, because that's essentially what it is -- did not increase the capture significantly. Because, again, it's -- in the end, you're going to capture SO2.

Now, the indirect effect of that is if you remove SO2, then your carbon is more effective. Because the SO2 creates SO3, and the SO3 poisons and occupies the same sites that mercury would attach to.

Q. So in the same process -- instance where, all things being equal, one where you used the spray dryer absorber and activate carbon and one where you only used activated carbon, how much extra mercury did the spray -- was removed when you had the spray dryer?

A. That's a hard test to do because you either have it, and if you don't, what you're comparing to is with carbon versus without carbon

but with no additive.

And so you're really looking at how much did the plain activated carbon remove versus the -- just the spray dryer itself and a fabric filter. That difference may have only been, like, 10 percent. I mean, the difference wouldn't be much.

Q. And without a fabric filter, did you try to do that comparison ever?

A. Well, I don't know if we actually did that, but we had the capability to it. It would be less, because an ESP is more of an entrained-flow device, whereas the PM filter is essentially a fixed bed-type device.

MR. TOBIN: Okay. I'd like to go to a different line, so why don't we take a break. We've been going about an hour.

THE WITNESS: Okay. Five minutes?

THE COURT REPORTER: Yeah.

MR. TOBIN: Five minutes is good. Let's go off record.

THE COURT REPORTER: We're off the record at 2:13 p.m.

(A recess was taken from 2:13 p.m. to 2:24 p.m.)

THE COURT REPORTER: All right. We are back on the record at 2:24 p.m.

MR. TOBIN: Welcome back from the break, everyone.

BY MR. TOBIN:

Q. Mr. Pavlish, I want to introduce a new document to the Chat window. Let me just make sure this is the right one.

A. Um-hum.

Q. Yep.

(Exhibit 2012 referenced.)

BY MR. TOBIN:

Q. I'm passing you Exhibit 2012. And let me know when you have that.

A. (Complied.) Okay. I think I have it.

Q. Okay. Make sure we're looking at the same document. Exhibit 2012 is entitled, "Pilot-And Full-Scale Demonstration Of Advanced Mercury Control Technologies For Lignite-Fired Power Plants."

And on the bottom, it shows a date of February 2004; is that right?

A. I do see that, yes.

Q. Okay. Exhibit 2012 was a quarterly report that you and your team prepared?

A. Yes.
Q. This quarterly report was dated February 2004?
A. I see that, yes.
Q. All right. The February 2004 report was intended to capture your research activities from October 1st, 2003, until December 31st, 2003?
A. Yes.
Q. This February 2004 report, you're one of the authors?
A. Yes.
Q. And this February 2004 report is something you would have reviewed and made sure it was accurate?
A. Yeah. Yes.
Q. And also made sure it was well-written?
A. Well, attempted to, anyway.
Q. Don't we all?
Okay. Actually, hold on to this for a moment.
I want to go back to the October report, which is the 232. But I'm going to hop one more time to paragraph 33 of your declaration regarding the October report. So apologies for hopping around like that.

But why don't we go to paragraph 33 of your declaration, please. Let me know when you're there.

A. I'm getting there.

Q. Okay.

A. Paragraph 33, right?

Q. Yes, sir.

A. (Complied.) Yes.

Q. Okay. In paragraph 33, you state, regarding September testing, "...we tested various coal additives and sorbents, including the combined use of bromine additive and activated carbon sorbent."

Do you see that?

A. Yes.

Q. Who's the "we" in paragraph 33 of your declaration?

A. "We" would be the EERC. I mean, in terms of actually doing the tests.

Q. Can you name me all the specific individuals that are included in the "we" tested various coal additives and sorbents in September 8th to September 19th, 2003?

A. No, I can't name them all.

Q. Can you name any of them, besides

yourself?

A. Well, Mike Holmes -- I mean, when you say "we," collectively, Mike Holmes, myself, Butch Riske, the operators, the technicians. Whoever was involved in doing the actual tests.

Q. Okay. And do you remember the names of any of the people involved in doing the actual tests?

A. Other than the ones I mentioned before, no.

Q. Okay. If you look at paragraph 34 -- actually, in paragraph 35, you see there's a -- looks like a piece of a logbook?

A. Yes.

Q. First off, do you know who those initials are in the right-hand margin?

A. I did at the time, but not now.

Q. Okay.

A. "BR" could be Butch Riske.

Q. Do you know that it is? Or just --

A. I don't know that. I mean, I'm just saying "BR" -- I mean, I know Butch Riske was the operator lead at the time. But whether that was actually him, it certainly could have been.

Q. Well, do you know who "RI" or -- I can't

read the other initials. Do you know who those are?

A. No, I don't recall.

Q. Okay. And do you see how there's a box that says, "Witnessed & Understood by me"?

A. Yes.

Q. And that box is blank, right?

A. Yes, it really doesn't need to be signed in the sense that all the initials are provided in terms of how the test is being witnessed. So in many cases, that -- whether or not they should have signed it. But you had added up everyone that was involved in signing it, which is shown as the initials on the right-hand side.

Q. Okay. And, again, those initials on the right-hand side, you don't know who those are, right?

A. Well, "BR" is probably Butch Riske. Because, again, he would be the one leading it and making -- typically made some of those, but I can't give you a hundred percent certainty in that. But seems like it.

Q. Right. Do you know what Butch Riske's technical background was?

A. He was the -- he was an operator. In

terms of what his education, I don't know. If he had a four-year degree or a two-year degree, I don't know. But he had operated the PTC for many years.

So when I say "lead," I mean, he oversaw the operation of that unit -- not just for these tests, but for tests -- many years of coming into these tests and tests thereafter.

Q. All right. If we look down to page 18, there's some more, I guess, excerpts of the logbook; is that right?

A. Yes.

Q. And one of the initials appears to be "RL." Do you know who RL was?

A. Don't recall.

Q. One of the initials in the logbook appears to be "GF." Do you know who GF was?

A. Don't recall.

Q. If you look at page 19 of your declaration, there's more pages of logbook from September 19 reportedly.

Do you see that?

A. Yep.

Q. Do you recognize any of the initials on page 19 of your declaration?

A. "Ye." Ye Zhuang, "Ye." I recognize that one.

"JH," I know it's John -- I can't recall his last name. I don't want to mispronounce it.

Q. Do you know who "KJ" was?

A. No, I don't recall. I did at the time, but I don't now.

Q. Okay. If you look at page 19, there on the second set of initials, I can't read that, but maybe you can?

A. Which page are you referring to?

Q. Page 19, the bottom screenshot.

A. Okay.

Q. Next to the entry for (as read) "carbon injection," there's what? I guess three sets of initials at "451" and "1459"?

A. Well, the one is "Ye." I mean, you can see the "Ye."

Q. Okay.

A. The ones below it, yeah, I can't make that out.

Q. Okay. And then there's an entry at -- do you see? -- at "4:59"?

A. Yes.

Q. Why does an entry for "4:59" come after "1542"?

A. No idea.

Q. Okay. And this is the one where it says, "Started Feeder NaBr."

Do you see that entry?

A. Yeah, I mean, is it just military time versus clock time?

Q. I don't know. Do you know?

A. I'm assuming that's what it is. I mean, they were told to report things in military time. Because sometimes if you run 24 hours a day and you put in "4:59," that could be morning, or it could be night.

Q. So do you know whether this is "4:59" in the morning or "4:59" in the evening on page 19 of your declaration?

A. Yeah, I guess I would follow the "1542" that's right above it.

Q. Okay. Do you know who initialed that, all the way on the right?

A. It looks like it would be Ye, in a small manner. Probably a "Y" with an "e," just smaller than the one above it.

Q. Okay. I want to ask you some questions

about the hardware that's shown on paragraph -- well, before I do that.

Do you see that there's -- at "16:22," there's something that says "stop NaBr injection" on page 20?

A. Yes.

Q. Do you know who initialed that one?

A. Looks like it's cut off, so can't see the initials.

Q. And so --

A. The top of that logbook doesn't -- doesn't include it, really.

Q. You see there you have a picture on paragraph 38?

A. (Examined exhibit.) Yes.

Q. Okay. Is this the setup your team used to apply powdered solid halogens to coal?

A. Yes.

Q. Okay. Who built the setup?

A. The EERC, but I mean, that system existed -- I mean, we used it because they had -- they had used a system of this sort for other testing, and ...

Q. Okay. Do you see there's a -- you see there's a blue box?

A. Yes.
Q. What was in the blue box?
A. That would be the sodium bromide, the additive in the coal.
Q. Or sodium chloride?
A. Yes.
Q. Was that -- did that box -- was that box open on top?
A. Only during the times of, like, mixing or putting the things together.
Q. Okay.
A. And then close them, and the feeder gets turned on, and ...
Q. Was that any kind of a airtight environment, that blue box?
A. It's -- I don't know about airtight. You know, boxed off from the environment? No. Was it airtight? I can't speak to that.
Q. Okay. But it was designed to hold solids, right?
A. Yeah, designed to hold solids. And the solids -- the solids generally weren't put in the box until the test was ready to go. So I mean, it's not like it sat there for weeks. You know, you mixed up the blend, and you added it.

Q. Got it.

And then was that some kind of a screw valve coming out of the box?

A. Yeah, it's like a screw feeder. Yeah, like a screw.

Q. Was it on a control loop?

A. Yeah, there's a controller on it, speed control, so you can control how fast it goes. In other words, you can adjust the feed rate based on the RPM. And calibrations would generally be done on that too so that they knew, if they're running at a certain RPM, what -- how much material would be fed. They mainly controlled the feed rate by the RPM.

Q. Was the -- was there a signal from the mercury monitor to the halogen delivery screw valve?

A. No, it was manual.

Q. Okay. So if someone wanted more powdered halogen to be fed, they would manually adjust the amount?

A. Yeah, I mean, if you wanna -- you look at the monitor and say, "We're not quite there," we would adjust. You know, the test would generally adjust that feed rate, more or less, to see if the

mercury would go up or down. So that adjustment was -- you know, could be made and was made on some occasions, looking at the outlet mercury concentrations. In some cases, it was like we're going to feed at this rate and see what the mercury concentration is.

Q. Do you know any specific days where that adjustment was made in response to a mercury measurement?

A. Well, that could have been done many times during the test. Usually, we would start off at a lower rate and then ramp up based on the mercury reading till we got to what we thought was either a test point or we didn't want to go any higher.

Q. Do you have any specific days where that was done on specific testing?

A. Not that I recall. Yeah, I can't recall any specific days, but ...

Q. Okay. Let me move -- go back to where we were, please, with Exhibit 2012. Let me know when you have that open.

A. (Complied.) I do.

Q. Okay. This report was submitted, I think, pursuant to a different written grant

number, the -03NT41897, correct?

A. It looks like, yes.

Q. How long was the -03NT41897 grant for?

A. I have no idea. I don't recall. Again, it probably would have been for a year or two. Generally, none of these were less than a year, and then if we needed to extend them -- in other words, if the project didn't go as planned -- then we would just get an extension.

Q. Okay. And this report contains the measurements you made within the period of October 1st, 2003, -- well, I meant -- "you," I mean you and your team.

This report contains the measurements by your team between October 1st, 2003, and December 31st, 2003?

A. Yes, with some overlap. I mean, you're going to see testing from September. But, again, the reporting the data and so forth available during that time period.

Q. Okay. Let's look at page 9, please, of the exhibit.

A. (Complied.)

Q. Do you see that?

A. I do.

Q. And in the first sentence of that paragraph, you told -- your team told the DOE-NETL in February 2004 that "Activated carbon injection is the most mature technology available for Hg control."

Do you see that?

A. I do.

Q. Was that a true statement when you provided it to DOE-NETL in February 2004?

A. Yeah, in terms of maturity. Not necessarily in terms of effectiveness, but certainly it was the most mature.

Q. I want to talk about the test you ran. So let's go to page 17 of the report, please.

A. (Complied.) Okay.

Q. By the way, why were the tests called T1-1 and T1-2 and not just T1 or T2? Is there some nomenclature to that?

A. I guess -- well, maybe -- probably not, but it might have referred to a specific task within the project or something.

Q. Okay.

A. So the 1 through 11 -- or 14 are the tests. And I guess -- I'm assuming that's what the T1 reflected, but ...

Q. All right. So let me see if I'm interpreting this table correctly.

T1-1, that was just your baseline test with no mercury oxidant additive and with no sorbent; is that correct?

A. Correct.

Q. And then you ran, it looks to be, a number of tests on coal additive alone but no activated sorbent?

A. Correct.

Q. So for example, Tests 1-3, 1-5, 1-10, and 1-11 all had some form of additive but 0 activated carbon, correct?

A. Yes.

Q. Okay. So at least in September to December 2003, you were still investigating multiple kinds of additives to see which one would work the best. Is that fair?

A. To work the best as to be more -- most acceptable in terms of application.

Q. Fair enough.

So at least by December 2003, you had not decided on a candidate to say, "Here's the best and most acceptable one." At this point, you were just still presenting data. Is that fair?

A. Yeah, trying to quantify data, quantify the effect or the enhancement. Trying to look at -- or narrow the list down to what would be more practical in full-scale application.

Q. All right. So at least as of the end of December 2003, you were still considering sodium chloride as a potential additive?

A. We were still considering it, yes.

Q. And I'll get to SEA 2.

But you were considering SEA 2?

A. Yes.

Q. End of December 2003, you were considering zinc as a potential additive?

A. I don't know if we were considering that. I mean, that was one of those where we had some information that might further enhance, so we wanted to try.

Q. But you were at least testing zinc?

A. Yeah. Yeah, testing it.

Q. And you were testing other things too, right?

A. Yes.

Q. Okay. And were you also -- and you were also considering alternatives to activated carbon as well, right?

A. Not too much. Most of the focus was primarily on activated carbons. As you can see in the list, they were either treated or not. By far and large, most of them were activated carbons. Yes, we did test this sodium tetrasulfide, but again, it was one of those experimentals to see maybe what it would do.

Q. And you tested an Alstom sorbent?

A. Yes.

Q. What was in the Alstom solvent?

A. That was -- I don't even know what was in it. At the time, for sure, we didn't know. But it was a process that they had where they manipulated the size of the sorbent and then injected it. So it was kind of done as part of that process -- particle reduction and injection, so ...

Q. Now, I see a reference to SEA 2. Was there ever a SEA 1?

A. Yeah, I mean, SEA 1 eventually kind of became any chlorine additive. We started the -- because it got to be sterile. So it's like SEA 1 kind of be -- was collectively a chlorine.

SEA 2 was, in this case, NaBr, but really, it was collectively any bromine-containing

material. Because like I said, it doesn't matter what bromine-containing material you put into the combustor.

So it really became, well, if you're using bromine, it's probably an SEA 2. In this case specifically, it was sodium bromide, but ...

Q. Well, you say it doesn't matter to a combustor, but you would agree that in terms of perhaps the setup or the economics or other tradeoffs, what type of Br used that has an effect on other --

(Speaking simultaneously.)

A. Well, handling the economics, the hazards certainly play into what bromine-containing material you would use.

Q. Correct.

A. As an additive to the coal and to the combustor.

Q. And those -- and, in fact, those actually make a difference as to what you tested, because you only tested NaBr among the option -- the various Br-containing options, right?

A. Yeah, again, like, it rated -- there was no need to -- I mean, NaBr is easy to handle, not hazardous, and so there was no reason to

physically test, you know, HBr, Br2 into the combustor.

Q. Because HBr and Br2 are hard to handle and are extremely toxic, right?

A. They can be. As I said, precautions can be taken. But in general, yes, they're in need of -- usually in a gas form, although Br2 can be aqueous. But even then, you don't want it on your skin.

Q. Right.

A. So you know -- so yes, we didn't do it primarily for those reasons.

Like I said, though, Ed did it in his lab. You know, he was using Br2, and as you see in this one, there's an EERC-treated carbon. That was a brominated carbon. So he was using HBr and Br2 in the lab, but we didn't do it in the pilot facility.

Q. And to be clear, in Dr. Olson's lab, you may be using HBr and Br2 but never applying it to coal, correct?

A. I don't believe in the coal, no. Just applying it to sorbents.

Q. Can you show me anywhere in Exhibit 2012 that it defines what's in SEA 2?

A. Again, it was a proprietary component that the IP department -- or, shall I say, commercialization department of the EERC did not want to release what was held proprietary.

It was likely a confidential -- like, with DOE, you had the oppor- -- you had the ability to submit what was considered nonconfidential information because the public -- it's open to the public.

There's also the ability to submit an appendix the DOE would then have so that they had a better understanding of actually what you did. But it was held confidential.

Q. Did you submit an appendix to the DOE with the February 2004 report?

A. I don't recall. It's certainly possible, but I don't recall for certainty that was done.

Q. Okay. So back to the original question, can you show me anywhere in Exhibit 2012 that mentions Br or bromine or any form of bromine?

A. I thought it would be in there. I mean, I haven't searched for it, but I'm pretty sure it's not listed there because of the reasons I stated.

Q. You're welcome to search for it, if that

would help.

A. I don't think I need to. I mean, I already know that we were told not to specifically spell out bromine, bromine compounds, anything to do with bromine because that was to be held proprietary and confidential.

MR. TOBIN: Can we go off record for two minutes. I'm sorry.

THE COURT REPORTER: Sure. We're off the record at 2:49 p.m.

(A recess was taken from 2:49 p.m. to 2:50 p.m.)

THE COURT REPORTER: We're back on the record at 2:50 p.m.

MR. TOBIN: All right. Welcome back, everyone. Okay.

BY MR. TOBIN:

Q. So -- and, again, apologies for the interruption before.

But, Mr. Pavlish, nowhere in Exhibit 2012 does it use the words "bromine" or "Br" or "bromide," correct?

A. Correct.

Q. The only reference in Exhibit 2012 to a bromine-containing ingredient is your testimony

that SEA 2 is NaBr; is that right?

A. Correct.

Q. Do you know whether the term "SEA 2" is used in any of the logbooks?

A. I don't recall. Maybe on a few cases or a few instances where it's called out as such. The terminology came about when we were putting together a proposal at the DOE, and they had limited page and word count.

And we couldn't use "sorbent enhancement additive" in every case, so it became "SEA," sorbent enhancement additive.

Q. Okay. But --

A. So the logbook would refer to it as "NaBr" on the old case, is it not?

Q. If there were something in the logbook that used the term "SEA 2" or "sorbent additive," do you expect you would have put it in your declaration?

A. Probably.

Q. All right. So assuming that SEA 2 is NaBr, going with that assumption, can you show me anywhere in Exhibit 2012 where it discusses a ratio of 1 to 30 grams Br for every 100 grams of activated carbon sorbent?

A. Not those -- not those specific numbers. I mean, we did test different ratios of that as part of the testing.

Q. Why don't you look at table --

A. It states somewhere it's one of 30, probably not in that document.

Q. Okay. So -- nothing in Exhibit 2012 would state a ratio of 1 to 30, correct?

A. Correct. There would be test data to support different test ratios, but not explicitly stated.

Q. Okay. So why don't you look at the table of -- on page 17. And feel free to bust out a calculator, if you need, although I don't think you do.

But do any of the Tests T1-1 to T1-14 have a ratio of 1 to 30 grams Br for every 100 grams of activated carbon sorbent?

A. It doesn't cover that full range, no.

Q. In fact, I don't think there's any data points within that range, are there?

A. Now you're gonna make me pull my calculator out. (Short pause.) No.

Q. And, in fact, the -- which test numbers were you running your calculation on just now?

A. The SEA 2 relative to the injection rate as shown there.

Q. Is this Test T1-6 you're talking about and T1-9?

A. Yeah, T1-9 and T1-6.

Q. It's actually fair to say that the ratio in Tests T1 to -6 between Br in activated carbon is closer to 70 percent instead of 1 to 30 percent?

A. That'd be closer to 50 percent, but the sodium chloride -- usually, we look at the bromine. SEA 2 is sodium bromine. Right.

Q. Ah. Good point. Okay. But for T1-6, you agree the ratio of Br to activated carbon is about 50 percent?

A. Yes.

Q. Which is greater than the range of 1 to 30 percent, right?

A. Well, it's shown in this document, yes.

Q. And in T1-9, the ratio is also greater than 30 percent?

A. Yes.

Q. Okay. So if I wanted -- again, there's -- withdrawn.

In the February 2004 report to DOE,

you're providing data for 14 tests, one of which was a baseline test. Is that fair?

A. Yes.

Q. If I wanted to understand the test data that you were providing to DOE in your February 2004 report, showing the two-step process, the tests you would focus on are T1-6 and T1-9?

A. No, those would be some data points, yes, in this document, yes.

Q. And I'm just asking about this document for right now. The two-part test with Br, the only tests are T1-6 and T1-9.

A. Yes. Well, there's three tests but the only two involving activated carbon --

THE COURT REPORTER: I'm sorry, guys. That really got garbled for me. Do you mind repeating.

MR. TOBIN: Sure.

BY MR. TOBIN:

Q. Let me ask a specific -- let me reask that question, Mr. Pavlish. I'll try to speak a little more clearly.

Test T1-5 involved SEA 2 but no activated carbon, correct?

A. Correct.
Q. T1-6 involved SEA 2 and activated carbon?
A. Yes.
Q. T1-9 involved SEA 2 and activated carbon?
A. Yes.
Q. Other than T1-6 and T1-9, are there any other tests reported in Exhibit 2012 that disclose what you referred to as the two-part process?
A. No, it should be the tests -- document again, in this document.
Q. Okay. And I'm just asking about 2012 right now.

In Exhibit 2012, can you show me where you report to the DOE-NETL your mercury measurements for either Test T1-6 or test T1-9?
A. I'm sure they're in there somewhere. You know, the results are likely provided in the following report.
Q. And we may get to that.

But can you point to anything in Exhibit 2012 that discloses mercury measurements for the two-part process?
A. Looks like we did do other tests. Documented under T4-6 or -7, we tested under a different configuration.

Q. Well, T4-6 was NaCl with no activated carbon, correct?

A. T4-7 was -- was SEA 2 alone.

Q. With no activated carbon in T4-7, correct?

A. That's what I see in the table, yes. Yeah, I think the results weren't presented -- if you go down to "Future Work," it says, "The results from the test runs performed under Tasks 1 through 4 have been distributed to the project commercial sponsors for review and comments."

Q. Where are you reading?

A. Under "Future work," page 29 of the document. It is 29 of 33.

Q. Uh-hum.

A. It says future work is distributed but not publicly released.

Q. Okay.

So is it fair to say Exhibit 2012 itself does not provide any mercury measurements for any of your tests of the two-part process?

A. Well, it includes measurements. Certainly baseline, but not for those specific tests, not the inlet and all the concentrations.

Q. Right. Exhibit 2012 may include -- and

by "baseline mercury measurement," you mean where no activated carbon and no sorbent enhancement are used?

That's what you mean by baseline, correct?

A. Correct.

Q. So Exhibit 2012, they report just native mercury in the coal, but it does not report how much of that mercury you were able to remove with the two-part process, correct?

A. Correct. That was shared with the sponsors for their review and their comments before being publicly released.

Q. Okay. Is that a document included as part of your declaration?

A. I don't believe so. Again, these are the endpoint test points. The intermediates aren't provided. I don't even know if we have that.

Q. Okay. You don't know if you have those mercury measurements that were conducted?

A. Well, I don't know if I have access to them. We certainly had them at the time. We certainly provided them to the sponsors on which DOE is one.

I mean, because it says right in the

following sentence, "Once comments are received and addressed, the results will be released to DOE."

So DOE has seen them, I mean, the sponsor -- any and all sponsors have seen them, but they're not reported in this document.

Q. Got it. And do you have any reason to think that I've seen your mercury test results from this testing?

A. I have no idea if you've seen them or not.

Q. Okay.

A. If you've seen them in this document, probably not. If you've seen them somewhere else, probably.

Q. Okay. Well, we can at least agree mercury measurements for your two-part process are not provided in Exhibit 2012? Can we agree on that?

A. Yes.

Q. Okay. I want to look -- back to your declaration, please. And let me know when you're there.

A. (Complied.) I'm there.

Q. Okay. And this is Exhibit 2046, and it's

the same in both years. But are you in 2046a or -b?

A. Sample 1061827.

Q. Oh, I think we jumped the shark. Let me go to page 2.

What -- are you on the declaration for the '114 patent or the '517 patent?

A. Those are the same. Correct.

Q. I think -- that's my understanding. Is that yours?

A. Oh, I'm not in the right one. I'm in the '430, not the '225 at the moment. I do have the other one up, so it should be ...

Q. Okay.

A. I'm there now, but I need to check that, but yes, I'm in the '114/'517.

Q. In the logbook excerpts you have on paragraphs 35 to 42 of your declaration -- well, withdrawn.

Throughout your declaration, you provide a number of excerpts of logbooks, correct?

A. Correct.

Q. Are any mercury measurements provided in the logbooks that are in your declaration?

A. I don't recall, but likely not. Again,

they typically weren't recorded as part of the logbooks.

Q. Okay. And you certainly would not expect any mercury measurements to be found in the logbooks, correct?

A. Correct.

Q. Let's put up a different document, and you're welcome to keep whatever you want open or closed, but I'll introduce to you a new document now. This is Exhibit 1020.

(Exhibit 1020 referenced.)

BY MR. TOBIN:

Q. Let me know when you have access to that.

A. (Complied.) All right. I think I'm there.

Q. All right. Exhibit 1020 is -- do you see it as your professional application, 60/605640?

A. Yes.

Q. I'm sure this is a document you've seen more times than you wanted to.

A. I would say not.

Q. Okay. You're familiar with this document, though, right?

A. I'm familiar with the provisional, yes.

Q. Okay. You helped author the provisional?

A. Yes.

Q. Can you -- and take whatever time you need to review, but can you identify for me any measurements of mercury results performed for the two-part process that are disclosed in your provisional?

A. (Examined exhibit.) I don't see any specific results like a graph or a table.

Q. Do you see even any numbers reported for mercury measurements for your two-part process disclosed in the provisional?

A. (Examined exhibit.) Discussion, but I'm looking for specific numbers.

Q. No specific numbers of mercury removal in your provisional or a process adding bromide to coal and activated carbon downstream, correct?

A. (Examined exhibit.) Well, I described it in the paragraph. "In the example shown, the sorbent is injected into the flue gas after the boiler. And additives can be injected where desired (before, after, or within the boiler), so ... Describes the process, certainly.

And for specific numbers, I'm not finding those.

Q. Okay. I want to ask you kind of a --

switch to some chemistry-type questions again.

Have you heard of a fourth state of matter referred to as plasma?

A. Oh, yeah, I have.

Q. What is a plasma?

A. Plasma is essentially a high-energy/-temperature device which ionizes, if you will, whatever elements are either in a gas -- I'm assuming in a gas.

I don't know if you can do solids or not. But I assume you can hit a solid with a plasma too, so ...

Q. In your research in 2002 to 2005, did you do any work with plasmas?

A. Yes.

Q. What work is that?

A. There was some work done where we used -- well, you could consider it a plasma. We used an arc welder to generate a reactive form of bromine, which was then added to the carbon, not into the combustor, and then added in the carbon and then injected -- you know, as part of the injection process.

Q. And that was a downstream process?

A. That was, yeah. We have different

patents. We won't get into that discussion, but ...

Q. Okay.

A. We have an HET and NEC. There's two other families of patents that deal with that type of approach, so ...

Q. Okay. But that has nothing to do with our patents in this case, right?

A. No, I mean, here we're adding something to the coal or combustor and a carbon downstream.

Q. Was the PTC at EERC -- did it get hot enough to generate a plasma inside the combustor?

A. Potentially. I mean, again, we're talking about flame temperature, you know, not the bulk temperature.

So flame temperatures, I've done some calculations called adiabatic flame temperatures. Those can get as high as 4600. So I mean, it can get pretty hot.

Q. But you're really not sure whether a plasma is generated?

A. I don't know. I'm not that familiar with the plasma in terms of actual temperature. If you look at the -- like, we use the welder arc. If you look at the color of the flame, you get some

indication as to the temperature.

Q. Okay. Let me hand you a different exhibit.

(Exhibit 1026 (excerpt) marked.)

MR. TOBIN: Okay. And for the record, this is within Exhibit 1026, but rather than sending a 50-megabyte file, I excerpted a set of pages, so I can pass that over to Mr. Pavlish.

BY MR. TOBIN:

Q. And, Mr. Pavlish, do you have that?

A. Not yet.

Q. Okay. Did you see it come through?

A. It's coming.

MR. TOBIN: Okay. For the record, this is from Exhibit 1026. It's exhibit pages 316 to 331. And it's from the file history for the '114 patent.

BY MR. TOBIN:

Q. Do you see it now?

A. I do.

Q. Okay. Do you recognize what's labeled here in Declaration C?

A. Yes, I recognize.

Q. Okay. Declaration C is a declaration

that you signed and submitted to the United States Patent Office?

A. Yes.

Q. You signed Declaration C on March 20th, 2019?

A. March 20th, 2019, yes.

Q. Okay. And I wasn't psychic. I was reading from the last page.

A. That's what I went to.

Q. Okay. Very good.

When you authored Declaration C, I assume you meant to be truthful and accurate in everything you represented?

A. Yes.

Q. Okay. And that would have been your practice with the Patent Office, right?

A. Absolutely.

Q. Okay. So why don't we turn to paragraph 4. And in paragraph 4, you provide a definition for "bromine" that, in part, said it was a "deep red corrosive toxic volatile liquid of disagreeable odor"?

A. That's how Merriam Webster defined it.

Q. And you would agree with that definition?

A. Generally, yeah.

Q. Okay. And then let's turn to paragraph 12 that's on Exhibit 1026 page 320.

A. (Complied.) Yes.

Q. And you provided a definition that "hydrogen bromide" is "a colorless irritating gas HBr that fumes in moist air and yields hydrobromic acid when dissolved in water"?

A. Again, that's what Merriam-Webster defines it as.

Q. And that's very consistent with what you explained earlier today?

A. Yes, yes.

Q. Turn to paragraph 14.

A. (Complied.)

Q. And I think earlier today you testified that HBr is a gas at room temperature; is that right?

A. Yes.

Q. And is that consistent with what you told the Patent Office, that it has a boiling point of minus 67 degrees centigrade?

A. Well, I assume it would be. I mean, it boils at minus 67. It should be a gas.

Q. Yeah. Let's turn to paragraph 19, if you could.

A. (Complied.)
Q. Do you see that?
A. I do.
Q. And you were explaining to the Patent Office a study by a gentleman named Yang?
A. Yes.
Q. And Yang -- and I -- and I think earlier maybe you testified that regardless of -- withdrawn.

There may be handling issues and toxicity and environmental and economic issues that vary between which Br ingredient you add to coal, correct?
A. Can you restate that.
Q. Sure. I'm just trying not to ask you too many things in one question.

There may be handling issues or toxicity issues or other environmental issues or economic issues that may affect what form of Br you supply to coal in the two-part process?
A. Yeah, correct.
Q. But what happens in the combustion chamber and what comes out, I think you testified, is -- is the same, regardless of the Br source. Is that fair?

A. Yeah, it's gonna be -- well, immediately atomic form of bromine.

Q. Okay. You say it's going to be an atomic form of bromine?

A. Atomic -- it's going to be a very reduced state. If you want to call it reduced, that's probably not a scientific term to use, but --

Q. I would think of --

(Speaking simultaneously.)

A. -- Br -- it'd be BrS. It'll be Br and -- you know, hydrogen, which is going to recombine with water at some point. But it's not going to survive as HBr.

Q. I understand.

So regardless of what form of Br you add to coal, you will get Br atoms floating around in the combustion chamber. Is that fair?

A. Yes.

Q. Okay. And you understand the difference between an atom and an ion?

A. Generally, yes.

Q. You know an atom is charge neutral and an ion is not?

A. Yes.

Q. Okay. And then regardless of the Br

source you apply to coal -- to be clear, you would get Br atoms in the mercury-containing gas, not Br ions. Fair?

A. Well, I don't know that you couldn't get Br ions either, but it's possible. But it's not going to stay as HBr.

Q. Well --

(Speaking simultaneously.)

A. You could get some radicals or ions or different atomic forms, yes. So I'm not saying the only thing it can have is an atom. Could you have an ionized form of bromine? Yeah, probably. Is it gonna survive long thereafter? No. It's gonna react very quick.

Q. Is that something you actually measured, the Br ion in the gas phase?

A. No.

Q. Because I want to -- and in paragraph 19, I assume you thought the Yang article was a good source of information. That's why you sent it -- this discussion to the patent examiner?

A. That was sent, yeah, to support the -- I mean, the HBr does form, but it --

Q. Okay.

A. -- forms downstream. They measured it

downstream. But they put in calcium bromide.

In other words, the calcium bromide did not stay as calcium bromide. Why? Because the combustion process converted it to either atomic or ionized forms, which then reacted later on to form HBr. And that's what this article was trying to -- you know, demonstrated.

Q. Got it.

And to be clear, you're summarizing Yang's research. You, yourself, do not, before 2005, add calcium bromide to coal, right?

A. No, we hadn't.

Q. Okay. So Yang is the one saying, when you apply CaBr2 to coal, you get, inside the combustion chamber or after the combustion chamber, you get HBr?

That's what Yang is saying, correct?

A. Correct.

Q. And one thing Yang also says is that -- if you read the full sentence, it says -- well, actually, you said, "Section 3.4 states at page 59012 bridging to page 59013 that '[t]he results confirmed the generation of HBr and coal-fired flue gas due to the CABr2 additive to coal, but Br2 was not detected.'"

Do you see that?

A. (Examined exhibit.) I do see that.

Q. Okay. And that -- you certainly believed that Br2 would not be detected when you sent this to the patent examiner in 2019?

A. I think what we're saying there is Br2 was not detected, meaning -- and we talked about this earlier -- he likely used Method 26.

And is that method capable of detecting Br2? It was capable of certainly detecting HBr. We wouldn't expect Br2 to be there in a very large quantity. Like, maybe 1, 2 percent.

So concentrationwise, it'd be very weak. Methodwise, well, he didn't detect it.

Q. And certainly, no one in your research group detected gas phase Br2 in the mercury-containing gas, correct?

A. Well, we didn't measure for it, no. Again --

Q. So --

A. -- it doesn't matter what form, as long as the -- some form of bromine came in contact with the carbon sites to react with the mercury. By the way, it was HBr, which we are pretty

certain of, and -- or Br2. Br2 would react as well.

Q. Well, but the more -- the specific question I asked is what -- is what you tested for. And I think may be buried within your answer.

But you certainly did not test for the -- ever for the presence of Br2 in mercury-containing gas when using your two-part process; is that correct?

A. Correct.

Q. I want to move down a little bit to the paragraph 22.

A. (Complied.)

Q. Do you see that?

A. Yep. Yes.

Q. And I think -- and here you told the patent examiner that (as read) "Typical temperatures in a coal-combustion furnace range from 2,400 to 4,200 degrees Fahrenheit," and you agree with that, right?

A. Yes.

Q. And that's not far off from what you said earlier today. I think you said 3,000 degrees Fahrenheit, which is certainly within that range,

right?

A. Correct.

Q. And I think you mentioned, in certain cases, the internal flame temperature can get a little higher, to 4200 degrees Fahrenheit, in a combustion furnace, right?

A. Correct.

Q. And then I think you mentioned that the furnaces actually operate higher than the boiling point of these various salts, right?

A. Correct.

Q. And so if you look at the next page, you provide a table where NaBr boils at 2,534 degrees Fahrenheit?

A. Correct.

Q. And so when NaBr boils -- withdrawn.

So if you apply NaBr to the coal, in your two-part process, you're going to get gas phase NaBr at 2534 Fahrenheit, right?

A. Correct.

Q. Okay. And then I think if we go on a little farther below the table, the last sentence on page 325, you told the patent examiner that, you know, as the gas phase NaBr gets even hotter, above the boiling point, and is brought to

temperatures of 3,000, then NaBr disassociates, right?

A. Correct.

Q. And you didn't tell the examiner that the NaBr dissociates into ions, correct?

A. Correct.

Q. You told the examiner that the NaBr disassociates into Na atoms in the gas phase and Br atoms in the gas phase?

A. Correct.

Q. I think one of the programs you use for this is called FactSage.

Do you see that?

A. That was one of the programs, yes.

Q. Is FactSage a computer simulation?

A. It's -- it's a program available, I think, for anybody. Again, we didn't develop it. And it gives you some insight as to when certain species may or may not form as a function of temperature and so forth.

Q. Okay. Let's turn to the next page. You have a graph between paragraphs 23 and 24.

Do you see that?

A. I do.

Q. And was the graph you submitted to the

patent examiner originally in color?

A. That I don't know -- I can't recall if it was in color or if it was black-and-white.

Q. Okay. Well, maybe you can help me interpret the peaks here in the declaration you sent the examiner.

Do you see how there appears to be really three curves showing some presence of materials, and then the rest is just about 0?

A. Yeah, I see 0. Yes.

Q. Okay.

A. I see different curves there. Again, I can't really tell what species or what form it's referring to as, so ...

Q. Okay. So it -- if you look, one of the data points is a circle, and that's for NaBr gas. It's third from the bottom.

Do you see that?

A. I do.

Q. And do you remember your discussion above that the boiling point of NaBr is about 2500 degrees?

A. Yes.

Q. So do you see that large first peak in the graph of Figure 1?

A. I do.
Q. Would you expect that to be the gas phase concentration of NaBr?
A. I guess I would expect it to. Again, I can't really read that, yeah.
Q. Is there a reason why?
(Speaking simultaneously.)
A. -- or if it's Br minus, or I mean, there's a whole list of different bromine possibilities. So I would presume so, but I can't ascertain that based on this graph.
Q. Well, is it most likely that that first -- based on the boiling point of NaBr at 2534, is it most likely the first peak of the graph is showing the gas phase concentration of NaBr?
A. Yes, most likely.
Q. And then I think -- do you recall your discussion of Yang, how at higher temperatures the NaBr breaks apart into Na atoms and Br atoms?
A. Yes.
Q. Do you expect that the other two peaks represent gas phase Na and gas phase Br atoms?
A. Could be. Don't know. But, again, the portion that made the color is not there, so it's

really hard to assemble them. Unfortunately, they're very unreadable. And I don't recall specifically what -- you know, what line is for each. I apologize, but I am struggling to read it.

Q. Okay. Yeah, I am too. And that's fine.

Well, you see in the legend, there are a number of different species. And would you agree that at furnace-operating temperatures of about 4,000 degrees, all the species, other than three of them, are at 0 concentration?

A. Yes, I do see that.

Q. Okay. I want to ask you, what is "pyrolysis char"?

A. Pyrolysis char is when you heat up a material, i.e. pyrolyze, but heat up the material to drive off the volatiles. It's like a preliminary stage of creating an activated carbon. First thing you do when you create an activated carbon is you get rid of the volatiles, so you end up with, I think, what's called fixed carbon, you know, carbon that doesn't volatilize.

Q. In any of your experiments from 2002 to 2005, did you mix pyrolysis char with coal?

A. And add it to the coal? No.

Q. In any of your experiments from 2002 to 2005, did you add pyrolysis char to the combustion chamber?

A. No.

Q. Does pyrolysis char just naturally form all by itself inside a combustion chamber?

A. In the early stages of the combustion. I mean, it goes through the same process, just much quicker. You know, as it goes from ambient temperature to, say, 4500 degrees, there's not gonna be any volatiles left, obviously, but it does go through that process.

The first thing that comes off is the volatiles, and then the carbon obviously gets converted to CO2, but ...

Q. So pyrolysis char -- is it fair to say pyrolysis char formation inherently results in combustion chamber burning of coal?

A. It's the early stages of combustion.

Q. When did you first learn about pyrolysis char and how it forms in a combustion chamber?

A. When did I look for it?

Q. When did you first learn about that process?

A. Oh, I don't know. When I was working at

Black & Veatch. You know, part of the combustion, it's -- you understand how the combustion process works. I mean, you add coal. You add oxygen, your stage combustion. There's how the coal evolves as part of that.

So I mean, pyrolysis is -- I learned it, I guess, at Black & Veatch, but it's pretty common.

Q. All right. So it's certainly not something you discovered, that pyrolysis char forms in the combustion chamber?

A. No.

Q. Okay. Do you have the -- still have the patents in front of you?

A. Do I have the patents themselves?

Q. Yes.

A. Only if they're in one of those exhibits you've already provided.

Q. They are. Do you need me to send them over again?

A. Not if you've already sent them to me. I mean, I have them all loaded up. I just need you to tell me which one.

Q. Let's go to 1- --

A. The 1001a?

Q. Sure. Let's go to that one.
A. Okay. (Complied.)
Q. Let me know when you're there.
A. I'm there.
Q. Okay. Can you go to the claims at the end of the patent, and I guess we can do Claim 1.
A. (Complied.) Okay. I am there.
Q. Do you need a moment to read it?
A. Probably not. I mean, I've read it enough times, but ...
Q. Okay. So I want to direct you to Column 34. Do you see Column 34?
A. Yes.
Q. Okay. And this limitation starts with the word "controlling."

Do you see that?

A. I see Column 34. Are you still referring to Claim 1?
Q. Yes, I am.
A. Yes, second sentence down. "controlling, and response ..."
Q. Okay. So yeah. So you have a controlling step, and that controlling step takes -- is performed "in response to the monitored mercury content of the cleaned gas,"

correct?

A. Correct.

Q. And then what gets controlled is one or more of three variables.

Do you see that?

A. I do, yes.

Q. The three variables are sorbent injection rate, sorbent composition. I guess in this claim, just -- just these two variables, yes?

A. I do see that.

Q. Okay. And I think you mentioned maybe the activated carbon injector you had at the PTC, was there some kind of valve that allowed adjusting -- introducing more or less activated carbon?

A. Yeah, you know, we had a feeder that was controlled by speed, and the speed can be adjusted up or down.

Q. Got it. And then did you have another valve that let you change the sorbent composition?

A. Well, the sorbent composition is the mercury/sorbent composition.

Q. And was that an independent variable you could change?

A. Well, I don't think it's something you

would change. If it's something you could respond to. In other words, collect, more or less, depending upon the sorbent injection rate.

Q. Did you have, for any given test, two different, for lack of a better word, activated carbon silos with different carbon types?

A. No, we had enough silos. Just small systems.

Q. Did you have for any given test, two small systems and valves between them where you could turn one on and one off?

A. No, if we were gonna combine different elements in the sorbent, that would be -- that would have been done and put into our small-scale feeder. So there wasn't, like, a separate system with valving.

Q. What does the word "controlling" mean to you in the context of Claim 1 of the patent here?

A. My understanding and the meaning, to me, is you see a perfect concentration as measured, whether it's by a continuous work remonitor or even a sorbent test or lack of it. But you see that, and then you make an adjustment. You're controlling.

It doesn't have to be connected to

some analyzer. "Controlling" means you're making an adjustment based -- you know, that's your feedback based on some measured value.

Q. Okay. So the claim you drafted would include "controlling," meaning you look, you see the mercury a little too high, so a human being turns a knob for a next test to use a different sorbent injection rate?

A. Correct.

Q. Okay. And then how does one turn a knob to adjust sorbent composition?

A. Well, the sorbent composition, again, if you're talking about the composition of mercury and sorbent to change that composition, you would change the sorbent rate.

Q. So how are -- so don't these two items really collapse one into each other in your claim?

A. You could say that, yeah. I mean, you're adjusting -- you're primarily adjusting the sorbent rate.

Q. Okay. So --

A. It does change the composition ultimately, depending upon how you define "composition." Right.

Q. Well, how do you define "composition" --

A. Well, it's going to be more or less. In other words, you have a certain feed rate with a certain composition. If you change that, that composition changes.

Q. Did you run any kind of experiment where you saw the mercury and then switched to a different kind of activated carbon in its spot?

A. We did a lot of tests looking at different sorbents. We would -- we would do a test, test the sorbent, see how it performed, move on to a different sorbent, make a comparative test of how it performed, and so forth.

Q. Was there any kind of a feedback process between mercury measurement and sorbent composition and test you ran?

A. Well, the feedback was, again, manual. The feedback was you had a rate with a given sorbent. You have a mercury concentration, again, continuous mercury monitor, so you're getting a concentration of the mercury. And then based on that, you make an adjustment.

Q. Okay. Can you open up your February 2004 report again, and show me which of the tests use that process you just described.

A. I'm sorry. Which document do you want me

to open?

Q. Your February 2004 report ... It's Exhibit 2012.

A. I've got too many things open. Here we go. 2012.

Q. And I guess more specifically, can you show me an example in your Exhibit 2012 where your group controlled and response to the monitored mercury content of the clean gas, the sorbent composition?

A. Again, this was done as part of the testing, and what's reported here are the endpoints, as I mentioned earlier. We didn't show the intermediate steps. It was here's what we achieved at the specific conditions.

Q. Okay. But even in Exhibit 2012, can you show me an example of performing that step where you control and, in response, monitor the mercury content with the clean gas?

The sorbent composition, is that anywhere in Exhibit 2012?

A. You can see we certainly did it for chlorine, because there was ranges given for both. So you know, we covered those ranges. For SEA 2, it looks like we did it at 1 -- well, again,

what's documented, we did it at 1.

I can't show you again on the document, other than to point to what we were doing with sodium chloride, and that is documented. We covered the range, and we did it with SEA 2 on T1-5 where we covered the range. But, again, part of our sorbent there -- and then we did other tests -- again, these are reported numbers at the endpoints. In other words, "Here's specific conditions. Here's sorbitol."

Q. I understand. And, again, I wasn't there with you on the floor of the lab. So I'm really just asking for your results.

So can you -- I think the answer's "no," but can you show me anywhere in February 2004 where you applied the two-part process, and as part of applying the two-part process, you controlled, in response, the monitored mercury content of the clean gas, the sorbent composition?

A. Table 4 shows me when you vary the SEA from 1.84 to 3.67, so we were varying that as a function of mercury content or mercury measurement.

Q. I understand that.

I'm asking if you can show me anywhere where you vary -- where you adjusted the sorbent composition in response to the measured mercury content?

A. Again, you're referring strictly to SEA 2?

Q. Yes.

A. (Examined exhibit.) Looks like Figure 3 might show that, page 12.

Q. Where in Figure 3 does it show adjusting the sorbent composition -- withdrawn.

Where in Figure 3 does it show controlling the sorbent composition based on the measured mercury content?

A. [Read back.] When you see there -- it says, "Sorbent Rate 1," "Sorbent Rate 2," "Sorbent Rate 3" in the legend. And then you see the "Mercury Emissions" on the left side.

MR. TOBIN: I apologize. I kicked a cable with my foot.

BY MR. TOBIN:

Q. Would you mind repeating your answer, please. Or let me -- excuse me. One last --

MR. TOBIN: Karen, could you please read back Mr. Pavlish's answer, because I kicked a

cable and lost my connection.

(The last answer was read.)

MR. TOBIN: Okay. And thank you for that.

BY MR. TOBIN:

Q. But anywhere does it show controlling the sorbent -- and I'm not asking about the rate. I'm asking about the composition.

Does anywhere in Figure 3 or elsewhere in your February 2004 report show controlling the sorbent composition in response to the measured mercury content?

MR. NEMUNAITIS: Objection; asked and answered.

You can answer.

A. I -- I already answered that. The composition is the mercury in the sorbent, so what changes that composition is obviously the amount of sorbent that's being fed or rejected.

BY MR. TOBIN:

Q. Okay. So under your interpretation of -- and you can go back to Claim 1 of the '114 patent.

Do the words "the sorbent composition" add anything to Claim 1, or is that just an inherent feature of changing the sorbent

rate and the composition will follow?

A. Yes.

Q. Sorry. It wasn't really a "yes" or "no" question. Does -- let me ask it differently.

Do the words "the sorbent composition" add anything to Claim 1?

A. Well, I mean, what prefaces before that. It's the sorbent to form a mercury sorbent composition.

So a few sentences prior to what, we're talking about talks about a mercury sorbent composition. So does it add anything? I mean obviously, the sorbent composition does change as a function of rate. The mercury -- the amount of mercury captured on the sorbent changes that composition.

Q. In any of the tests you ran was sorbent composition -- in your February 2004 report, was the sorbent composition an independent variable that you could change?

A. Independent in the sense we changed the sorbent feed rate.

Q. That's sounds like dependent, doesn't it?

A. Well, I mean, you can change -- you can change the coal feeder rate too, change the

mercury content going in, but that will change the mercury sorbent composition too, but --

Q. Okay.

A. -- is it a controllable factor, I guess, is what you're asking, and --

Q. Correct.

A. -- it is, based on the sorbent feed rate.

Q. Got it. Now, someone else could have designed an experiment to measure mercury concentration and, based on the concentration, switch which kind of sorbent is being fed to the flue gas.

Someone could have done that, correct?

A. We did that. I mean, it would still be related to that particular sorbent in mercury. Because -- again, going back to the previous statement where we're saying capture the mercury and the mercury-containing gas with the sorbent -- that could be any sorbent -- to form a mercury sorbent composition.

So that mercury sorbent composition is tied to that sorbent. So someone else could put another sorbent in. They're going to form a mercury sorbent composition.

Q. Okay. But you, yourself -- your team never did that, switch sorbents based on the mercury reading?

A. Sure, we did. I mean, we evaluated a number of different sorbents, and if the sorbent wasn't performing, we quit the test and tested a different sorbent.

Q. In the February 2004 report with the SEA 2, you never switched sorbents based on a mercury measurement. All you did was change sorbent rate, correct?

A. Yes, in that report, yes.

Q. Okay. Now --

MR. TOBIN: Let's go off record, and let me check my notes. Maybe we can wrap up sooner than I thought.

THE COURT REPORTER: Yes, sir.

We are off the record at 3:53 p.m.

(A recess was taken from 3:53 p.m. to 4:12 p.m.)

THE COURT REPORTER: All right.

We're back on the record at 4:12 p.m.

BY MR. TOBIN:

Q. Okay. And -- hi. Welcome back, Mr. Pavlish.

I've put into the Chat window two exhibits. They're both -- they've both been filed as Exhibit 2017, but it's broken up into two parts.

(Exhibit 2017 (Part 1 and Part 2) referenced.)

BY MR. TOBIN:

Q. Do you have those in front of you?

A. I have the first one open. I haven't opened up the second one, but I can, or when you want me to.

Q. Thank you.

The first one that you have opened, the cover page says, "Declaration of Thomas Erickson"?

A. I have that one open.

Q. Okay. I wanted to ask you about some gaps I saw in the lab notebook and see if you understand why those are or what was happening then.

So let me direct you to page 126 of the exhibit, please.

A. (Complied.) Okay. I think I'm there. Exhibit 2017, page 126?

Q. Yes, sir.

Do you see on the -- and by the way, when I'm referring to page numbers, at the bottom right corner, it'll say "Exhibit 2017" and then below that, a page.

Do you see that?

A. I do.

Q. Okay. So I'm on page 126 of the exhibit.

Do you see how this is a page of the logbook dated July 18th, 2002, it looks like?

A. I do.

Q. Okay. And then if you go to the following page, there's a page of the logbook on page 127 that doesn't have a date on it.

Do you see that?

A. I do.

Q. And then the following page, there's a -- page 128 of the exhibit is dated August 12th, 2018, and August 13th.

Do you see that?

A. I do.

Q. So there appears to be a gap of close to a month in the logbook between July 18th and August 12th, 2002.

Do you see that?

A. I do.

Q. Do you know why there's a gap in the logbook?

A. Yes, I do.

Q. Why is that?

A. There was no testing going on for that period of time. I think I mentioned we had three different test campaigns that summer. I think we started one the end of June.

This one -- second one appears like it was middle of July.

And then the last one was -- looks like 8-12, and that's when we discovered the invention was -- like I said, it was in August, but it was in conjunction with this last set of testing, so ...

Q. Now, when you say there's no testing at the PTC, do you mean no testing by your group or no testing at all?

A. Probably likely no testing at all. I don't know for sure. I'm guessing there was no testing done at all.

Q. So someone could have been using the PTC between July 18th and August 12th, 2002? It's just not recorded here?

A. That's a possibility, but I'm guessing --

I can look. (Examined exhibit.) Let me see. -6. It doesn't indicate that. I can't get it from that either. So it's possible.

Again, it could be same logbook. And if it is the same logbook, unless there was confidentiality -- or confidential testing going on, which probably would have an excerpt or been removed or so forth. But I'm guessing -- just looking at this, I would say there was no testing done.

Q. Okay. What about -- why don't you go to page 137, please.

A. 137?

Q. Yes.

A. (Complied.) Okay. I do see that.

Q. Page 137 was dated August 15th, 2002?

A. Yes.

Q. Page 138 doesn't have the date, correct?

A. It does not have a date. If you look at the timestamp, though, it follows on. I mean, "1709," "1720," "1752." So the date is not recorded, but the time -- if I read the logbook, it's a continuation because the time continues on.

Q. Okay. So you expect that page 138 was on -- also on August 15th, 2002?

A. Correct. I'm looking at the time. Military time was "2003." Looks like they were pretty well done then, so ... I would reply "yes."

Q. Okay. And then if we look at the following page, 139, it jumps from August 15th to September 29th of 2002.

Do you see that?

A. Are you referring to page 139?

Q. Yes, I am.

A. Yes. It's -- yeah, okay. 9-29, 9-30. So looks like it ran overnight, but ...

Q. Well, I'm -- between -- if you compare page 138 to 139, there appears to be a gap of about six weeks?

A. Correct.

Q. Do you know what was happening to the PTC during those six weeks?

A. My guess is it wasn't running --

(Speaking simultaneously.)

Q. Is --

A. -- assuming for maintenance, or the operators were off running a test or tests on a different unit or -- I mean, there's probably many reasons. But my guess is it wasn't running during

that time.

Q. Okay. But -- but at least you were not conducting research on the PTC during that time, or your group was not, correct?

A. Correct. If they were -- or if we were, we'd have a logbook with those entries.

Q. Okay. Let's go down to page 204, please.

A. (Complied.) Okay. 204?

Q. Yes, sir.

A. Yes.

Q. Page 204 is dated March 21st, 2003?

A. Yes.

Q. And the following page, 205, is undated, correct?

A. Correct.

Q. And then page 206 is dated July 28th, 2003?

A. Correct. I do see that.

Q. So there's a gap in the logbook of about four months and one week?

A. Yes, on the one that's not dated, the second page -- 205 is a continuation. Again, if you look at the military time, "1346," "1426," so they didn't date it, but it was a continuation. That test ended, you know, that following day, and

then the PTC, again, sat idle for several months.

Q. Do you remember, when you were there, the PTC not being used for over four months?

A. Oh. Yeah, I mean, when mercury -- when we got into testing for mercury, there might have been six months -- I mean, there's other facilities.

There's a CTF, which is similar to the PTC, which if you're studying, like, slagging and flowing -- I mean, you could run the CTF instead of the PTC.

We did our testing on the PTC, primarily because it had a proven record of generating flue gas and emissions consistent with full-scale power plants. That's not to say the other units didn't either. It's just we focused on the PTC. We started there, and then we didn't want to switch to another unit, because then we'd have some discrepancy, potentially, with one unit versus another.

Q. So do you know whether another research group was using the PTC between March 21st and July 28th, 2003?

A. No, I have no recollection. I can't recall --

Q. So it could be?

A. It could be. I can't -- I don't recall of it does, but it's certainly possible.

Q. Okay.

A. My guess is it wasn't, just because I don't see any continuation of data. But -- and that's only based on that. I would just say it was either being maintained and ready -- getting ready for run. But, yeah, it wasn't being run.

Q. Do you know whether anyone removed pages from the logbook before providing copies to counsel?

A. I would think not. I mean, I don't -- I'm not aware. I don't know why anyone would do this. I mean, the request was made for the logbook, and there was no reason or motivation to eliminate any pages.

And I believe the declaration provided by Dr. -- you know, Mr. Erickson, I mean, he was a director at this request. So I mean -- his declaration says that these pages are from the logbook. None were removed or inserted or manipulated in any way.

Q. Well, could it be that some got removed for confidentiality concerns because of other

research groups' projects at the --

A. That's a possibility. I'm not fully aware of how the logbooks -- I know that specific projects that were done with industry only -- generally speaking, with -- if you had a government funding, they were confidential in the sense that, yeah, there might be proprietary information you want to protect, you know, under your reporting. But usually, you know, they were generally public and government funding.

But in the case where we had just an industrial sponsor, in other words, if someone came, for example, and said, "I want to test this real cool sorbent that I developed for mercury control. I don't want anybody to know that" -- first of all, they're not even doing testing. Second of all, I don't want anybody to find out what the sorbent is. Third, I don't want anybody to find out what the results are.

And so they would come to the EERC because they don't have the PTC. They don't have the pilot-scale combustor. And they can't afford to do at full scale, because then you're talking hundreds of thousands. And so they would come to the EERC and request that type of test. And if

it's just for a sponsor, they would require confidentiality.

Q. But do you think it's at least fair to say that between March 21st and July 28th, 2003, your research group was not doing any testing on the PTC?

A. The group that I oversaw. Again, as I mentioned earlier, there were other -- the EERC, at the time, was about 250 people. About 60 percent of the staff was working on mercury, and so they may have done other tests.

They may have done other tests of confidentiality folks, per my example. Because we did have folks coming in wanting to help them assess their technology, so ...

Q. Do you know what happened -- do you know what happened with the PTC between March 21st and July 28, 2003, to any degree of confidence?

A. No, other than I was -- my first response would be, it probably did not run. It would not be unusual to not run for three, four months. That would not be unusual.

Q. Did you personally have any involvement in collecting the logbooks and reviewing the logbooks for purposes of making copies for

litigation?

A. No, just a request.

Q. All right. Next I want to turn to -- you can close this file.

A. (Complied.)

Q. And you can open Part 2, please. And let me know when you have that open.

A. Isn't part 2 the logbook we just looked at, or is that a different one?

Q. This one has "Part 2" in the file name.

A. Okay. I have the right one loaded up.

Q. What do you see on the first page of your document?

A. Logbook entry.

Q. Do you see Exhibit 2017 page 226 on the bottom?

A. 226? Yes.

Q. Okay. So I'm hoping you can help me put together some activities that happened on March 18. And for that, can you go to page -- let's see. Where does that start? That starts, I think, on page 265 of the logbook. And just, I guess, skipping to the conclusion. I think the pages are out of order, and I'm hoping you can help me put them back in order.

A. Hopefully.
Q. Okay. We'll give it the old college try?
A. 265.
Q. Okay. So page 265, is it your understanding this represents testing on March 18th, 2003?
A. Yes.
Q. And this represents, I guess, military time, "0235," in the morning?
A. It should.
Q. And then the testing continued till "0810" in the morning?
A. It should.
Q. And then if we look at the following page, page 266, would you expect that this page follows the immediately previous page, because it -- the top line is "0820"?
A. Yes, I would expect that.
Q. Okay. And then the last entry is at "13:27" of September 18th?
A. What page are you looking at?
Q. 266?
A. 266. The file is dated 9-18. 267's also dated 9-18.
Q. One page at a time. Page 266 goes from

"0820" to "1327"?

A. Yes, I see that.

Q. And then page 267 appears to jump to 16- -- or excuse me -- "1836" and go to "2332" of September 18th?

A. Yes, I do, yep.

Q. And then page 268 appears to go backwards in time, to "1336" of September 18th?

A. I see that. I see why you're questioning it.

Q. And it goes to "1746" of September 18th on page 268, right?

A. Yeah, I -- I see that, yes.

Q. Is the lab book out of order, or am I misreading?

A. I'm guessing -- I don't know if the lab book is out of order or when it was copied, you know, whether -- when they copied it, somehow the pages got switched -- in other words, they copied the other one first, and then they went back and copied that. I don't know if they actually switched in the logbook or if it was switched during the copying of the logbook.

Q. One way or the other, does it appear that pages 267 and 266 are swapped?

A. Yes.

Q. Okay. So let's see if we can do this chronologically. And I think this is all in your declaration in public anyway.

So at -- let's go to page 268 of the logbook. And this page starts at "1336"?

A. Yes, I see that.

Q. Okay. And so at "1358" on September 18th, someone shut off the carbon and salt feeders.

Do you see that?

A. I do.

Q. And the carbon feeder is activated carbon?

A. Yes.

Q. Then on September 18th, at "1414," someone turned back on the feeders?

A. Correct.

Q. At "1535," someone added sodium chloride?

A. Yes.

Q. Sodium chloride is not NAPR, correct? It's NaCl?

A. Correct.

Q. And then at "1713," someone shut down the carbon and salt feeder, correct?

A. Correct.
Q. So as of "1713," the activated carbon was turned off?
A. Yes.
Q. Okay. And then at "1743," the PTC was taken offline to do a little bit of cleaning?
A. Yes.
Q. Okay. And as of now, the activated carbon is still off?
A. Should be.
Q. You certainly don't want to clean it with the carbon on, right?
A. Correct.
Q. Okay. And the salt feeder is also off as of "1743" on September 18th?
A. Yes.
Q. And, now, this is where we had the page swapping. But on page 268, we left off at "1746," and at that point in time, just someone on September 18th was cleaning the setup, right?
A. Yes.
Q. Okay. So if we want to do this chronologically, we would then go to page 267 and go to "1836"?
A. Yes.

Q. Okay. And the activated carbon is still off at "1836"?

A. Yes, the bromide feeder was turned on.

Q. Right. And certainly no record of someone turning on the activated carbon, correct?

A. No, I don't see that, based on the previous page, no. I may have.

Q. So at "1836," someone -- on September 18th, someone was feeding sodium bromide, right?

A. Yes.

Q. And at "2036," I guess they finished their test and turned off the sodium bromide?

A. Yes.

Q. So between "1836" and "2036," on September 18th, 2003, the technician that was running a test was running a test with only sodium bromide and no activated carbon, correct?

A. Yes.

Q. Okay.

MR. TOBIN: I'll pass the witness and reserve the right to recross.

And, Counsel, just so we're on the same page here, I don't think I got into any more detail than what's in the public declaration. Can we agree that up to

here, I don't need to seal, and we can file at the right time?

MR. NEMUNAITIS: Yes, agreed.

MR. TOBIN: Thank you for that.

Pass the witness.

THE COURT REPORTER: Okay. We're off the record at 4:33 p.m.

(A recess was taken from 4:33 p.m. to 4:37 p.m.)

THE COURT REPORTER: We're back on the record at 4:37 p.m.

EXAMINATION

BY MR. NEMUNAITIS:

Q. Mr. Pavlish, could you turn to page 270 of the logbook document we were just looking at.

A. (Complied.) 270 of 2017. I'm there.

Q. And do you see the line entries for "950" and "1028"?

A. I do.

Q. Does this page have an example of one of the tests where you were using sodium bromide and activated carbon?

A. Yes, it does. Or yes, it is.

MR. NEMUNAITIS: Pass the witness.

MR. TOBIN: Just a quick follow-up

on that.

FURTHER EXAMINATION

BY MR. TOBIN:

Q. On the page 20 -- page 270 of Exhibit 2017, counsel just asked you about the tests from "0950" to "1028" on September 19th, 2003.

Do you see that?

A. Please repeat.

Q. Sure. (Short pause.)

MR. TOBIN: You know what? I'm gonna pass the witness. Done.

THE COURT REPORTER: Okay. All right. We're off the record at 4:38 p.m.

(Following discussion had for administrative purposes.)

THE COURT REPORTER: I just need to confirm the transcripts order for you both.

David, I have a standing order for you. This transcript it set to be delivered on Monday with a rough draft tonight.

MR. TOBIN: What day is today? Is today Thursday?

THE COURT REPORTER: Yes, sir.

MR. TOBIN: All right. Yeah, I've had a couple other depositions with Karen this week. I'm thinking of another case.

Can I -- we have some upcoming filings. Could I get the transcript sometime by Saturday?

THE COURT REPORTER: Yes, probably. If not Saturday, Sunday morning at the latest.

MR. TOBIN: That's fine. Thank you.

THE COURT REPORTER: Okay. I've got some time zone issues on my end, so if I could have until Sunday morning, I'll meet that for you.

MR. TOBIN: No issues. That's fine. Thank you.

THE COURT REPORTER: However, if I can get it done a little sooner, I'll send it on.

MR. TOBIN: Okay. That works.

THE COURT REPORTER: The rough

draft will be delivered probably either late/late tonight -- yeah, it will be late tonight. The rough draft will come to you tonight.

MR. TOBIN: Okay. If you need -- that's fine. Thank you.

THE COURT REPORTER: Justin, would like a rough draft?

MR. NEMUNAITIS: Yes.

THE COURT REPORTER: And when would you like delivery of the transcript? On Saturday as well?

MR. NEMUNAITIS: Yes, same thing.

THE COURT REPORTER: Okay. And then I'm confirming that I'm okay submitting all the exhibits that were presented in the deposition with the final transcript which have the confidentiality stamp on them.

Additionally, I will denote that in the Exhibit Index part of the transcript. I will not be adding any other stamp physically on the exhibit; just how they are already presently denoted. I'm going to simply indicate if they are

confidential in the Exhibit Index.

Is that correct, gentlemen?

MR. NEMUNAITIS: Correct.

MR. TOBIN: Yes, ma'am.

THE COURT REPORTER: Thank you, gentlemen.

With that, that concludes our deposition today.

I'll ask you a couple spelling questions off the record. I have three.

(Remote deposition concluded at 4:38 p.m., February 26, 2026.)

CHANGES AND SIGNATURE

WITNESS NAME: JOHN HENRY PAVLISH

DATE: FEBRUARY 26, 2026

PAGE/LINE	CHANGE	REASON

I, JOHN HENRY PAVLISH, have read the foregoing deposition and hereby affix my signature that same is true and correct, except as noted above.

_____

JOHN HENRY PAVLISH

THE STATE OF _____)

COUNTY OF _____)

Before me, _____, on this day personally appeared JOHN HENRY PAVLISH, known to me (or proved to me under oath or through _____) (description of identity card or other document) to be the person whose name is subscribed to the foregoing instrument and acknowledged to me that they executed the same for the purposes and consideration therein expressed.

Given under my hand and seal of office this _____ day of _____, 2026.

_____

NOTARY PUBLIC IN AND FOR

THE STATE OF _____

CERTIFIED STENOGRAPHIC

COURT REPORTER'S CERTIFICATE

I, Karen L. D. Schoeve, Registered Diplomate Reporter, Certified Realtime Reporter, and Realtime Systems Administrator, residing in the State of Texas, do hereby certify that the foregoing proceedings were reported remotely by me on an electronic stenographic machine and that the foregoing transcript constitutes a full, true, and correct transcription of my stenographic machine notes, to the best of my ability, and I hereby certify to the following:

By agreement of all attending attorneys, the witness, JOHN HENRY PAVLISH, was remotely duly sworn by the officer and that the transcript of the oral deposition is a true record of the testimony given by the witness;

I further certify that signature of the witness was requested by the witness or a party before the completion of the deposition and the signature is to be returned within 30 days from date of receipt of the transcript.

If returned, the attached Changes and Signature Page contains any changes and the reasons therefor.

That the original deposition was delivered to David J. Tobin representing Petitioner PacifiCorp;

I further certify that I am neither counsel for, related to, nor employed by any of the parties in the action in which this proceeding was taken; and further, that I am not financially or otherwise interested in the outcome of the action.

Subscribed and sworn to on this the 27th day of February, 2026.



_____

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