

In the Matter of:

Arkema France
vs.
Honeywell International

Robert D. Lousenberg, Ph.D.

April 15, 2016



Court Reporting Solutions

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ARKEMA FRANCE,

Petitioner

v.

HONEYWELL INTERNATIONAL, INC.,

Patent Owner

VIDEOTAPED DEPOSITION OF

ROBERT D. LOUSENBERG, Ph.D.

Volume 2

Pages 165 - 323

Trial No. IPR2015-00915

Trial No. IPR2015-00916

Trial No. IPR2015-00917

U.S. Patent No. 8,710,282

1 Videotaped Deposition of ROBERT D.
2 LOUSENBERG, Ph.D., taken before KAREN K. KIDWELL,
3 RMR-CRR, and Notary Public, pursuant to the
4 Rules of the United States Patent and Trademark
5 Office, on the 15th of April, 2016, at the offices
6 of Alston & Bird, Bank of America Plaza, 101 South
7 Tryon Street, Suite 4000, Charlotte, North
8 Carolina, commencing at 9:00 a.m.

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1 FRIDAY, APRIL 15, 2016, CHARLOTTE, NORTH CAROLINA

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

3 -oOo-

4 VIDEOGRAPHER: We are now on the record.
5 Today's date is April 15th, 2016. The time is 9:00
6 o'clock exactly. This is the video deposition of
7 Mr. Robert Lousenberg taken by counsel for the
8 Petitioner. The location is Alston & Bird, Bank of
9 America Building, 101 South Tryon Street, Charlotte,
10 North Carolina.

11 My name is Ernie Magness, legal
12 videographer, representing Merrill Corporation,
13 Chicago, Illinois.

14 This deposition is taken in the matter of
15 Arkema versus Honeywell, Trial Number IPR2015-00915,
16 -00916, -00917, U.S. Patent Number 8,710,282. Case
17 number CH-080661.

18 Counsel, if you'll please introduce
19 yourselves for the record.

20 MR. BAUM: My name is Allen Baum for
21 Petitioner Arkema France, and I have with me Jon
22 Beaupre, Allyn Elliott and Joshua Ney.

23 MR. ROSE: Good morning. Bruce Rose from
24 Alston Bird for the Patent Owner. With me is my
25 colleague, Christopher Douglas.

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ROBERT D. LOUSENBERG, Ph.D.
being first duly sworn, testified as follows:
VOLUME 2
EXAMINATION (Continuing)
BY MR. BAUM:
Q. Good morning, Dr. Lousenberg.
A. Good morning.
Q. Have you discussed your deposition
testimony with anyone since yesterday?
A. No.
Q. Have you discussed your deposition at all
with anyone since yesterday?
A. No.
Q. Have you discussed the testimony that you
gave yesterday with anyone?
A. No.
Q. You haven't had any discussions with
counsel concerning your deposition yesterday?
A. Not concerning my deposition.
Q. What did you discuss with counsel?
A. Football schedule.
Q. Anything else?
A. Getting my boarding pass printed out.
Q. Anything else?
A. Well, we knew this question would come up.

1 We did discuss the price of tea in China.

2 Q. Anything beyond the price of tea in China?

3 A. No.

4 Q. Thank you. Do you have any experience
5 separating a solid from a liquid in a chemical
6 process?

7 A. Yes.

8 Q. And what is that experience?

9 A. One example, filtration, evaporation of
10 the liquid from the solid.

11 Q. And is evaporation a means that a gas can
12 be separated from a liquid as well?

13 A. Yes.

14 Q. What types of equipment have you used to
15 separate a solid from a liquid?

16 A. Filtration equipment, distillation
17 equipment.

18 Q. Any other types of equipment?

19 A. None that come to mind at the moment.

20 Q. Can a centrifuge be used to separate a
21 solid from a liquid in a chemical process?

22 A. Yes.

23 Q. And how does that work?

24 A. It spins the sample at high RPM and the
25 centrifugal force increases the pull -- the

1 separation force, and the denser material tends to go
2 to the bottom.

3 Q. And a centrifuge can be used in a
4 continuous process; is that correct?

5 A. Yes.

6 Q. In a chemical process including a reactor
7 where ingredients are added to the reactor, is it
8 typical to include a stirrer in that reactor?

9 A. Yes.

10 Q. Why is that?

11 A. To increase contact with the materials in
12 the reactor.

13 Q. And when you increase contact with the
14 materials in the reactor, what happens?

15 A. You tend to create a more favorable
16 reaction conditions.

17 Q. What does "more favorable reaction
18 conditions" mean?

19 A. Meaning the reaction will go further in
20 terms of conversion of reactants to products.

21 Q. Will a stirrer help the reaction go faster
22 from reactants to products?

23 A. Yes.

24 Q. Can one of ordinary skill in the art
25 typically determine an effective reactant temperature

1 with little experimentation?

2 MR. ROSE: Objection to form.

3 BY MR. BAUM:

4 Q. Strike that. Let me ask it again.

5 Can one of ordinary skill in the art
6 typically determine an effective reaction temperature
7 with little experimentation?

8 MR. ROSE: Objection to form.

9 THE WITNESS: How little?

10 BY MR. BAUM:

11 Q. Yesterday, I think you mentioned three
12 data points.

13 A. Yes.

14 Q. I'd like you to take -- so let me
15 strike -- strike that. Let's begin again.

16 So one of ordinary skill in the art could
17 typically determine an effective reactant temperature
18 with three data points?

19 MR. ROSE: Objection. Form.

20 THE WITNESS: Likely, yes.

21 BY MR. BAUM:

22 Q. I'd like you to turn to the '282 patent
23 which we were looking at yesterday. If you could
24 turn to column 12, please. You'll see there's a
25 reaction formula set forth in column 12. Actually

1 there's two reaction formulas. Do you see that?

2 A. Yes. Are we talking about formulas 1 and
3 2?

4 Q. Yes, correct. Can you tell me what the
5 Formula 1 is?

6 A. Yes. That is 236ea.

7 Q. And can you tell me what reaction 2
8 relates to?

9 A. 245eb.

10 Q. So in reaction 1, is it correct that we
11 are reacting 236 -- one mole of 236 with one mole of
12 KOH to yield one mole of 1225 with one mole of KF and
13 one mole of water?

14 A. That is correct.

15 Q. And is it correct that in reaction 2, we
16 are reacting one mole of 245 with one mole of KOH to
17 yield one mole of 1234 plus one mole of KF and one
18 mole of water?

19 A. Correct. May I add that we do -- in a
20 general equation like this, unless it's specifically
21 known, the -- the co-efficients in front of the
22 reactants is taken to be 1. But in a lot of times,
23 it may not be -- the actual conditions may be
24 different. It's just written that way until
25 conditions are known for such a reaction.

1 Q. So is it your understanding that since
2 there's no indication as to whether it's one mole or
3 two moles, that each of the reactants and products is
4 present in the amount of one mole or a one-to-one
5 ratio?

6 A. That is one assumption or it could be
7 that -- that we're talking about the actual chemistry
8 and not the actual stoichiometry of the reaction.

9 Q. Are the formulas --

10 A. But --

11 Q. Go ahead.

12 A. That's fine.

13 Q. Please. I don't want to interrupt you.

14 A. Oh. So yes, yes, it can be taken either
15 way. Unless it's in context, it can be taken either
16 way.

17 Q. Okay. So you've spent a fair amount of
18 time reviewing the '282 patent in connection with
19 this matter, correct?

20 A. Right.

21 Q. And you're here to testify as an expert?

22 A. Yes.

23 Q. With regard to the '282 patent, correct?

24 A. Yes.

25 Q. So reading Formula 1 in column 12, is that

1 the stoichiometric formula for preparing 1225 from
2 236?

3 A. The text does not say that one mole is
4 reacting with one mole.

5 Q. I understand that the text may not say
6 that. But what do you understand the '282 patent to
7 mean with regard to Formula 1 and the ratios of the
8 reactants in that stoichiometric formula?

9 A. I would understand it to mean one to one.

10 Q. Okay. So back to my original question.
11 Formula 1 describes reacting one mole of 236 with one
12 mole of KOH to yield one mole of 1225 plus one mole
13 of KF plus one mole of H₂O, correct?

14 A. Correct.

15 Q. And Formula 2 discloses reacting one mole
16 of 245 with one mole of KOH to yield one mole of 1234
17 and one mole of KF and one mole of H₂O, correct?

18 A. Correct.

19 Q. So if we speak now in terms of what's
20 happening in the reactor described in the '282
21 patent, the dehydrohalogenation reactor in the '282
22 patent, and we think about what's present -- just
23 what's present in the aqueous phase in view of
24 Formulas 1 and 2, if we have 50 parts of water and 50
25 parts of KOH as reactants, that will yield 25 parts

1 of KF and 25 parts of KOH and 75 parts of water,
2 correct?

3 MR. ROSE: Objection to form.

4 THE WITNESS: There was a lot of numbers
5 there. I would need to hear the question again.

6 MR. BAUM: Okay. Could the reporter
7 please read back the question?

8 (Whereupon the Court Reporter read the
9 previous question.)

10 THE WITNESS: Oh. We're just talking
11 about the aqueous phase?

12 BY MR. BAUM:

13 Q. Correct.

14 A. And if 50 parts -- 50 parts of KOH and 50
15 parts of water, and are we saying 25 parts of KOH
16 will react to yield 25 parts of remaining KOH, 25
17 parts of KF and another 25 parts of water from a
18 reaction so there will be 75 parts of water, 25 parts
19 of KF and 25 parts of KOH? Is that an accurate
20 representation of what you asked?

21 Q. Yes.

22 A. Yes.

23 Q. Okay. So just to make sure we're on the
24 same page. So my question assumed a 50 percent
25 conversion rate and that's what you've --

1 A. Right, right. Now that's what I
2 understand.

3 Q. Okay. So --

4 A. Are we --

5 Q. Go ahead.

6 A. Can I correct my answer? It will not
7 yield 25 parts of water. What parts in terms of
8 moles if we -- how are we defining parts?

9 Q. Well, let's -- we can go back to moles.
10 Why don't we start again?

11 A. Okay.

12 Q. Okay. So if we speak now in terms of
13 what's happening in the reactor described in the '282
14 patent, the dehydrohalogenation reaction in the '282
15 patent and we think about what's present -- just
16 what's present in the aqueous phase in view of
17 Formulas 1 and 2 in column 12 of the '282 patent.

18 A. Okay.

19 Q. And we assume a 50 percent conversion
20 rate, is it correct that 50 moles of water plus
21 50 moles of KOH would yield 25 moles of KF, 25 moles
22 of KOH and 75 moles of water?

23 A. Okay. I agree that the reaction --
24 there's something I'm missing here to answer this
25 correctly. We started with 50 moles of KOH and how

1 much water?

2 Q. 50 moles of water.

3 A. Okay. Hypothetically, that is -- I don't
4 know what KOH concentration that is, but, okay, I
5 will -- in light of not recognizing what the actual
6 concentration is with 50 moles of water, I will agree
7 that 50 moles of KOH reacting to 50 percent
8 conversion will leave you with 25 moles -- will give
9 you 25 moles of KF, 25 moles of KOH remaining and
10 produce 25 moles of water.

11 Q. So that in the end, you would have a total
12 of 75 moles of water present?

13 A. Correct.

14 Q. Correct? So we've talked about what
15 happens in the aqueous phase and the reactor of the
16 '282 patent with regard to moles. Can we also talk
17 about what's happening in terms of parts by weight?

18 A. Yes, if we -- we can do that. But it is
19 much -- unless we've done -- we have the molecular
20 weights in mind, and that's typically not easy to do
21 in just a conversation. Typically, you would want to
22 be writing things down. Yes, we could. It could get
23 kind of confusing in asking those questions, but yes,
24 it could be done.

25 Q. Is it correct that whether you're looking

1 at it from a molar concentration standpoint or a
2 parts-by-weight concentration standpoint, the
3 reactions of Formula 1 and 2 in column 12 of the '282
4 patent would result in the production of water?

5 A. Yes.

6 Q. And is it correct that whether you're
7 talking about the moles of reactant and product or
8 parts by weight of reactant and product, that you're
9 going to produce that water in the reaction of
10 Formulas 1 and 2 in column 12 in the '282 patent in
11 amounts equal to the amount of KOH and KF produced in
12 that reaction?

13 MR. ROSE: Objection. Form.

14 THE WITNESS: That question had a lot of
15 assumptions in it, and I would need to see it written
16 down to probably answer it correctly.

17 BY MR. BAUM:

18 Q. Would it help if you heard the question
19 again?

20 A. It might.

21 MR. BAUM: Can you read the question back,
22 please?

23 (Whereupon the Court Reporter read the
24 requested question.)

25 THE WITNESS: At 50 percent conversion, I

1 believe that is correct.

2 BY MR. BAUM:

3 Q. So for every mole of KF produced in the
4 Formula 1 or the Formula 2 in column 12 of the '282
5 patent, you're going to produce 1 mole of water?

6 A. Correct.

7 Q. How many chemical processes would you say
8 you've designed in your career?

9 A. Designed that went commercial? Or
10 designed experimentally that maybe -- that were
11 documented but never implemented commercially, which?

12 Q. Either one.

13 A. I have had three chemical process --
14 processes -- no, two chemical processes go
15 commercial. And I -- I don't know -- numerous.
16 Every year we were designing reactant, chemical
17 reactions.

18 Q. So on the order of ten, hundreds per year?

19 A. Not hundreds. More than ten.

20 Q. Okay. Looking at your CV, after your
21 undergraduate degree, you worked at Ballard Power
22 Systems?

23 A. Yes.

24 Q. From July, or excuse me, from 1991 to
25 1995?

1 A. Correct.

2 Q. And were you designing processes at -- let
3 me scratch that.

4 Were you designing chemical processes at
5 Ballard Power Systems?

6 A. I was doing chemical experiments and
7 reactions. If you equate doing chemical reactions to
8 make potentially new products as processes, then yes.
9 But if -- did I -- did I design processes from
10 implementation to commercial products at Ballard?
11 No.

12 Q. Did you design processes -- scratch that.
13 What did those processes relate to at
14 Ballard Power Systems?

15 A. Monomer synthesis and polymer synthesis
16 from those monomers and fabrication of membranes from
17 those polymers that were used in the electrode
18 assemblies of fuel cells.

19 Q. At Ballard Power Systems, did you have any
20 experience designing chemical processes for
21 manufacturing gases?

22 A. No.

23 Q. After Ballard Power Systems, I believe you
24 went back for your graduate work; is that correct?

25 A. Correct.

1 Q. And then you returned to working in
2 industry at DuPont; is that correct?

3 A. At -- after graduate school and after my
4 Ph.D., I was hired directly into DuPont.

5 Q. And from August of 2000 to April of 2007,
6 your CV says that you were senior research chemist in
7 fluoro products, fuel cells, R&D.

8 A. Yes.

9 Q. Can you generally describe the work that
10 you did there?

11 A. My first assignment was in fluoro products
12 in Fayetteville, North Carolina. There, I was
13 working on reformulating and making a more robust
14 process for their Nafion dispersion products. In
15 2004, I transferred to Wilmington into the fuel cells
16 group where I worked on synthesizing new
17 fluoropolymers, ionic fluoropolymers that were
18 similar to Nafion that had advanced properties for
19 fuel cell applications.

20 Q. Between August 2007 -- excuse me. Let me
21 start again.

22 Between August of 2000 and April of 2007,
23 did you have any experience designing chemical
24 processes to manufacture gases?

25 A. Yes.

1 Q. And what gases were you designing chemical
2 processes to manufacture during that period?

3 A. We were designing chemical processes for
4 intermediates that would ultimately lead to 1234yf.

5 Q. Now was that during the period of
6 August 2000 to April 2007 when you were a senior
7 research chemist of fluoro products?

8 A. No, that would have been August -- that
9 would have been -- I transferred from the fuel cells
10 group in spring of 2007 into the fluoro chemicals
11 group. So from spring of 2007 until maybe mid-2008,
12 I was working on processes for chemical intermediates
13 for 1234yf.

14 At that point, I transferred into our
15 solvents group and working on processes to make new
16 solvent materials such as HFX-110 and others that did
17 not become commercial. It was -- basically HFX-110
18 was the product that ultimately went to commercial
19 production, but I worked on the research of a lot of
20 other materials that the intended application if they
21 had gone commercial would have been as new types of
22 solvent molecules.

23 Q. So until April of 2007, you didn't have
24 any experience designing processes to manufacture
25 gases, correct?

1 A. That -- in graduate school, I worked with
2 tetrafluoroethylene. That's a gas. I had to
3 synthesize that in order to do the experiments.

4 There, I took what was -- what was already
5 documented in the literature and adapted it to -- for
6 my laboratory to make tetrafluoroethylene. That
7 process is basically pyrolyzation of
8 polytetrafluoroethylene to make tetrafluoroethylene.
9 So I have handled gases.

10 It -- the idea or -- for the process to
11 make tetrafluoroethylene certainly wasn't my own. It
12 was already documented in the literature. But I have
13 implemented those types of processes --

14 Q. Other than --

15 A. -- before.

16 Q. -- that one experience preparing
17 tetrafluoroethylene in graduate school, you didn't
18 have any experience with -- in designing chemical
19 processes for manufacturing gases until April of
20 2007, correct?

21 A. That is correct.

22 Q. And the work that you did on
23 tetrafluoroethylene in graduate school, that wasn't a
24 commercial scale process, was it?

25 A. No.

1 Q. What was the purpose of that experiment
2 that you conducted concerning tetrafluoroethylene in
3 graduate school?

4 A. It was a means to get access to an
5 intermediate tetrafluoroethylene which you couldn't
6 buy commercially so that I could do further
7 experiments for my graduate work and thesis.

8 Q. And how much tetraethylene do you believe
9 you produced during that experience in graduate
10 school?

11 A. Maybe one to two kilograms.

12 Q. And then what did you do with that one to
13 two kilograms of tetrafluoroethylene that you
14 produced?

15 A. Made new fluoromonomers and polymers with
16 it.

17 Q. So the end product of that work in
18 graduate school relating to tetrafluoroethylene was
19 not a gas, correct?

20 A. Correct.

21 Q. So up until April 2007, you didn't have
22 any experience designing chemical processes where the
23 end product would be a gas, correct?

24 A. That is correct.

25 Q. And then from April 2007 to June of 2015,

1 how many chemical processes for manufacturing gases
2 did you have experience with?

3 A. I don't know an exact number offhand.
4 There's a lot of research done. We made a lot of
5 different molecules.

6 Gases, can we define where are we consider
7 a gas -- what are we defining as a gas? A gas
8 ambient is a -- is gaseous at ambient temperature?
9 Say 20 degrees something?

10 Q. Is that your understanding of what a gas
11 is?

12 MR. BAUM: Objection to form.

13 THE WITNESS: Well, many things can be
14 gas. Water can be a gas, steam if it's hot enough,
15 so. Are we talking about refrigerant molecules or
16 anything that has a boiling point before room
17 temperature?

18 BY MR. BAUM:

19 Q. Let's talk about refrigerants. How many
20 chemical processes did you have experience with
21 during your tenure at DuPont from 2007 to 2015 --

22 A. Okay. Well, let's see.

23 Q. -- involving refrigerants?

24 A. When I first started, I also worked on
25 doing the dehydrofluorination of 245eb. That was

1 done in -- in a similar type way as the '282 patent.
2 There, my objective was to explore the use of
3 solvents for making that reaction go and to what
4 extent and efficiency it went. I also -- I believe I
5 also did the dehydrofluorination of 236ea in a
6 similar fashion.

7 That was not a part of any patent because
8 at the time, I believe DuPont was not going to -- was
9 not ultimately probably going to go that way and I
10 think DuPont had assumed that Honeywell had already
11 covered a lot of this. I think looking back now,
12 that we may have been in that same time frame as
13 Honeywell in doing a lot of the experiments, but we
14 didn't ultimately pursue them in -- into patents. So
15 yes, I did do those experiments for making 1225ye and
16 1224yf.

17 But soon after doing that, my major focus
18 was looking on the long-term alternative routes for
19 1234yf. DuPont realized that an HFP route was likely
20 not going to be in the long term. The variable cost
21 in producing that would be higher than other routes
22 so they had me transition into looking into making
23 1234yf, ultimately starting from chlorocarbons, such
24 as reactions of carbon tetrachloride with ethylene to
25 make 250fb and then reactions of 250fb to make other

1 chlorocarbon intermediates that could then go through
2 vapor phase reactions with, for example, HF to
3 ultimately lead to 1234yf.

4 Q. So that's two reactions that you had
5 experience with --

6 MR. ROSE: Objection.

7 BY MR. BAUM:

8 Q. -- concerning refrigerants at DuPont
9 during 2007 --

10 MR. ROSE: Objection to form.

11 BY MR. BAUM:

12 Q. -- to 2015?

13 A. I would say maybe three because the
14 chlorocarbon routes ultimately did lead into gases.

15 Q. So between the periods of 2007 and 2015 at
16 DuPont, you had experience with three chemical
17 processes relating to the manufacture of
18 refrigerants?

19 A. Well, I had -- I had experience with -- I
20 didn't always make them in the same way. And if we
21 define -- if -- if chemical processes are distinct,
22 if you do them in slightly different ways, then I've
23 done lots. I've done dozens. But ultimately, these
24 different chemical processes were focusing on a
25 certain set of intermediates. So the amount of

1 processes that I looked to make them could be in the
2 dozens.

3 Q. So during the period of 2007 to 2015 at
4 DuPont, you only had experience with three distinct
5 chemical processes for manufacturing refrigerants; is
6 that correct?

7 MR. ROSE: Objection to form.

8 THE WITNESS: I'm not sure we're defining
9 distinct. I think I said that if you look at
10 carrying them out in different ways, either through
11 vapor phase or liquid reactions or running the vapor
12 phase with different catalysts, those could be
13 considered distinct processes, couldn't they?

14 BY MR. BAUM:

15 Q. Well, how do you define the term "distinct
16 processes"?

17 A. Well, it has to be -- there has to be some
18 fundamental difference between them. Using different
19 catalysts is a fundamental difference I would say.
20 Even doing deaqueous phase dehyrdofluorinations with
21 different catalysts could be viewed as distinct
22 differences between processes.

23 Q. So if we use the definition of distinct
24 processes to mean processes that have either
25 different reactants or products, how many distinct

1 processes did you have experience with at DuPont
2 between 2007 and 2015 relating to refrigerants?

3 MR. ROSE: Objection to form.

4 THE WITNESS: I can't give you an exact
5 number on there because there -- when I -- because
6 there was -- there was always variations in
7 intermediates that we were making. Yes, there --
8 what I'm talking -- when we first started this line
9 of questioning, you asked me what I had in my mind
10 was distinct processes that I could -- I could recall
11 that -- that, for example, chlorocarbon routes are
12 distinct from fluorocarbon routes starting with HFP
13 to go to 1234yf.

14 I used many different chlorofluorocarbons
15 and pure chloro -- chlorocarbons to go to different
16 intermediates. For example, 1230xa is an
17 intermediate for long-term production of 1234yf.
18 That's -- that intermediate, 1230xa, is hydro -- is
19 hydrofluorinated to make 244bb and then that is
20 dehydrochlorinated to make 1234yf.

21 1230xa can come about by several different
22 routes. It can come from two -- from
23 hydrofluorination of 1230xa. It can come about by
24 chlorination of 243zf and then dehydrochlorination of
25 243zf.

1 were a few other compounds that were gases that you
2 have experience in designing a manufacturing
3 process --

4 A. Can you say that again, please?

5 Q. So you only have experience in designing a
6 few other compounds -- let me strike that.

7 So you only have experience designing
8 processes to manufacture a few compounds in addition
9 to HFX-110 and 1234yf, correct?

10 MR. ROSE: Objection. Form.
11 Mischaracterizes.

12 THE WITNESS: Are these few compounds
13 gases? Are you saying these few compounds are gases?
14 BY MR. BAUM:

15 Q. Yes.

16 A. Okay, because HFX-110 is not a gas.

17 Q. Okay. Thank you. So other than 1234yf,
18 you have experience designing chemical manufacturing
19 processes to manufacture gases of how many different
20 compounds?

21 A. That are gases?

22 Q. That are gases.

23 A. Two or three.

24 Q. And all of that experience would have
25 occurred other than the work you did in graduate

1 school after April of 2007, correct?

2 A. Correct.

3 Q. Do you know what a flash drum is?

4 A. A flash drum? No.

5 Q. Do you know what a phase splitter is?

6 A. Yes.

7 Q. What is a phase splitter?

8 A. I know the term. I have never used one.

9 I've just -- so, yes, I've heard the term. I don't
10 know its operation, although I presume it splits two
11 phases or -- or -- yeah.

12 Q. So you've heard the term, but you don't
13 know what it is?

14 A. No, it's -- I've heard it through
15 engineers so I believe it's common to engineering.

16 Q. And you don't consider yourself an
17 engineer?

18 A. Not by practice, although I have picked up
19 some engineering skills.

20 Q. Do you know what the configuration of a
21 phase splitter is?

22 A. No.

23 Q. Do you know if a phase splitter separates
24 a liquid from a gas?

25 A. I -- I don't know. I haven't used the

1 term "phase splitter" in my work so I don't know its
2 operation. If a phase splitter -- if a decanter is
3 an example of a phase splitter, then I can know what
4 it is, but I have not commonly worked with the term
5 or I haven't worked with the term "phase splitter."

6 Q. Can a reactor function as a phase
7 splitter?

8 MR. ROSE: Objection to form.

9 THE WITNESS: Yes, if -- if you have
10 two -- two phases in a reactor and, for example, the
11 reactor is stirring and you stop stirring, then the
12 reactor is acting as a phase splitter.

13 BY MR. BAUM:

14 Q. Can a decanter act as a phase splitter?

15 A. Yes.

16 Q. Is sodium hydroxide a dehalogenating
17 agent?

18 A. Yes. Sorry. Say that again?

19 Q. Is sodium hydroxide a dehydrohalogenating
20 agent?

21 A. Yes.

22 Q. Yesterday we were talking about continuous
23 reactor and reactants being introduced to that
24 reactor and products, by-products and reactants being
25 removed from that reactor. And we were talking about

1 the desire to maintain a steady state in the reactor.

2 How do you measure whether you have a
3 steady state in that reactor?

4 MR. ROSE: Objection to form.

5 THE WITNESS: Well, you can do analytical
6 methods to measure the product coming out. You
7 can -- your reactor support equipment like pumps and
8 such can be designed so that they balance input with
9 output so the level in the reactor remains constant.
10 But if you -- if you're asking about steady state in
11 terms of the product coming out, you pretty -- you
12 have -- you have to balance the inputs with the
13 outputs. And to confirm that you have a steady
14 state, you need to measure the outputs, assuming you
15 have premeasured your inputs and your inputs are well
16 known as to what -- what their characterization is.

17 BY MR. BAUM:

18 Q. So if you have a reactant going in at
19 50 percent and you want to maintain a steady state?

20 A. 50 percent what?

21 Q. By weight. And you want to maintain that
22 level of reactant in the reactor, you have to add an
23 amount of reactant equal to the amount that's being
24 reacted to produce product in order to maintain a
25 steady state in the reactor?

1 A. Can you say that again, please?

2 MR. BAUM: Could you read that question
3 back, please?

4 (Whereupon the Court Reporter read the
5 previous question.)

6 THE WITNESS: I believe so.

7 BY MR. BAUM:

8 Q. So that's a yes?

9 A. Yes.

10 Q. And then to confirm that you had achieved
11 a steady state, would you measure the output of that
12 reactant to confirm that it matched the input of that
13 reactant?

14 MR. ROSE: Objection to form.

15 THE WITNESS: No, because the reactant
16 will react. It will be something less in the reactor
17 and coming out.

18 BY MR. BAUM:

19 Q. But you'll be adding fresh reactant to
20 replace the reactant that had reacted, correct?

21 A. Right. You -- you have -- in order to
22 confirm steady state, the material coming out, its
23 composition needs to be a constant composition.

24 Q. So if we have 50 parts of reactant going
25 into the continuous reactor, we would want to add

1 enough of that reactant such that -- let me -- let's
2 scratch that. So in a continuous process, if we have
3 50 parts of a reactant going in and there's a
4 50 percent conversion rate.

5 A. Correct.

6 Q. 25 percent of that reactant would be
7 reacted in the reactor?

8 A. Correct.

9 MR. ROSE: Objection to form.

10 BY MR. BAUM:

11 Q. And to maintain a steady state, you would
12 want to add a fresh 25 parts by weight of that
13 reactant so that the reactor has 50 parts by weight
14 of that reactant being withdrawn from the reactor,
15 correct?

16 MR. ROSE: Objection to form.

17 THE WITNESS: So we have 50 parts going
18 in. There was some level -- it is not 50 parts in
19 the reactor. It is reacting. It is steady state.
20 So there is 25 parts in the reactor or -- and coming
21 out of that is 25 parts so you -- so if you want to
22 maintain that 25 parts coming out, then you have to
23 keep adding 50 parts.

24 BY MR. BAUM:

25 Q. I think you'd want to add --

1 A. At the same rate that 25 parts is coming
2 out.

3 Q. Okay. Let's -- let's try it again. So --

4 A. See, we're talking about parts, and then
5 we're talking about rates, and they are very
6 different -- they're different units. Parts don't
7 have a time dependency on them, the parts per minute.

8 Q. Right. So I want you to assume a
9 50 percent conversion rate in the reactor. Okay?

10 A. Okay.

11 Q. So if we have 50 parts by weight of
12 reactant going into a continuous reactor?

13 A. Right.

14 Q. And we know our conversion is 50 percent?

15 A. Correct.

16 Q. Unless we add fresh reactant, we're only
17 going to have 25 percent, or excuse me, 25 parts by
18 weight coming out of the reactor of that reactant,
19 correct?

20 MR. ROSE: Objection. Form.

21 THE WITNESS: Y is less? We're talking
22 steady state, right?

23 BY MR. BAUM:

24 Q. Yes.

25 A. Everything is continuous. There's a

1 constant flow of 50 parts in and a constant flow of
2 25 parts out.

3 Q. Okay. So --

4 MR. BAUM: All right. We've been going
5 for close to an hour. Let's take a break.

6 THE WITNESS: All right.

7 VIDEOGRAPHER: The time is 9:47 a.m. and
8 we are now going off the record.

9 (A recess transpired from 9:47 a.m. until
10 10:08 a.m.)

11 VIDEOGRAPHER: Okay. The time is 10:08
12 and we are now going back on the record.

13 BY MR. BAUM:

14 Q. Dr. Lousenberg, before the break, we were
15 talking about a steady state in a continuously
16 stirred reactor, and if you have 50 percent
17 conversion of a reactant and were adding that
18 reactant to the reactor at 50 parts by weight, I want
19 to make sure I understood that we would then be
20 withdrawing that reactant at 25 parts by weight from
21 the reactor. Is that correct?

22 A. Are -- we're adding a reactant at 20 -- 50
23 parts by weight. Is there anything else going into
24 this reactor? So it's reacting with something that
25 has no weight and then coming out at 25 parts by

1 weight?

2 Q. Well --

3 A. Because the parts by weight will change
4 because even though it's 25 parts by weight in its
5 feed, the other feed has to be factored into the
6 parts by weight that are coming out.

7 Q. Okay. So let's assume in a continuously
8 stirred reactor, we're inserting two reactants, both
9 at 50 parts by weight. And we have a 50 percent
10 conversion of those two reactants into a product in
11 the reactor.

12 A. So we have two reactants, both 50 parts by
13 weight going into a reactor, and they react in
14 one-to-one stoichiometry for argument's sake?

15 Q. Yes.

16 A. And what's coming out? Well, now
17 you've -- now you've got -- now you've got 100 parts
18 coming out, correct? Of the reactor? Under steady
19 state condition? I'm not saying what it is. So --

20 Q. Well, could you give me a breakdown of the
21 100 parts by weight that's being withdrawn from the
22 reactor?

23 A. Okay, okay. So at 50 parts per weight of
24 reactant A, 50 parts by weight of reactant B, they
25 react stoichiometrically to 50 percent conversion.

1 Now you -- now you have a total of 100 parts coming
2 out so you have -- I'm just getting confused with
3 math, but I understand where you're going. 50 parts
4 by weight going in of each. They react at 50 percent
5 so you have 25 parts by weight of one product and one
6 by-product maybe at the same. They're equal.

7 Q. And how many parts by weight of each
8 reactant?

9 MR. ROSE: Objection to form.

10 THE WITNESS: Are remaining?

11 BY MR. BAUM:

12 Q. Would you remove from the reactor?

13 A. I'm just a little nervous. This is a math
14 test for me. I -- I can do this.

15 So 50 parts by weight going in. 50 parts
16 by weight of another going in. They react at
17 50 percent. Are -- again, is the molecular weights
18 the same?

19 Q. It's a one-to-one stoichiometric
20 relationship in the formula so --

21 A. Yeah, but we're talking parts by weight,
22 and reactions don't go by weight. They go by --

23 Q. So let's back up and talk about this in
24 terms of moles then. Would that be helpful?

25 A. Okay.

1 Q. So if we have 50 moles of one reactant,
2 50 moles of another reactant going into a
3 continuously stirred reactor.

4 A. Right.

5 Q. To produce a product at a 50 percent
6 conversion rate.

7 A. Right. So you have 25 moles of product.

8 Q. Correct. And how many moles of each
9 reactant would be withdrawn from that continuously
10 stirred reactor?

11 A. 25 moles.

12 Q. Of each reactant?

13 A. Yes.

14 Q. And is it desirable in a continuous
15 reaction to maintain a steady state?

16 A. Yes.

17 Q. And what do you mean by steady state?

18 A. The -- the composition and flow rates of
19 the output are constant in time.

20 Q. And would the concentrations -- scratch
21 that.

22 Does steady state also tell you something
23 about the concentrations of the reactant's being
24 removed from the reactor?

25 A. Does -- sorry. Does the steady state tell

1 you something?

2 Q. Let me ask the question a little bit
3 differently.

4 If it's desirable to maintain a steady
5 state in a continuous reactor as you've said, what
6 does steady state with regard to the amount of
7 reactants being removed from the reactor mean?

8 A. The amount of reactants -- the -- the flow
9 rate of those reactants is constant in time.

10 Q. Are the amounts of those ingredients
11 constant in time, too?

12 MR. ROSE: Objection to form.

13 THE WITNESS: When we -- when we -- when
14 we talk about steady state, we don't necessarily
15 talk -- the composition of the outputs is constant.
16 But what we really want in steady state operation is
17 constant -- constant -- the volume that goes in is
18 equal to the volume that comes out in time. The
19 volume flow rates going in and the volume flow rates
20 going out are constant in time; and therefore, the
21 level in the reactor stays constant.

22 And because that is constant, you're
23 feeding your reagents at a constant composition. If
24 they're neat, of course, is one aspect, but if they
25 are solutions such as KOH, but it's a constant

1 composition going in, then the outputs will be
2 constant as well. If they're not constant, then what
3 has happened is the level in the reactor has changed.

4 BY MR. BAUM:

5 Q. And when you say that the composition is
6 constant of the reactants coming out of the reactor,
7 do you mean that the concentration is constant?

8 A. Yes.

9 Q. So in a continuous process, it sounds like
10 there's significant amounts of reactant being removed
11 on a constant basis from the continuous reactor,
12 correct?

13 MR. ROSE: Objection to form.

14 THE WITNESS: If -- if -- it will depend
15 on the conversion. If --

16 BY MR. BAUM:

17 Q. So at a 50 percent conversion rate --

18 A. Yes.

19 Q. -- it sounds like there's significant
20 amounts of reactant being removed on a constant basis
21 from a continuous reactor, correct?

22 A. Yes.

23 MR. ROSE: Objection to form.

24 BY MR. BAUM:

25 Q. And if you have significant amounts of

1 reactant being removed from a continuous reactor
2 constantly, is it desirable to recycle those
3 unreacted reactants?

4 MR. ROSE: Objection to form.

5 THE WITNESS: Yes.

6 BY MR. BAUM:

7 Q. And in recycling those unreacted
8 reactants, is it common to try to separate out any
9 by-products that may be present?

10 MR. ROSE: Objection to form.

11 THE WITNESS: Yes, separations are -- are
12 usually part of the process to recycle reactants.

13 BY MR. BAUM:

14 Q. And was that true in 2010?

15 A. Yes.

16 Q. Was that true in 2008?

17 A. Yes.

18 Q. In the continuous process that we've been
19 discussing where you are introducing 50 moles of one
20 reactant and 50 moles of another reactant and we have
21 a 50 percent conversion rate, does the composition of
22 the reaction mixture inside the reactor stay constant
23 over time?

24 A. Yes.

25 Q. So it's desirable to keep the composition

1 of the reaction mixture inside the reactor constant
2 over time?

3 A. Yes, that -- that is steady state.

4 Q. When maintaining a steady state in a
5 continuous reaction, does the rate at which each
6 stream enters the reactor remain constant?

7 A. Yes.

8 Q. When maintaining a steady state in a
9 continuous reaction, does the composition of each
10 stream entering the reactor remain constant?

11 A. When they -- say that again, please?

12 MR. BAUM: Would the reporter read back
13 the question, please?

14 (Whereupon the Court Reporter read the
15 previous question.)

16 THE WITNESS: Yes.

17 BY MR. BAUM:

18 Q. When maintaining a steady state in a
19 continuous reaction, does the composition of the
20 mixture inside the reactor remain constant?

21 A. Yes.

22 Q. When maintaining a steady state in a
23 continuous reaction, does the rate at which each
24 stream leaves the reactor remain constant?

25 A. Yes.

1 Q. When maintaining a steady state in a
2 reaction, does the composition of each stream leaving
3 the reactor remain constant?

4 A. Sorry. Say that one again, please?

5 MR. BAUM: Please.

6 (Whereupon the Court Reporter read the
7 previous question.)

8 THE WITNESS: Yes.

9 BY MR. BAUM:

10 Q. I'd like to move now to -- well, before we
11 do that, a couple other questions.

12 We were talking earlier about your
13 experience in designing chemical processes. Do you
14 remember that?

15 A. Yes.

16 Q. And I'd like to have you describe for me
17 what types of activities you were engaged when you
18 were designing chemical processes generally?

19 A. We were measuring the flows under various
20 conditions of steady state and looking at their
21 outputs to maximize the yield and minimize
22 by-products and determine the overall efficiency of
23 their reaction. We used various analytical
24 techniques to do that.

25 Gas chromatography was the main one. We

1 looked at different sources of reagents, different
2 suppliers, ran them through the process to see if the
3 process was robust and could handle variation in
4 suppliers or materials from different suppliers.

5 Q. Anything else?

6 A. We looked at design of equipment, the size
7 of equipment that would be needed so that we could
8 scale it up so because -- if I give you an example
9 with HFX-110, we didn't have a budget to build a
10 pilot plant so we built a laboratory scale working
11 process for what the -- what it would look like at
12 full commercial production. There, we looked at
13 different designs of the decanter in terms of size,
14 placement of the inlets and outlets of that decanter.
15 We looked at the distillation in terms of different
16 distillation column configurations and how that
17 affected the various streams through that
18 distillation.

19 Q. Anything else?

20 A. There are other things. Just -- just
21 that's -- they're not coming to mind at the moment.

22 Q. So these are the most significant things
23 that --

24 A. Right.

25 Q. -- you recall being involved with? You

1 said "we" many times in your response.

2 A. Oh.

3 Q. Who is "we"?

4 A. Me and typically my technician and
5 engineering advice from engineers who were involved
6 with the product -- project.

7 Q. Do you know what a flow diagram is in a
8 chemical process?

9 A. Yes.

10 Q. What is a flow diagram?

11 A. It is a flow diagram outlining the
12 different steps in unit operations that are involved
13 in a chemical process.

14 Q. Were you responsible during your time at
15 DuPont for designing a flow diagram outlining
16 different steps and unit operations that are involved
17 in a chemical process?

18 A. At a very high level. Since I was more at
19 the research laboratory scale, I did -- was not in
20 depth. I did not do any significant modeling of the
21 flow diagram with the various inputs. We had
22 engineers involved who would use Aspen to make a more
23 refined model and refine their flow diagram.

24 Q. So did you have any responsibility while
25 you were at DuPont for selecting the particular steps

1 that were occurring in a flow diagram outlining
2 different steps and unit operations that are involved
3 in the chemical process?

4 MR. ROSE: Objection to form.

5 THE WITNESS: I had -- I had some -- I had
6 responsibility in -- in designing how -- where we
7 would add certain -- well, sorry. Can you state that
8 again, please?

9 MR. BAUM: Could you read the question
10 back, please?

11 (Whereupon the Court Reporter read the
12 previous question.)

13 THE WITNESS: Yes.

14 BY MR. BAUM:

15 Q. Can you describe your responsibilities in
16 that regard?

17 A. Well, as an example, I designed the
18 decanter configuration to get appropriate phase
19 separation of organic from aqueous and vice versa.
20 And that information from the laboratory scale model
21 was then incorporated into the full scale commercial
22 engineering flow diagram.

23 Q. So there was a full scale commercial
24 engineering flow diagram --

25 A. Right.

1 Q. -- that was used. Before full scale
2 commercial engineering flow diagrams are obtained,
3 how does the process work? First, you have to start
4 with, I assume, a lab scale flow diagram? And then
5 you --

6 A. Yes, yes. But in terms of being like a
7 blueprint, it is really just an outline in a notebook
8 to that much. It never really goes to a full model
9 working in Excel to that extent or in Aspen.

10 Q. Okay. Let's describe how this all works
11 or if you can help me understand how it all works.

12 A. Okay.

13 Q. I'm not a chemical engineer. I'm just a
14 chemist. So I don't have the experience that you do.
15 It would be helpful, you know, if you could sort of
16 give me a background.

17 A. Okay.

18 Q. So when you're designing a chemical
19 process, you start with the reaction?

20 A. Right.

21 Q. You figure out what the reaction is. Then
22 you have to figure out what processing steps you're
23 going to use.

24 A. Well, when we start -- for example, when
25 we started with HFX-110, most of the steps were batch

1 in nature. And when we realized that the actual
2 product composition, what had commercial utility, we
3 then started thinking, how can we make this in a
4 consistent manner with a small footprint in an
5 economical way meaning the equipment is not huge. So
6 then -- so in my case, I started with -- and I, and I
7 may use we, in which case I mean me and my
8 technician.

9 Q. Okay.

10 A. Started -- once we had established that we
11 had a product that was desirable, we then started --
12 an engineer was brought in to help scale it up. And
13 at that point, the engineer could not -- did not have
14 a budget to build a pilot facility and he didn't even
15 know how he would build a pilot facility.

16 I was asked to take a reactor I had, an
17 existing commercial, small-scale laboratory reactor,
18 Par, and adapt it for continuous stirred operations,
19 so it's a CSTR. Bought laboratory scale pumps that
20 could handle caustic and fluorocarbon, integrated
21 that into the reactor, changed out the head fitting
22 so that I could get input flow in and input flow out.
23 That initially didn't go into a decanter because we
24 just wanted to see could we make a consistent product
25 at steady state.

1 So it went into a batch container, for
2 lack of a better word, and then we took that batch
3 container -- since we had the laboratory scale
4 continuous distillation train, we then took that
5 batch material and started pumping it through the
6 distillation under various conditions, various
7 heights in the columns, various -- various take-off,
8 reflux ratios. And as we started to develop data
9 from that, that laboratory data said that even at a
10 lab scale, we were getting a separation that we
11 couldn't predict even from -- I don't know that -- I
12 don't know that it was Aspen, but we have modelers
13 who will take materials, get vapor liquid equilibrium
14 and then figure out what the best configuration of a
15 commercial column might be.

16 And because in the case of HFX-110, it's a
17 complex mixture of different isomers, that we could
18 never get high purity components from it to model
19 that system. But they did the best they could, and
20 their model said the separation that we wanted was
21 maybe not that good, but we were already getting the
22 separation on a laboratory scale.

23 And it's -- it's -- there is no
24 substitution for height in a distillation. I mean,
25 if you can have a taller column, you're going to get

1 a better separation. In a laboratory, you're limited
2 by the height of your ceiling. But it -- typically
3 in a commercial process, you can go 20, 30, 40 feet
4 if you have to.

5 So we knew just from that, from the
6 laboratory distillation, that we were -- we had a --
7 that we -- we were getting the separations that we
8 wanted, that this would work in a commercial process
9 so we weren't worried about that at all.

10 The next step in that process was, well,
11 we're going to have to decant this in a continuous
12 type of operation so let's build a decanter. In my
13 case, I took a commercial cylinder, which was really
14 just a jug, and adapted it with outlets on the side
15 and the bottom with a siphon tube that I could adjust
16 the various heights from. And based on that and the
17 calculations based on density where I thought the
18 phase separation would occur, I would set my siphon
19 there, and it usually came out pretty close to what
20 would be predicted from the formulas for calculating
21 that.

22 So we looked at various residence times in
23 the decanter, and that, of course, you can do by
24 adjusting the outlets of the decanter to see what
25 kind of separation we were getting. So if we had an

1 organic phase at the bottom, one of the critical
2 components was, would I need the aqueous phase?
3 That's where Karl Fischer titration would come into
4 play to see how much water is in that organic phase.

5 We could then titrate it to see how much
6 KOH was left in the aqueous phase that was entrained
7 in that organic, for example. We could do
8 gravimetric drawing to see what the overall
9 concentration of salts in that aqueous phase were.

10 So those types of tests were run on
11 running the reactor under continuous conditions and
12 the decanter under various conditions. There's a lot
13 of variables involved. The residence time in the
14 reactor, for example, determines how much conversion
15 you get. And your residence time is determined by
16 the volume of the reactor you have and the flow rate.
17 So if you have a volume of 1 and your flow rate is 2,
18 your residence time is one half. So by varying the
19 flow rates in, we could see what the effect of
20 residence time is.

21 So we were able to get data for all the
22 various inputs and variations and configurations of
23 that process and then use that to develop a flow
24 sheet model engineering, scaling it for a full scale
25 process to predict what we were going to get in full

1 scale process so that it's -- it's not just one
2 series of steps linearly, there's a lot of
3 reiterations in a lot of cases. Sometimes we may,
4 uh-uh, we really need to look at this because we're
5 seeing something downstream that we didn't see
6 before. So that's --

7 Q. Thanks. That's helpful.

8 A. That's a very long answer, but --

9 Q. I understand generally how the process
10 works. So in the work that you described, how did
11 you know that you needed to decant in a continuous
12 process?

13 A. How did -- how did -- that is common
14 knowledge for lack of -- if you're -- if you're
15 continuous and you need to -- well, you have to
16 separate your phases.

17 Q. And so that was common knowledge back in
18 2008?

19 A. Yes.

20 Q. So it sounds like you started with HFX-110
21 with a flow diagram that you wrote out in a lab
22 notebook?

23 A. I believe so at a high level, yeah, yeah,
24 so maybe sketched out points --

25 Q. Right.

1 A. -- and draw -- drew them in PowerPoint and
2 incorporated them into my notebook.

3 Q. So that's an example from where in the
4 very beginning from that first -- those first
5 decisions about what process steps and to use and
6 what the flow diagram would look like?

7 A. Right, but the flow diagram changed over
8 time as --

9 Q. Okay.

10 A. -- as other components were recognized and
11 added into it.

12 Q. So all the work that you've just
13 described, this is an example where you have taken it
14 from the very beginning and carried it out from
15 conception all the way through a commercial process?

16 A. Yes.

17 Q. Correct? Were there -- and as I recall
18 correctly, earlier you said that HFX-110 is not a
19 gas?

20 A. That's correct.

21 Q. Okay. With regard to the processes that
22 you were involved with at DuPont for the manufacture
23 of 1234, can you describe your role there?

24 A. Laboratory scale experiments. I did --
25 earlier, I said that when I started in fluoro

1 chemicals, I looked at the liquid phase reactions of
2 245eb in particular and a little bit of 236ea
3 dehydrofluorinations with caustic, basting, and
4 solvent system. But that was early and it was --
5 that was early in my fluoro -- fluorochemicals, when
6 I had transitioned to fluorochemicals.

7 I then transitioned probably in later 2007
8 into doing vapor phase reactions of fluorocarbons and
9 chlorocarbons to generate intermediates that some in
10 themselves were gases that were then a step towards
11 1234yf.

12 Q. Okay. So the process for manufacturing
13 1234yf that you were working on, what was the
14 starting material?

15 A. There were various starting materials. It
16 went -- in fact, it went all the way back to carbon
17 tetrachloride and ethylene. But DuPont has a process
18 to make 1243zf which is trifluoropropene. That is a
19 gas. And the chlorination of that and
20 dehydrochlorination leads to 1233xf which is
21 desirable.

22 A lot of -- without -- there are a lot of
23 steps that go into 12 -- that can lead to 1233xf, not
24 just through trifluoropropene. So then
25 hydrochlorination of that to 244db. And then

1 dehydrochlorination is 1234yf. So --

2 Q. Okay. So with regard to the process for
3 manufacturing 1234 that you had experience with --

4 A. Right.

5 Q. -- at DuPont, were you responsible for
6 coming up with the initial list of process steps that
7 were required to manufacture 1234?

8 A. Actually --

9 MR. ROSE: Objection. Form.

10 THE WITNESS: That was one of my initial
11 assignments was to develop -- is to map out potential
12 long-term routes to 1234yf starting -- using
13 chlorocarbons.

14 BY MR. BAUM:

15 Q. And did you develop such a process?

16 A. I worked on the individual steps, but I
17 never combined all the steps myself into a process
18 from start to beginning. If you -- I have -- one --
19 on my CV, there are two patents that have issued
20 where I was -- where I am one of the inventors, and
21 the -- the inventors, we all had responsibility for
22 looking at different steps.

23 Q. So you don't have any experience
24 developing a process for manufacturing 1234yf from
25 start to finish, correct?

1 MR. ROSE: Objection to form.

2 THE WITNESS: That's -- from start to
3 finish, correct.

4 BY MR. BAUM:

5 Q. Yesterday I believe you had mentioned that
6 the patent that you got relating to the decanter
7 developed in connection with HF-110 -- HX -- sorry.

8 A. HFX-110.

9 Q. HFX-110 was U.S. Patent Number 8,592.630;
10 is that correct?

11 A. I don't remember the patent number. But
12 if you say the title, I will confirm it.

13 Q. And the title is A Process for Separating
14 Components in Alkyl Perfluoroalkene in Ether
15 Production.

16 A. Correct.

17 Q. Is that the patent that you've been
18 describing the work that resulted in that patent?

19 A. Yes.

20 Q. Okay.

21 (Exhibit 1024 was marked for identification.)

22 BY MR. BAUM:

23 Q. I'd like to mark a new exhibit. I'm
24 placing before the witness a copy of Exhibit 1024,
25 which is U.S. Patent Number 8,592,630.

1 Dr. Lousenberg, are you familiar with this
2 document?

3 A. Yes, I am. I have not looked at in the
4 detail for a long time and I was only aware of it as
5 an exhibit last week so --

6 Q. Okay. So this is the patent that you've
7 been referring to?

8 A. Right.

9 MR. ROSE: Do you have an extra copy of
10 that exhibit?

11 MR. BAUM: Yeah, sure. I'm just going to
12 mark it. I don't have any questions right now.

13 BY MR. BAUM:

14 Q. I'd like to now return to your report in
15 IPR 2015-00916.

16 A. Can I have a copy of that, please?

17 MR. BAUM: I've got a copy.

18 BY MR. BAUM:

19 Q. So you have a copy of your expert report?

20 A. Yes.

21 Q. And the 916 IPR in front of you?

22 A. Yes.

23 Q. I'd like you to turn to your paragraph 121
24 of your report, please. This is the section of your
25 report where you're performing some high level

1 analysis of Smith if I recall correctly. Are you
2 discussing the Smith reference in paragraph 121?

3 A. This --

4 MR. ROSE: Objection. Form.

5 THE WITNESS: This paragraph contains
6 information from both Smith and Masayuki.

7 BY MR. BAUM:

8 Q. And you see that in the second sentence,
9 it says, "The person of ordinary skill in the art
10 would understand that the higher concentration of KOH
11 or alkali metal hydroxide."

12 A. Sorry.

13 Q. "The faster the reaction will occur and
14 the greater conversion to products, resulting in a
15 more economic process."

16 A. Sorry. I don't see that. I know what
17 you're referring to. I'm just not maybe looking at
18 the right part of it right now.

19 Q. That's fine. It's the second sentence.

20 A. Of 121?

21 Q. Yes.

22 A. Okay. I'm looking at 916 here.

23 Declaration 916.

24 Q. Correct. So yeah. The second sentence
25 says, just to make sure you've got the right document

1 in front of you, "Even though this wide range is
2 disclosed."

3 A. Oh.

4 Q. It goes on to say, "The person of ordinary
5 skill in the art would understand that the higher the
6 concentration of KOH or alkali metal hydroxide, the
7 faster the reaction will occur and the greater
8 conversion to products, resulting in a more economic
9 process."

10 A. Yes, I see that.

11 Q. You see that? What did you mean by
12 "higher concentration of KOH" in that sentence?

13 A. A higher percent concentration so, for
14 example, 25 versus 55 or 5 versus --

15 Q. So that higher concentration of your --
16 strike that.

17 A. Yeah, it's the higher concentrate -- KOH
18 in an aqueous medium.

19 Q. So make -- make sure I've got that right.
20 So when you refer in that sentence to a higher
21 concentration of KOH, you're referring to the
22 concentration of KOH in the aqueous phase in the
23 reactor?

24 A. Yes. Or -- no. Yes, and also higher
25 concentration of the KOH going into the reactor. So

1 yes. So both.

2 Q. So your answer is yes, and also a higher
3 concentration of KOH going into the reactor; is that
4 correct?

5 A. Yes, it is a higher concentration of KOH
6 going into the reactor, and there is a higher
7 concentration -- steady state concentration of KOH in
8 the reactor.

9 Q. When you say "faster reaction" in that
10 sentence, are you referring to the organic reactants?

11 MR. ROSE: Objection to form.

12 BY MR. BAUM:

13 Q. Let me try to rephrase. When you referred
14 --

15 A. A faster --

16 Q. Yeah, so let me --

17 MR. ROSE: Let him ask his question.

18 BY MR. BAUM:

19 Q. When you refer to "faster reaction" in
20 that sentence, are you referring to the speed of
21 reaction to obtain product? What are you referring
22 to?

23 MR. ROSE: Objection to form.

24 THE WITNESS: Yes, the speed of reaction
25 will be faster. The concentration of KOH entering

1 and the steady state concentration of KOH.

2 BY MR. BAUM:

3 Q. So are you referring to a faster rate of
4 consumption of organic starting materials as well?

5 A. Yes.

6 Q. And are you referring to a faster
7 production of by-products as well?

8 A. Yes. Well, yes. For -- for argument's
9 sake, yes.

10 Q. You also mention "greater conversion" in
11 that sentence of paragraph 121.

12 A. Right.

13 Q. What did you mean by "greater conversion"?

14 A. Well, if the reaction is faster and steady
15 state conditions are maintained such that your
16 residence time is the same, then -- then you will
17 have greater conversion in that residence time to
18 products.

19 Q. And greater conversion is a desired
20 result, correct?

21 A. Yes.

22 Q. You also refer to a higher concentration
23 of KOH. What did you mean by that?

24 A. Sorry. Can you --

25 Q. I'm sorry. Never mind. Let's strike

1 that. We've already asked that question.

2 Why does a higher concentration of KOH
3 lead to faster reaction and greater conversion?

4 A. That's -- that's chemistry 101. The
5 higher the concentration, the faster the reaction.
6 The rate constants to the reaction don't necessarily
7 change in a simple argument. But the higher --
8 because the rate of reaction is the rate constant
9 times the concentration of the reactions, the
10 reactant. So it goes to argument if you have higher
11 concentration of reactants in the reactor, you're
12 going to have a higher rate of reaction.

13 I think the question yesterday was asked
14 if we have less reactants in a reactor, will the
15 reactor rate goes down? And I answered in the
16 affirmative to that yesterday.

17 Q. Okay. I do recall that.

18 So in paragraph 121 of your report, you're
19 referring to the use of KOH as a dehydrohalogenating
20 agent, correct?

21 A. Correct.

22 Q. And that dehydrohalogenating agent is used
23 to convert either 236 or 245 to 1225 or 1234,
24 correct?

25 A. Correct.

1 Q. In that reaction, is it desirable to have
2 an excess of KOH or an excess of 236 or 245?

3 A. In --

4 MR. ROSE: Objection to form.

5 THE WITNESS: In looking within the '282
6 patent, it looks like it is desirable to have a
7 slight excess of KOH over organic reaction. In
8 Masayuki, it looks like there is a slight excess of
9 KOH over organic reactant. Smith does not -- is
10 not -- does not -- is silent to what the reagent is.
11 He says the person doing the reaction will appreciate
12 those types of conditions so --

13 BY MR. BAUM:

14 Q. So referring back to that second sentence
15 in paragraph 121 of your report, as the reaction
16 proceeds, KOH is converted to KF, correct?

17 A. Correct.

18 Q. The KF forms in the aqueous phase of the
19 reactor, correct?

20 A. Yes.

21 Q. And KF does not --

22 A. Sorry. Can I restate that? KF more -- KF
23 may form at the interface between the two phases, but
24 it exists in the aqueous phase in the reactor.

25 Q. So let me ask the question again and just

1 make sure I've got it right. So referring back to
2 that second sentence in paragraph 121 of your report,
3 as the reaction proceeds, KOH is converted to KF,
4 correct?

5 A. Correct.

6 Q. KF does not facilitate
7 dehydrofluorination, correct?

8 MR. ROSE: Objection to form.

9 THE WITNESS: I don't know. It's not --
10 it's not within any of the exhibits that that occurs.

11 BY MR. BAUM:

12 Q. KF is not a dehydrohalogenating agent, is
13 it?

14 A. It is a weak base, but I don't think it is
15 a dehydrohalogenating agent.

16 Q. And KF is a by-product --

17 A. Of?

18 Q. -- the dehydrohalogenation reaction? And
19 yesterday and in your report, you said that KF is a
20 by-product that would necessarily be present in the
21 Smith reaction that includes a continuous reactor and
22 KOH is a dehydrohalogenating agent, correct?

23 MR. ROSE: Objection to form.

24 THE WITNESS: I don't know that we talked
25 about in context of a continuous reactor yesterday.

1 BY MR. BAUM:

2 Q. Well, so let's -- let's just ask the
3 question again then.

4 So your report in the 915 matter in
5 paragraph 118 states that "A person of ordinary skill
6 in the art would understand that an alkali halide
7 salt, KF, would be present as a reaction by-product
8 of the base-mediated dehydrofluorination steps
9 purportedly disclosed in Smith."

10 MR. ROSE: Do you have a copy of the 915
11 report that we used yesterday?

12 MR. BAUM: Yeah. Let's go off the record
13 for a minute. See if we can find.

14 VIDEOGRAPHER: 10:55 a.m. and we're now
15 going off the record.

16 (A brief recess transpired from 10:55 a.m.
17 until 10:55 a.m.)

18 VIDEOGRAPHER: Okay. The time is 10 --
19 okay. The time is 10:55 and now we're going back on
20 the record.

21 BY MR. BAUM:

22 Q. So to refresh your recollection with
23 regard to our discussion yesterday, I placed a copy
24 of your report in the 915 IPR in front of you and I'm
25 now directing you to paragraph 118.

1 Do you see that there you stated, "A
2 person of ordinary skill in the art would understand
3 that an alkali halide salt, example, KF, would be
4 present as a reaction by-product of the base-mediated
5 dehydrofluorination steps purportedly disclosed in
6 Smith"?

7 A. Yes.

8 Q. Do you see that? Do you --

9 Have you changed your opinion with regard
10 to that statement?

11 A. No.

12 Q. Would that statement also be true with
13 regard to a continuous reactor such as that described
14 in Smith?

15 A. Would there be KF in -- as a by-product?
16 As a reaction by-product in a continuous reactor?

17 Q. Yes.

18 A. Yes.

19 Q. So a person of ordinary skill in the art
20 would understand that an alkali halide salt, example,
21 KF, would be present as a reaction by-product of the
22 base-mediated dehydrohalogenation steps in a
23 continuous reactor disclosed in Smith, correct?

24 A. Correct.

25 Q. And so I'd like you to now go back to your

1 report in the 916 IPR, please.

2 A. Okay.

3 Q. So the KF that's present in the continuous
4 reactor Smith does not facilitate the
5 dehydrofluorination reaction, correct?

6 A. Not that I'm aware.

7 Q. If KOH decreases, does the rate of
8 reaction go down?

9 A. Yes.

10 Q. What would happen if the reaction were to
11 run to 100 percent conversion of KOH to KF?

12 A. There would be 100 percent KF in the
13 aqueous phase.

14 Q. Would that be a desirable process?

15 MR. ROSE: Objection. Form.

16 THE WITNESS: Yes.

17 BY MR. BAUM:

18 Q. If the process in Smith were to run to
19 100 percent KF in a continuous reactor, what would
20 happen?

21 MR. ROSE: Objection. Form.

22 THE WITNESS: Happen to what?

23 MR. BAUM: Let's take a break. Been going
24 about an hour.

25 THE WITNESS: Okay.

1 VIDEOGRAPHER: Okay. The time is 10:59.
2 We're now going off the record.

3 (A recess transpired from 10:59 a.m. until
4 11:23 a.m.)

5 VIDEOGRAPHER: Okay. The time is 11:23
6 and we are now going back on the record.

7 BY MR. BAUM:

8 Q. Dr. Lousenberg, yesterday we were talking
9 about the Smith reference.

10 A. Yes.

11 Q. Let's make sure you have a copy in front
12 of you. Do you --

13 MR. ROSE: I think you guys packed up the
14 exhibits that were used yesterday. Here it is.

15 (Exhibit 1003 was previously marked for
16 identification.)

17 BY MR. BAUM:

18 Q. So Smith is Petitioner's Exhibit 1003.
19 And you recall we went through this document and
20 highlighted a number of portions of the document. Do
21 you recall that?

22 A. I didn't highlight anything in the
23 document, but I do recall us going over Smith.

24 Q. And you recall that Smith teaches
25 dehydrohalogenation in a continuous reactor, correct?

1 A. Yes.

2 Q. And you recall that that
3 dehydrohalogenation can be accomplished with
4 potassium hydroxide, correct?

5 A. Correct.

6 Q. And you recall that most preferably, that
7 dehydrohalogenation was conducted with potassium
8 hydroxide, correct?

9 A. Correct.

10 Q. And you also recall that Smith discloses
11 using from 1 to 50 percent based on total weight of
12 the components which makes the steps (b) and (d)
13 of --

14 A. Sorry. Where are you reading this?

15 Q. If you turn to page 12. The last full
16 paragraph. You see that it says, "The base is
17 typically present in an amount of 1 to 50 percent by
18 weight on the total weight of the compounds which
19 make up steps (b) and (d)"?

20 A. Yes.

21 Q. And do you understand the base being
22 referred to there includes potassium hydroxide?

23 A. Yes.

24 Q. And do you understand that steps (b) and
25 (d) are the dehydrohalogenation steps disclosed in

1 Smith?

2 A. Yes.

3 Q. And the very next paragraph says that "The
4 base-mediated dehydrofluorination may preferably
5 employ water as the solvent."

6 Do you see that?

7 A. Yes.

8 Q. So let's talk about what's happening in
9 that continuous reactor Smith. There's KOH?

10 A. Um-hmm.

11 Q. And either 236 or 245 going in as
12 reactants, correct?

13 A. Right.

14 Q. And what amount of KOH would one of
15 ordinary skill in the art select to input into that
16 reactor?

17 A. By total weight or by weight percent in
18 the aqueous phase going in?

19 Q. Weight percent in the aqueous phase going
20 in.

21 A. Probably around 25 percent.

22 Q. If you could look at your report in the
23 916 IPR, please?

24 A. Okay. Sorry. Where again?

25 Q. Just a moment, please.

1 A. Okay.

2 Q. Paragraph 121?

3 A. Okay.

4 Q. You state that, "Irrespective, a person of
5 ordinary skill in the art would have understood that
6 no matter the level of concentration, for an economic
7 process to result and generate sufficient desired
8 product, it is desirable to have at least 50 percent
9 KOH utilization."

10 Do you see that?

11 A. Yes.

12 Q. And then the next sentence says, "Said
13 differently, the product streams should be at least
14 comparable in size and preferably larger than the
15 recycle streams." Correct?

16 A. Correct.

17 Q. what do you mean when you say that "the
18 product stream should be at least comparable in size
19 and preferably larger than the recycle streams"?

20 A. In that case, I'm typically referring to
21 volume of equipment -- the volume of products coming
22 off, it is desirable to have those larger than the
23 streams that are being recycled or wasted.

24 Q. And the result of that is that you're
25 generating more organic product than by-products?

1 A. More in terms of --

2 MR. ROSE: Objection. Form.

3 THE WITNESS: More in terms of volume.

4 BY MR. BAUM:

5 Q. More in terms -- so if we think now about
6 what's happening inside the continuous reactor Smith
7 that we've been discussing.

8 A. Of Smith?

9 Q. Yes. We have an aqueous phase?

10 A. Okay.

11 Q. Correct?

12 A. We -- yes, Smith allows for that.

13 Q. And what's in that aqueous phase?

14 A. KOH.

15 Q. Once the --

16 A. Oh, sorry. Can you -- can I -- in a
17 continuous reactor -- okay. We're assuming that a
18 reaction has begun and is progressing?

19 Q. Yes.

20 A. Okay. Then there is KOH and KF for the
21 most part. There may be trace others, but they
22 are -- Smith is silent to that or he's actually --
23 no -- if the reaction is going, Smith doesn't say
24 there's any -- no, there is -- by -- according to
25 Smith, Smith teaches a very high efficiency reaction.

1 So for the most part, there's going to be only KF in
2 the aqueous phases, if the reaction is established at
3 steady state.

4 Q. So --

5 A. There will be next -- Smith is silent. He
6 doesn't say there's any KOH in that.

7 Q. So if there's no KOH in the aqueous phase,
8 once you've achieved steady state, no reaction would
9 occur, correct?

10 A. Okay. No, to the extent that there's any
11 significant amount. It's probably a small amount
12 because Smith just doesn't disclose it.

13 Q. Now, earlier you testified that you would
14 want a high concentration of KOH in the reactor to
15 make the reaction occur faster?

16 A. Right. High concentration in the aqueous
17 phase.

18 Q. So there would be a high concentration of
19 KOH in the aqueous phase in the Smith continuous
20 reactor, correct?

21 A. Smith is silent to that. He doesn't say
22 anything about that.

23 Q. Well, I'm asking you what your
24 understanding is.

25 A. I don't -- there would be a high

1 concentration of KOH in the aqueous phase going in,
2 but I don't know what the concentration of KOH in the
3 aqueous phase in the reactor would be, if there would
4 be any at all. Smith is just silent to that.

5 Q. Well, it would be desirable to have high
6 amounts of KOH present in the aqueous phase of Smith
7 to drive the reaction faster, wouldn't it?

8 A. Well, Smith -- Smith allows for a catalyst
9 and that has a big effect. So it -- in the absence
10 of a catalyst, yes. But Smith teaches the use of a
11 catalyst and he doesn't -- to make a reaction
12 efficient. He doesn't teach a lower efficiency
13 reaction. So how -- it's going to be mostly KF in
14 that -- in that system under steady state if you
15 follow teachings of Smith.

16 Q. So in Smith where -- strike that.

17 In Smith, they're introducing 236 or 245
18 into a reactor containing KOH.

19 A. Right.

20 Q. If there's no KOH present in the aqueous
21 phase, there's nothing to react with, correct?

22 A. The steady state concentration of any KOH
23 is very low.

24 Q. So if it's very low, you're going to have
25 a very slow reaction, correct?

1 A. No, no, catalyst is what facilitates that
2 reaction. That changes everything. Remember, I said
3 the rate is proportional to the rate constant times
4 the concentration of the reactants. That rate
5 constant will define as K is going to be much bigger
6 for the -- for that reaction system without -- and
7 the same reaction without it. So the amount of KOH,
8 to get a very high rate, because that rate constant
9 is very high, the amount of KOH that needs to be
10 there can be very small.

11 And so -- and depending on -- and of
12 course, the amount of -- even though you're feeding
13 in a large amount of reactant, that doesn't have to
14 be large at all, the steady state concentrations of
15 your reactants. This is a very similar condition to
16 what you pointed out in Sedat. That reaction is very
17 quick. There is not a lot of reactant in the reactor
18 to escape.

19 Q. So irrespective of the speed of the
20 reaction, if there is a very low concentration of KOH
21 in the reactor, there's no KOH to react with,
22 correct?

23 A. No. That -- that is not true. Low
24 concentrations can react if you give them conditions
25 that allow them to react.

1 In this case, in Smith, the catalyst has a
2 big effect. In general, yes, it's desirable to have
3 higher concentrations of reactions, but a catalyst
4 changes that perspective by a lot.

5 Q. So you're telling me that there can be no
6 KOH in the reactor and you would still --

7 A. I'm not saying no. I'm just saying
8 there -- it's -- it's a very small amount under
9 steady state conditions.

10 Q. So you previously said that one of
11 ordinary skill in the art reading Smith would
12 introduce 25 percent KOH into the reactor. And
13 you're saying that a -- well, let me back up. Strike
14 that.

15 So earlier you testified that it's
16 desirable to maintain a steady state of reactants in
17 a reactor?

18 A. Yes.

19 Q. Okay. And you said also that one of
20 ordinary skill in the art would, reading Smith, would
21 use 25 percent as the starting concentration for KOH
22 being introduced into the continuous reactor?

23 A. I -- you -- I didn't say it's one of
24 ordinary skill in the art reading Smith would use
25 25 percent. I believe.

1 Q. Well, we'll let the record reflect what it
2 says. So if you're introducing --

3 A. But -- sorry. Continue. My fault.

4 Q. If you're introducing KOH at a
5 concentration of 25 percent into the continuous
6 reactor of Smith, you're telling me that there would
7 be no KOH present in that solution?

8 A. That's not what I'm saying. I'm saying
9 the amount of KOH -- the KOH would react very quickly
10 because there is a finite residence time in that
11 reactor so the steady state concentration of KOH
12 would be very low.

13 Q. How does a phase transfer catalyst works?

14 A. It facilitates solubility of the reactants
15 at the interface of the two phases.

16 Q. And the reaction at the interface depends
17 on the concentration of KOH in the aqueous; is that
18 correct?

19 MR. ROSE: Objection to form.

20 THE WITNESS: Yes.

21 BY MR. BAUM:

22 Q. And if there's no KOH present, no reaction
23 will occur, correct?

24 A. If there's no KOH present, no reaction
25 will occur.

1 Q. You mentioned a finite residence time.
2 What is it that you're referring to by "finite
3 residence time"?

4 A. Finite is a measurable quantity of time.

5 Q. And what is it that's present for a finite
6 residence?

7 MR. ROSE: Objection to form.

8 BY MR. BAUM:

9 Q. In the reactor of Smith?

10 A. What is present for a finite residence? A
11 low concentration of -- I don't know how to answer
12 that. Let me think about that. The two phases are
13 present for a finite residence time.

14 Q. The phase including the organic product?
15 Is that what you're referring to?

16 A. Yeah, an organic phase that contains
17 organic product.

18 Q. And an aqueous phase?

19 A. And an aqueous phase that --

20 Q. Contain?

21 A. -- comprises KF.

22 Q. And no KOH?

23 A. Very little. Very low.

24 Q. And what's your basis for believing that
25 the concentration of KOH would be very low in a

1 reactor of Smith?

2 MR. ROSE: Objection to form. Asked and
3 answered.

4 THE WITNESS: I've -- I've seen reactions
5 where we are feeding a high concentration of KOH, yet
6 the concentration of KOH coming out of the reactor
7 which reflects the steady state concentration of KOH
8 in the reactor is very low.

9 BY MR. BAUM:

10 Q. Have you done any modeling to confirm that
11 that's what would be happening in the reactor of
12 Smith?

13 MR. ROSE: Objection to form.

14 THE WITNESS: I have not done any modeling
15 in -- to confirm that, what's happening in Smith.
16 Only thing I know is Smith doesn't disclose any spent
17 KOH in any of the permutations of his invention.

18 BY MR. BAUM:

19 Q. Did you rely on the reactions that you've
20 seen in forming your opinions?

21 A. The reactions in the evidence? Or in the
22 exhibits?

23 Q. The reactions that you just described that
24 you have previously seen, did you rely on those in
25 forming your opinion?

1 MR. ROSE: Objection to form.

2 THE WITNESS: Yes.

3 BY MR. BAUM:

4 Q. Where are those written down in your
5 opinion?

6 A. My notebooks.

7 Q. Where are they written down in your report
8 submitted in connection with the 916 or 917?

9 A. They're not in there. That is my opinion.

10 Q. The amount of -- well, strike that.

11 To the extent that KOH and KF are present
12 in the aqueous phase in the continuous reactor of
13 Smith, can that KF and KOH be separated in the
14 dehydrohalogenation reactor?

15 A. No.

16 Q. Why not?

17 A. Because the -- they are disassociated
18 species. There is potassium ions, hydroxide ions and
19 fluoride ions. No one -- no one molecule of
20 potassium associated with any one anion.

21 Q. So once you've achieved steady state
22 reaction in the dehydrohalogenation reactor of Smith
23 which is a continuous reactor?

24 A. Right.

25 Q. And you want to add fresh KOH to keep the

1 reaction going, do you have to remove some amount of
2 the aqueous phase to make room for the fresh KOH that
3 you want to add to the reactor?

4 A. Yes.

5 Q. And when you withdraw that stream, that
6 aqueous stream from the dehydrohalogenation reactor
7 in Smith containing KOH and KF, won't KOH and KF both
8 be present in that stream being withdrawn to make
9 room for the fresh KOH?

10 A. A very small amount. The fresh KOH going
11 into the reactor gets diluted fairly quickly so its
12 concentration drops very fast and it reacts very fast
13 because of the catalyst that's there. So the
14 concentration of a KOH -- I mean, if we're -- we
15 really shouldn't talking about hydroxide, but
16 we'll -- I think we both agree that KOH and KF, even
17 though they can't be distinguished in an aqueous
18 phase, we'll just -- we'll somewhat treat them as
19 distinct entities.

20 The concentration of KOH coming out of
21 that -- in that reactor is very low because it gets
22 diluted and there's not a lot of KOH -- and it reacts
23 very quickly so there's not a lot of KOH there under
24 steady state conditions. So the amount of KOH coming
25 out is very low.

1 Q. And what is very low in your opinion?

2 A. Probably -- if -- if we just look at
3 the -- the ratio, mole ratio/weight ratio is probably
4 very similar because they have similar molecular
5 weights. About more than 90 percent would be KF.

6 Q. With a phase transfer catalyst in the
7 reaction, in the continuous reaction of Smith, would
8 a higher concentration of KOH in the aqueous phase
9 lead to a faster reaction?

10 A. Faster in what sense?

11 Q. Would the rate of reaction be faster?

12 A. You mean the bulk reaction of moles --
13 moles per minute of product being produced be faster?

14 Q. Yes.

15 A. Yes.

16 Q. If you had a lower concentration of KOH in
17 the continuous dehydrohalogenation reactor of Smith,
18 would you expect a lower rate of reaction?

19 A. Yes. But that is what happens in the
20 reactor. It goes in. It reacts. Its concentration
21 is -- is dropping and its steady state concentration
22 is ultimately very low.

23 Q. So if your goal is to produce as much
24 product as possible, then wouldn't it be desirable to
25 have a high concentration of KOH in the aqueous phase

1 of Smith?

2 MR. ROSE: Objection to form.

3 THE WITNESS: Concentration in terms of --
4 oh, sorry. Concentration in the aqueous phase? Is
5 that what I heard?

6 BY MR. BAUM:

7 Q. Yes.

8 A. Yes, but there is a limit. Typically --
9 typically, it wouldn't go above -- above 50 percent
10 in an aqueous medium that would be manageable.
11 Plus -- plus, there is an issue that there is
12 solubility limits for KF. It is similar to KOH, but
13 it is slightly lower. So you do not want to produce
14 a solid precipitate in commercial practice if you can
15 avoid it because it makes the -- the pressure let --
16 it tends to clog the pressure let-down valves.

17 Q. So how do you know that it -- the limit of
18 KOH concentration in the aqueous phase with Smith is
19 50 percent?

20 A. I don't. That was just a -- my opinion as
21 since we were discussing various concentrations.

22 Q. So you don't have a specific basis for
23 that opinion?

24 A. It's based on my own experience working.

25 Q. Okay. So the rate of reaction is based on

1 the steady state concentration in the reactor; is
2 that correct?

3 MR. ROSE: Objection. Form.

4 THE WITNESS: It's based on the steady
5 state concentration of reactants times the rate
6 constant.

7 BY MR. BAUM:

8 Q. Let me ask the question again.

9 So the rate of reaction is based on the
10 steady state concentration of KOH in the reactor; is
11 that correct?

12 MR. ROSE: Objection to form. Asked and
13 answered.

14 THE WITNESS: Yes.

15 MR. BAUM: I'm ready to move on, Masayuki.

16 MR. ROSE: Want to do lunch break?

17 MR. BAUM: Yeah, why don't we do that and
18 then come back after that.

19 MR. ROSE: Okay. That's fine.

20 MR. BAUM: Off the record.

21 VIDEOGRAPHER: Okay. The time is 11:49.

22 We are now going off the record.

23 (A luncheon recess transpired from
24 11:49 a.m. until 1:04 p.m.)

25 VIDEOGRAPHER: Okay, we ready? Okay.

1 Time is 1:04 a.m. -- p.m., excuse me, and we're going
2 back on the record.

3 BY MR. BAUM:

4 Q. Dr. Lousenberg, before we took a break for
5 lunch, you mentioned that you had considered some
6 experiments in lab notebooks in rendering your
7 opinion concerning the presence of KF in the aqueous
8 phase of Smith; is that correct?

9 MR. ROSE: Objection to form.

10 THE WITNESS: It's my recollection. I
11 didn't look at them.

12 BY MR. BAUM:

13 Q. So you're just aware of these lab
14 notebooks?

15 A. Yes.

16 Q. And were these lab notebooks from DuPont
17 that you're referring to?

18 A. Yes.

19 Q. Are they publicly available lab notebooks?

20 A. No.

21 Q. Were there any public available materials
22 that you relied on in rendering your opinion that are
23 not listed in the expert report in IPR 916?

24 A. Are there any public documents? No.

25 Q. So yesterday, you had mentioned some, I

1 guess, Alibaba price quotes?

2 A. Yes.

3 Q. So other than the Alibaba price quotes you
4 mentioned yesterday, there's nothing else that you
5 relied on in rendering your report that's not
6 specifically listed in the report; is that correct?

7 A. Correct.

8 Q. And you didn't rely on any publicly
9 available documents describing the concentration of
10 KF in the aqueous phase of Smith, correct?

11 A. I did not.

12 Q. Before we move on to Masayuki, I just want
13 to ask a couple more questions about the Smith
14 reference. Do you have a copy in front of you? If
15 not, I can give you this.

16 A. Okay.

17 Q. Looks like you do. So you have Smith in
18 front of you, Exhibit 1003, correct?

19 A. Correct.

20 Q. if you could turn to page 11 of Smith,
21 please? You'll see that in the last full paragraph,
22 it says, "Typically, the base-mediated
23 dehydrofluorination process of steps (b) and (d) is
24 conducted at a temperature of from about negative 50
25 to about 300 degrees C." It further states,

1 "Preferably, the process is conducted at a
2 temperature from about 20 to about 250 degrees C, for
3 example, from about 50 to 200 degrees C." And
4 additionally states, "The base-mediated
5 dehydrofluorination may be conducted at a pressure
6 from about 0 to 30 bars."

7 Do you see that?

8 A. Yes.

9 Q. And yesterday, I had pointed out on page
10 2, if you'll turn to page 2, second full paragraph,
11 which says, "Each of steps (a) to (d) may be carried
12 out batch-wise or continuously, preferably
13 continuously, using a suitable apparatus, including a
14 stirred tank reactor."

15 Do you see that?

16 A. Yes.

17 Q. And you see that it also says,
18 "Preferably, the apparatus is made from one or more
19 materials that are resistant to corrosion, for
20 example, Hastelloy or Inconel"?

21 A. Correct.

22 Q. In the dehydrohalogenation reaction
23 occurring in the continuously stirred reaction
24 vessel -- let's begin again.

25 In the dehydrohalogenation reactor Smith,

1 which is a continuous reactor that is stirred, would
2 you expect that there would be any dissolved organics
3 in the aqueous phase along with KF and KOH?

4 MR. ROSE: Objection to form.

5 THE WITNESS: Yes. I would expect it,
6 since we do have entrained organics by the nature of
7 the fact that we're stirring the reactor, we would
8 have dissolved in the true meaning of the term in
9 that aqueous phase.

10 BY MR. BAUM:

11 Q. When you say "dissolved in the true
12 meaning of the term," what do you mean?

13 A. Molecularly dissolved at a molecular
14 level. Not at -- not at a discrete nanoscopic or
15 microscopic phase entrained in another phase.

16 Q. So dissolved organics include 236 and 245,
17 correct?

18 A. Yes.

19 Q. Are you saying that 245 and 236 would be
20 dissolved in water at the aqueous level?

21 A. At a very low concentration part per
22 million level.

23 Q. Would one of ordinary skill in the art
24 reading Smith understand that high shear mixing would
25 be desirable?

1 A. Yes.

2 Q. And would that high shear mixing result in
3 entrained organics being present in the aqueous phase
4 of Smith?

5 A. Yes. And vice versa.

6 Q. Earlier, you testified that there would be
7 product stream coming out of Smith and that there
8 would also be a stream containing KF, KOH and water.
9 Would that stream also include dissolved organics?

10 A. The product stream would likely be an
11 entrained -- if there -- if it's under steady state
12 and there was mixing occurring, the product stream
13 would be a mixture of the -- the entrained phases of
14 the aqueous and organic coming out of that reactor.
15 Under high shear mixing conditions, there is no way
16 to get separate phases out of the reactor as separate
17 streams.

18 Q. Would one of ordinary skill in the art
19 reading Smith understand that the continuous reactor
20 is desirably operated at steady state?

21 A. Smith doesn't talk about steady state.

22 Q. But one of ordinary skill in the art would
23 assume that it's advantageous to conduct a continuous
24 reaction at steady state, correct?

25 MR. ROSE: Objection to form.

1 THE WITNESS: In my opinion, yes.

2 BY MR. BAUM:

3 Q. In the stream being withdrawn from the
4 continuous reactor in Smith containing KOH, KF,
5 dissolved organics and water, can you tell me what
6 percentage of KF would be present?

7 A. No.

8 MR. ROSE: Objection to form.

9 THE WITNESS: Smith doesn't give any
10 examples.

11 BY MR. BAUM:

12 Q. Earlier, you had testified that up to
13 90 percent of that stream could be KF?

14 MR. ROSE: Objection. Form.

15 THE WITNESS: Under -- under conditions
16 where catalysts are, someone could expect to see more
17 than 90 percent KF in that aqueous -- in the aqueous
18 phase of that stream.

19 BY MR. BAUM:

20 Q. And of the remaining 10 percent, what
21 percentage would be dissolved organics?

22 MR. ROSE: Objection to form.

23 THE WITNESS: It would be time
24 dependent -- or sorry. Of that remaining 10 percent?

25

1 BY MR. BAUM:

2 Q. Yes.

3 A. Sorry. 90 -- we've said 90 percent is KF.
4 10 percent is KOH? Is that what you're saying?

5 Q. Well, I'm asking you what the remaining
6 10 percent, what portion of it would be KOH, what
7 portion of it would be dissolved organics?

8 A. There's no way to know because the KOH and
9 KF are not distinct species, when they're dissolved
10 in the aqueous phase.

11 Q. So then based on the molar reaction ratio
12 we talked about before in column 12, figures 1 and 2
13 of the '282 patent, one would expect there to be
14 roughly equal molar concentrations of KF and KOH in
15 that stream coming out of the Smith reactor
16 containing KOH, KF and dissolved organics, correct?

17 A. Can you restate that, please?

18 MR. BAUM: The reporter could read that
19 back, please.

20 (Whereupon the Court Reporter read the
21 previous question.)

22 MR. ROSE: Object to form.

23 THE WITNESS: No.

24 BY MR. BAUM:

25 Q. What would the ratio, the molar ratio --

1 let me begin again.

2 What would you expect the molar ratio of
3 KF to KOH be in the stream being removed from --

4 A. It would be -- depend on the factors of
5 operation of that reactor. If there's -- as I
6 stated, if there's a catalyst there, there's not
7 going to be a lot of KOH in that stream. There's
8 going to be a small amount. So we defined conversion
9 to 50 percent. Now we're asking for a real world
10 example where the real world example is based upon
11 the parameters defining that steady state operation
12 so we can't say what that will be.

13 Q. Now, earlier today, we talked about that
14 reaction formula in column 12, formulas 1 and 2 of
15 the '282 patent, column 12. Do you recall that?

16 A. Yes.

17 Q. So we focused just on the aqueous phase
18 and you had said that 50 moles of water plus 50 moles
19 of KOH going into the reactor would become 25 moles
20 of KF, 25 moles of KOH and 75 moles of water assuming
21 a 50 percent conversion rate.

22 Do you recall that?

23 A. Assuming 50 percent conversion.

24 Q. Okay. Does that also apply to the amount
25 of KF, KOH and water being produced as a result of

1 the dehydrohalogenation reaction in the continuous
2 reactor of Smith?

3 A. No.

4 Q. Why not?

5 A. Because, again, we've defined conversion,
6 whereas conversion is defined by the conditions of
7 operation of that CSTR.

8 Q. So assuming a 50 percent conversion rate
9 in the aqueous phase of the continuous Smith reactor
10 where you've got -- in a situation where you've got
11 50 moles of water and 50 moles of calcium hydroxide
12 entering the reactor, isn't it true that you would be
13 --

14 A. Calcium? Sorry.

15 Q. I'm sorry. Let me start again.

16 So assuming a 50 percent conversion rate
17 in the aqueous phase of continuous process disclosed
18 in Smith, in a situation where you're adding 50 moles
19 of water, 50 moles of potassium hydroxide, isn't it
20 correct that you would end up with 25 moles of
21 potassium fluoride, 25 moles of KOH and 75 moles of
22 water?

23 A. Well, the way you've asked the question,
24 you're teaching away from what Smith is describing.
25 He -- his purpose is to -- is to make an efficient

1 reaction by putting in the catalyst. So the
2 situation you're describing is not what Smith is
3 teaching.

4 Q. What is Smith teaching?

5 A. He's teaching -- he's teaching an
6 efficient reaction. An efficient reaction is a
7 reaction where all reactants go to products and
8 by-products at high conversion. You're setting up a
9 situation that is taught away from Smith.

10 Q. What is your understanding of teaching
11 away?

12 A. Teaching a less efficient reaction.

13 Q. So back to my question, which is simply a
14 question regarding what's happening from a standpoint
15 of a reaction in the reactor assuming a 50 percent
16 conversion rate. Is it correct that if you're adding
17 50 moles of water, 50 moles of KOH to the continuous
18 reactor Smith, that it would produce 25 moles of
19 potassium fluoride, 25 moles of potassium hydroxide
20 and 75 moles of water?

21 A. It is not correct because you've -- you've
22 said that in the context of Smith. But if you're
23 asking me of my general expert opinion outside of
24 Smith, then that is correct.

25 Q. How does anything in Smith change the

1 basic formula of the reaction that's described in
2 columns -- column 12, formulas 1 and 2 of the '282
3 patent?

4 MR. ROSE: Objection to form.

5 THE WITNESS: Now you're combining Smith
6 with the '282 patent.

7 BY MR. BAUM:

8 Q. No, I'm just -- I'm just asking you with
9 regard to -- that's the formula we're talking about.

10 A. Okay. I'm just not comfortable with
11 this -- see, if you're talking about a CSTR in
12 general, then I can answer that question. But if I'm
13 trying to answer this in the context of Smith, then
14 Smith has a catalyst. He has options for solvent,
15 various catalysts. There isn't going to be
16 50 percent conversion cases.

17 Q. Okay. So let's assume a 90 percent
18 conversion case. Are you comfortable with that?

19 A. Sure.

20 Q. Okay. So in the context of Smith, if we
21 have a 90 percent conversion rate, isn't it true that
22 if you're adding 50 moles of water and 50 moles of
23 potassium hydroxide to the reaction vessel, the
24 continuously stirred reaction vessel, that you're
25 going to end up with 25 moles of KF, 25 moles of KOH

1 and 75 moles of water?

2 A. No, it's not true.

3 Q. Why not?

4 A. Because you would have 45 moles of KF and
5 5 moles of KOH. And I don't know what the water is,
6 but it would be higher than 75.

7 Q. And what would that be?

8 A. I don't -- I don't know offhand. It's
9 simple algebra, but I don't have it in my head.

10 Q. So the net result is there is more water
11 after the reaction occurs than before it occurs?

12 A. Yes. In a molar basis. As a mass
13 fraction basis, which is typically how people would
14 look at the reaction, it's not that much. Water has
15 a very low molecular weight.

16 Q. But we'd still have more water after the
17 dehydrohalogenation reaction occurs than before,
18 correct?

19 A. Yes, but on the order -- 5 percent.

20 Q. 5 percent by weight?

21 A. In that -- in that range by weight.

22 Q. And it would be a much higher percentage
23 from a molar basis, correct?

24 A. Yes.

25 Q. Okay. Let's move on to Masayuki. I'm

1 happy to hand you the Japanese versions of the
2 document.

3 A. No thanks. I've been to Japan, but --

4 Q. Okay. So I'd assume you'd prefer the
5 English language translation?

6 A. I would.

7 (Exhibit 1005 was previously marked for
8 identification.)

9 Q. Okay. So I'm handing Dr. Lousenberg a
10 copy of Petitioner's Exhibit 1005 which is a
11 translation of Japanese language patent document
12 59-70626. Is this a document that you've spent
13 substantial time reviewing in connection with your
14 involvement in this case?

15 A. Yes, it is.

16 Q. So you're familiar with the contents of
17 this document?

18 A. Yes, I am.

19 Q. You understand the contents of the
20 document; is that correct?

21 A. Yes.

22 Q. You understand what it says?

23 A. Yes.

24 Q. Okay. You also indicated that you had
25 reviewed the petitions in IPRs 916 and 917, correct?

1 A. Correct.

2 Q. Okay. I'm handing the witness a copy --
3 let's go off the record for just a minute.

4 (Brief off record discussion.)

5 BY MR. BAUM:

6 Q. Back on the record. So I'm handing the
7 witness a copy of the Petition for Inter Partes
8 Review in the 916 case, and I'm directing -- well,
9 let me hand it to the witness first. First, I'd just
10 like you to confirm that you've actually seen this
11 document before and that you reviewed it in
12 connection with your report.

13 A. Yes, I have.

14 Q. Okay. Could you turn to page 23, please?
15 You see there's a figure on page 23?

16 A. Yes, I do.

17 Q. And you understand this to be an annotated
18 version of the figure in Masayuki?

19 A. Yes, I do.

20 Q. I'd like you to turn to page 10. You can
21 keep open the page 23 of the petition there, but also
22 open up Masayuki page 10. And you understand when I
23 say "Masayuki," I'm referring to Exhibit 1005,
24 correct?

25 A. Yes, I do.

1 Q. So on page 10, there's an example. And
2 that example describes the figure that's set forth
3 in -- on page 23 of the petition in the 916 case,
4 correct?

5 A. Correct.

6 Q. With the noted differences that we've
7 included some annotations.

8 So example 1 beginning on page 10 of
9 Masayuki says, "Chloroprene was produced via the
10 dehydrochlorination of 3-dichloro-butene-1 according
11 to the process shown in the figure."

12 Do you see that?

13 A. Yes, I do.

14 Q. "A mixture of fresh 3,4-dichloro-butene-1
15 derived from Conduit 1 and recovered
16 3,4-dichloro-butene derived from Conduit 18,
17 50 percent by weight sodium hydroxide aqueous
18 solution derived from Conduit 2 and the catalyst;
19 Quartamin, Q-U-A-R-T-A-M-I-N, 24P, the brand name of
20 lauryl trimethyl ammonium chloride sold by Kao Atlas
21 Company."

22 You see that?

23 A. Yes.

24 Q. And so if you refer to the figure, the
25 annotated figure on page 23, you see that there's

1 sodiums hydroxide coming in via Conduit 2?

2 A. Yes.

3 Q. You see that there's 236 or 235, excuse
4 me. Let me begin again.

5 You see that there's organic or
6 3,4-dichloro-butene coming in through Conduit 1 into
7 the Reactor 19?

8 A. Yes.

9 Q. And you also see that there's this
10 Quartamin catalyst coming in through Conduit 3. Do
11 you see that?

12 A. Yes.

13 Q. What do you understand Quartamin to be?

14 A. A quaternary ammonium salt.

15 Q. Is that a phase transfer catalyst?

16 A. Yes.

17 Q. The passage that I just read from Masayuki
18 also says that the stirring machine or, excuse me,
19 "the Reactor 19 is stirring machine equipped."

20 Do you see that?

21 A. Yes.

22 Q. And that "that reactor is operating rates
23 -- at rates of 100 parts per weight by hour, 76.8
24 parts per weight per hour and 1.0 part per weight per
25 hour respectively and a reaction was performed at

1 60 degrees C and 225 millimeters of mercury."

2 Do you see that?

3 A. Yes, I do.

4 Q. Do you understand what that passage says?

5 A. Yes.

6 Q. What does it mean to you?

7 MR. ROSE: Object to form.

8 THE WITNESS: It means that 100 parts per
9 hour were fed into the stirred reactor and those 100
10 parts were the 3,4-dichloro-butene-1, 76.8 parts per
11 weight per hour is the 50 percent by weight sodium
12 hydroxide aqueous solution and 1 part per weight per
13 hour is the Quartamin 24P phase transfer catalyst.

14 BY MR. BAUM:

15 Q. Thank you. Masayuki goes on to say, "The
16 aqueous phase was extracted via Conduit 4." And you
17 see Conduit 4 coming out of Reactor 19 in the figure?

18 A. I do.

19 Q. "Such that the level of Reactor 19
20 remained constant and the slightly mixed lipid and
21 aqueous phases, including precipitated sodium
22 chloride, were separated using Decanter 20."

23 Do you see that?

24 A. Yes, I do.

25 Q. Do you understand what that passage means?

1 A. Yes.

2 Q. Can you explain what that passage means to
3 you, please?

4 A. The aqueous phase --

5 MR. ROSE: Object to form.

6 THE WITNESS: -- in reactor was extracted
7 via Conduit 4 such that the -- and through Conduit 4,
8 it went into a decanter where it was separated after
9 which the lipid phase was returned to the reactor via
10 Conduit 5.

11 BY MR. BAUM:

12 Q. Do you understand what's meant by the
13 lipid phase?

14 A. The catalyst.

15 Q. The phase transfer catalyst?

16 A. Correct.

17 Q. Masayuki then says, "The lipid phase was
18 returned to the reactor via Conduit 5."

19 Do you see that?

20 A. Yes.

21 Q. And so there they're recycling the
22 recovered phase transfer catalyst to the Reactor 19;
23 is that correct?

24 A. Yes.

25 Q. Masayuki goes on to say that "The aqueous

1 phase containing solid sodium chloride from which the
2 lipid phase was removed using Decanter 20 was fed
3 into forced circulation-type Enricher 21 via
4 Conduit 6."

5 Do you see that in the description in the
6 figure?

7 A. Yes, I do.

8 Q. Masayuki further says, "Concentration was
9 carried out such that NaOH divided by NaOH plus water
10 equals 0.5 at 112 degrees C and 200 millimeters of
11 mercury."

12 You see that?

13 A. Yes, I do.

14 Q. What does that passage mean to you?

15 MR. ROSE: Object to form.

16 THE WITNESS: It means that the aqueous
17 phase that -- that goes out the bottom of Decanter 20
18 through 6 into the Enricher 20 -- 21 is concentrated
19 by removing water from the aqueous mixture of sodium
20 hydroxide and sodium -- sodium hydroxide and some
21 sodium chloride by -- by distillation.

22 BY MR. BAUM:

23 Q. The formula that's expressed in that
24 passage where they're dividing NaOH by NaOH plus
25 water is a half a percent. What does that mean to

1 you?

2 A. That's not a half percent. That means --

3 Q. I'm sorry. 0.5.

4 A. That means that the concentration of
5 sodium hydroxide in the water is 50 percent.

6 Q. And do you understand why they're
7 converting -- let me strike that, please.

8 Do you understand why they're
9 concentrating to 0.5?

10 A. Yes.

11 Q. 50 percent?

12 A. Yes.

13 Q. And why is that?

14 A. So that they can increase the
15 concentration of the sodium hydroxide to ultimately
16 return it back to the reactor and also precipitate
17 additional sodium chloride.

18 Q. So one of the purposes of Masayuki is to
19 recycle sodium hydroxide; is that correct?

20 A. Yes.

21 Q. And Masayuki teaches a way to recover
22 sodium hydroxide before it's recycled, correct?

23 MR. ROSE: Objection. Form.

24 THE WITNESS: What do you mean by
25 "recover"?

1 BY MR. BAUM:

2 Q. Using your definition of "recover" in your
3 report.

4 A. He teaches away from recovering? Yes.

5 Q. So Masayuki teaches a way to recover?

6 A. I'm sorry. A way or away?

7 Q. A way.

8 A. Okay.

9 MR. BEAUPRE: Two words.

10 BY MR. BAUM:

11 Q. Teaches a space way. So the question is,
12 does Masayuki teach a way to recover sodium hydroxide
13 from a dehydrohalogenation before recycling that
14 sodium hydroxide?

15 MR. ROSE: Objection. Form.

16 THE WITNESS: Not -- not as we've defined
17 it.

18 BY MR. BAUM:

19 Q. Why is that?

20 A. Because he has not separated out the
21 3,4-dichloro-1-butene or any other entrained organics
22 other than a lipid phase which in our definition of
23 organic which are the entrained -- the entrained
24 24 -- 245 or 236, the lipid phase in our definition
25 is not organic.

1 Q. When you say "in our definition," you mean
2 the definition in your --

3 A. In the '282 patent.

4 Q. In the '282 patent?

5 A. As adopted in the '282 patent.

6 Q. And you also mean the definition in your
7 report for "recover"?

8 A. Yes.

9 Q. Masayuki goes on to say that after --
10 "After passing through Conduit 9 from Conduit 8, the
11 aqueous phase was heated in the Heat Exchanger 22
12 after which it was circulated into Enricher 21 via
13 Conduit 10."

14 Do you see that?

15 A. I was looking at the diagram as you were
16 saying that. I should have been looking at the
17 written word. Can you say it --

18 Q. Sure. "After passing through Conduit 9
19 from Conduit 8."

20 A. Okay. Just a moment.

21 Q. It's below the enricher.

22 A. Oh, okay. "After passing." I see it now.

23 Q. So "After passing through Conduit 9 from
24 Conduit 8, the aqueous phase was heated in Heat
25 Exchanger 22 after which it was circulated into

1 Enricher 21 via Conduit 10."

2 Do you see that?

3 A. Yes, I do.

4 Q. "As concentration was performed, dissolved
5 sodium chloride precipitated out, but said aqueous
6 phase was extracted via Conduit 8."

7 Do you see that?

8 A. Yes.

9 Q. You see that in both the text and the
10 figure, correct?

11 A. Yes.

12 Q. Masayuki says, "The aqueous phase was
13 extracted via Conduit 8, directed into Slurry Tank 24
14 via Conduit 11 and fed into Centrifuge 25 where
15 precipitated sodium chloride was separated out and
16 also discarded via Conduit 12."

17 Do you see that?

18 A. I see it written and I see it in the
19 diagram.

20 Q. So you understand that calcium -- excuse
21 me. I'll begin again.

22 What is it that the centrifuge is
23 separating?

24 A. Sodium chloride from aqueous sodium
25 hydroxide.

1 Q. And the sodium chloride has been
2 precipitated?

3 A. Yes.

4 Q. And that sodium chloride is present in its
5 precipitated form in Slurry Tank 24 before it enters
6 the Centrifuge 25, correct?

7 A. Correct.

8 Q. And Conduit 12 is the conduit through
9 which the sodium chloride that's been precipitated is
10 removed from the process, correct?

11 A. Correct.

12 Q. Masayuki continues and says, line 14 on
13 page 11, "Recovered sodium hydroxide aqueous solution
14 was returned to Conduit 2."

15 That's the line that goes directly into
16 the reactor?

17 A. Uh-huh.

18 Q. "Via Conduit 13 and fed back into the
19 reaction."

20 Do you see that in the text and in the
21 figure?

22 A. Yes, I do.

23 Q. Do you have an understanding as to why
24 Masayuki returns sodium hydroxide to the
25 dehydrohalogenation reactor?

1 A. Yes, to reuse it.

2 Q. Is that --

3 A. In the dehydrohalogenation reaction.

4 Q. Is that something one of ordinary skill in
5 the art would want to do?

6 MR. ROSE: Objection to form.

7 BY MR. BAUM:

8 Q. To reuse unused reactant?

9 MR. ROSE: Objection to form.

10 THE WITNESS: If the concentration of
11 unused reactant was significant enough that throwing
12 it away would create an economic or environmental
13 need.

14 BY MR. BAUM:

15 Q. Masayuki goes on to say that,
16 "Additionally, in order to prevent clogging of the
17 apparatus due to deposition of sodium chloride onto
18 the walls of the enricher, warm water was fed into
19 the enricher once every eight hours to dissolve the
20 deposited sodium chloride."

21 Do you see that?

22 A. Yes.

23 Q. "At the same time, steam discharged from
24 Enricher 21 was directed into Condenser 23 via
25 Conduit 7, condensed and removed via Conduit 32 as

1 water."

2 Do you see that in the description and in
3 the figure?

4 A. I do.

5 Q. So there's steam coming out of the
6 enricher via Conduit 7 and being inserted into the
7 Condenser 23 via Line 7. Is that correct?

8 A. Yes.

9 Q. Masayuki continues and says, "Steam
10 discharged from Reactor 19 was introduced into
11 Condenser 26 via Conduit 14 and water separated out
12 in Decanter 27 following condensation was removed via
13 Conduit 15 and the remaining material was introduced
14 into the Dehydration Tower 28 via Conduit 16, after
15 which it was fed into Distillation Column 29
16 following dehydration."

17 Do you see that in the text and the
18 figure?

19 A. Yes.

20 Q. "The target chloroprene steam was
21 extracted from the distillation column via Conduit 17
22 and condensed in Condenser 30 to obtain liquid
23 chloroprene from Conduit 31."

24 Do you see that?

25 A. Yes.

1 Q. And then Masayuki says, "Unreacted
2 3,4-dichloro-butene was extracted from the bottom of
3 Distillation Column 29 and returned to Conduit 1 via
4 Conduit 18 for reuse in the reaction."

5 Do you see that?

6 A. Yes, I do.

7 Q. Do you have an understanding as to why
8 Masayuki would extract unreacted
9 3,4-dichloro-butene-1 and return it to the
10 dehydrohalogenation reactor?

11 A. Well, he extracts it in order to drive as
12 part of the process of driving his product out of the
13 top of the reactor and not having his starting -- a
14 significant quantity of his starting product end up
15 going into the decanter.

16 Q. So is it correct that Masayuki is
17 recycling unreacted 3,4-dichloro-butene back to the
18 reactor?

19 A. Yes.

20 Q. Is that correct?

21 A. Through Conduit 18.

22 Q. And do you have an understanding as to why
23 one would want to recycle unreacted
24 3,4-dichloro-butene-1 back to the dehydrohalogenation
25 reactor?

1 MR. ROSE: Objection to form.

2 THE WITNESS: Sure, to make an efficient
3 process.

4 BY MR. BAUM:

5 Q. And an efficient process is the goal of
6 one of ordinary skill in the art, correct?

7 MR. ROSE: Objection to form.

8 BY MR. BAUM:

9 Q. Let me ask again.

10 An efficient process is the goal of one of
11 ordinary skill in the art in designing a chemical
12 process for manufacturing gases; is that correct?

13 MR. ROSE: Objection to form.

14 THE WITNESS: For manufacturing gases?

15 BY MR. BAUM:

16 Q. Yes.

17 A. Well, in Masayuki, we're -- I don't
18 remember what the boiling point of
19 3,4-dichloro-butene is.

20 Q. I'm setting aside Masayuki.

21 I'm asking a question, is an efficient
22 process the goal of one of ordinary skill in the art
23 designing a chemical process for manufacturing gases?

24 MR. ROSE: Objection.

25 THE WITNESS: For manufacturing anything.

1 BY MR. BAUM:

2 Q. So your answer is yes?

3 A. Yes.

4 Q. Thank you. Masayuki goes on to say that,
5 "The above procedure was continued for approximately
6 one week with good separation of the lipid and
7 aqueous phases as well as no trouble with the
8 enricher observed and the reaction rate of
9 3,4-dichloro-butene achieved was 98 percent."

10 Do you see that?

11 A. Yes.

12 Q. Do you understand example 1 of Masayuki,
13 Dr. Lousenberg?

14 A. I understand this. I believe I understand
15 the last sentences that you just read. But
16 98 percent is not a reaction rate. 98 percent is
17 probably a conversion of 3,4-dichloro-butene in that
18 efficient process.

19 Q. What does efficiency mean to you? Let me
20 rephrase. What does it mean to have an efficient
21 process to you?

22 MR. ROSE: Objection to form.

23 BY MR. BAUM:

24 Q. I'll try it again. What does it mean to
25 you to have an efficient process?

1 MR. ROSE: Objection to form.

2 THE WITNESS: One in which a -- in which
3 reactants go to high yield of products in an
4 economically viable amount of time.

5 BY MR. BAUM:

6 Q. Does having an efficient process mean also
7 reusing reactants where you can?

8 MR. ROSE: Objection to form.

9 THE WITNESS: If the economics are
10 justified.

11 BY MR. BAUM:

12 Q. Does having an efficient process mean
13 maximizing desired production?

14 MR. ROSE: Objection to form.

15 THE WITNESS: Well, yes. You increase the
16 value of what you're making if you're maximizing
17 production because then you're -- the amount of --
18 you're -- I think I'm overstating it, but yes, I
19 agree.

20 BY MR. BAUM:

21 Q. Thank you. Does having an efficient
22 process also mean minimization of waste?

23 MR. ROSE: Objection to form.

24 THE WITNESS: Yes.

25

1 BY MR. BAUM:

2 Q. Does having an efficient process mean
3 minimizing the waste of unused reactants?

4 MR. ROSE: Objection to form.

5 THE WITNESS: It can.

6 BY MR. BAUM:

7 Q. Under what circumstances can having an
8 efficient process mean minimizing waste of unused
9 reactants?

10 A. If the unused reactions are a small
11 portion of the overall waste stream, then it may not
12 be efficient to recover.

13 MR. BAUM: Okay. Let's go off the record
14 and take a break for about ten minutes.

15 VIDEOGRAPHER: The time is 1:52 p.m. and
16 we are now going off the record.

17 (A recess transpired from 1:52 p.m. until
18 2:07 p.m.)

19 VIDEOGRAPHER: Okay. The time is 2:07 and
20 we are now back on the record.

21 BY MR. BAUM:

22 Q. Dr. Lousenberg, I'm going to ask you a
23 series of questions that are directed to practicing
24 the dehydrohalogenation reaction disclosed in Smith
25 in the process flow diagram of Masayuki.

1 A. Okay.

2 Q. Do you understand what I've just said?

3 A. The dehydrohalogenation reaction in Smith,
4 a CSTR, with 236ea or 245eb, a phase transfer
5 catalyst, aqueous KOH and everything else Masayuki.

6 Q. Yes, correct.

7 Could the reaction that you've just
8 described, the dehydrohalogenation reaction you've
9 just described, be conducted in Reactor 19 of
10 Masayuki?

11 A. Yes.

12 Q. So instead of 3,4-dichloro-butene-1 as the
13 organic, the reaction would involve 236 or 235,
14 correct?

15 A. 245, correct.

16 Q. Thank you. And instead of sodium
17 hydroxide, we would be using potassium hydroxide,
18 KOH, as the dehydrohalogenating agent, correct?

19 A. Correct.

20 Q. And both Masayuki and Smith disclosed the
21 use of a phase transfer catalyst in the
22 dehydrohalogenation reactor, correct?

23 A. Correct.

24 Q. So as applied to the flow diagram that you
25 have in front of you for Masayuki.

1 A. I may have closed it. What page was it on
2 again?

3 Q. 23.

4 A. Of the 916?

5 Q. Yes.

6 A. Okay.

7 Q. You see the flow diagram?

8 A. Yes, I do.

9 Q. So the phase transfer catalyst would be
10 introduced into the dehydrohalogenation reactor using
11 Conduit 3, correct?

12 A. Correct.

13 Q. The KOH would be introduced to the
14 dehydrohalogenation reactor using Conduit 2, correct?

15 A. Correct.

16 Q. The 236 or 245 would be introduced into
17 the dehydrohalogenation reactor using Conduit 1,
18 correct?

19 A. Correct.

20 Q. What would be coming out of the reactor
21 via Conduit 4 in Masayuki with the process of Smith
22 being conducted in the dehydrohalogenation reactor?

23 A. Aqueous KOH and the phase transfer
24 catalyst and a very small amount of KOH.

25 Q. Would there be any KF coming out of the

1 reactor as well?

2 A. Yes. That -- mostly what would be coming
3 out of 4 would be aqueous KF.

4 Q. Would there be any dissolved organics
5 coming out of Reactor 4?

6 A. Yes.

7 Q. So that mixture of KF, KOH, and dissolved
8 organics is then introduced into Decanter 20 via
9 Conduit 4, correct?

10 A. Correct.

11 Q. And what would happen in that decanter
12 with the aqueous solution of KOH, KF and dissolved
13 organics?

14 MR. ROSE: Objection to form.

15 THE WITNESS: The aqueous -- if it -- in
16 the -- in view of Masayuki, what would be happening
17 there is the catalyst and the aqueous layer would be
18 separating, and the catalyst would be returning to
19 the reactor through Conduit 5.

20 BY MR. BAUM:

21 Q. So the phase transfer catalyst would go
22 from Decanter 20 via Conduit 5 to Reactor 19 in
23 Masayuki, correct?

24 A. Yes.

25 Q. And the aqueous phase coming out of the

1 bottom of Decanter 6 -- of 20, would be introduced
2 into Enricher 20 line -- let me start again.

3 The aqueous phase coming out of Decanter
4 20 would be introduced to Enricher 21 via Conduit 6,
5 correct?

6 A. Correct.

7 Q. Would any of the dissolved organics be
8 separated from the aqueous phase in the decanter?

9 A. In Masayuki is silent to that occurring so
10 no.

11 Q. So the enricher would contain an aqueous
12 solution of KF, KOH and dissolved organics?

13 A. Yes.

14 Q. And what would happen to that aqueous
15 solution in the enricher?

16 A. The water in that aqueous solution would
17 be stripped off through Conduit 7 and condensed into
18 23 and out through 32.

19 Q. What would happen to the dissolved
20 organics?

21 A. Masayuki doesn't say.

22 Q. What are the boiling points of 236 and
23 245?

24 A. 236 is 6 degrees and 245 is 21.

25 Q. If the enricher is run hot enough to

1 evap- -- let me begin again.

2 If the enricher is run hot enough to
3 remove or strip off water, wouldn't it also remove or
4 strip off 236 or 245?

5 MR. ROSE: Object to form.

6 THE WITNESS: Outside of Masayuki, yes.

7 BY MR. BAUM:

8 Q. In the enricher of Masayuki?

9 A. Yes. Masayuki has fairly low boiling
10 components. He says there's nothing in there. But
11 outside of Masayuki, in my opinion, yes, you would
12 boil off low boiling components with water.

13 Q. So if we were to conduct the reaction of
14 Smith in the dehydrohalogenating reactor, deliver the
15 aqueous phase from that reactor to the decanter
16 through Conduit 4 and then deliver the aqueous phase
17 from the decanter to the enricher and the enricher
18 was operated at 100 degrees C, would you expect 236
19 and 245 to evaporate out of the enricher along with
20 water?

21 A. Yes, outside of Masayuki, that's what I
22 would expect. I don't know that it would happen, but
23 that's what I would expect.

24 Q. When you say "outside of Masayuki," what
25 do you mean?

12	Q. So --
----	----------

21 So you either take Masayuki as it is or we
22 interpret it on top of what's there. And the only
23 way that I can say that there are organics there is
24 outside of the framework of what Masayuki is telling
25 me.

1 Q. Well, what I'm asking you to do is look at
2 the flow diagram of Masayuki. Okay? And we're
3 talking about operating the chemistry of Smith --

4 A. Right.

5 Q. -- in the reactor of Masayuki and focusing
6 on what would happen if we conducted the reaction of
7 Smith in the flow diagram of Masayuki.

8 A. No, I understand.

9 Q. And so, you know, the question is whether
10 or not, if you were to conduct the Smith process in
11 the flow diagram of Masayuki, whether it's reasonable
12 to expect that 236 and 245 would be removed from the
13 aqueous solution and the enricher along with some
14 water if that enricher was run at 100 degrees C?

15 A. It is reasonable. I don't know that it
16 would work just for the reasons stated. That's all I
17 can say. It is reasonable but not -- but not as
18 Masayuki teaches me.

19 Q. Because you're looking at details other
20 than just what's in the flow diagram?

21 A. I'm putting my expert view onto what's
22 going here.

23 Q. So what are your reasons for thinking that
24 if we conducted the reaction of Smith in Masayuki, as
25 I've been describing that, you wouldn't remove 236 or

1 245 in the enricher along with some water if the
2 enricher was at 100 degrees C?

3 A. I don't know an exact reason. Maybe --
4 maybe in the enriching phase, you're -- I just don't
5 have an answer.

6 Q. So if 236 and 245 were removed in the
7 enricher because it's operated at 100 degrees C and
8 the aqueous solution is then passed to Slurry Tank
9 24, would the aqueous solution in Slurry Tank 24
10 include water, KOH and KF?

11 A. It would include water, KF and a small
12 amount of KOH.

13 Q. Can you separate the KF and KOH in that
14 aqueous solution that you've just described that
15 would be present in the slurry tank?

16 A. Not efficiently.

17 Q. And why is that?

18 A. Because their solubilities are so similar.

19 Q. And is there a chemical reaction that one
20 of ordinary skill in the art would be aware of that
21 would convert KF to something else that would permit
22 you to remove KF?

23 A. Sure. Reaction with calcium hydroxide.

24 Q. And that's a reaction that was known in
25 2008 or earlier; is that correct?

1 A. Yes, it is.

2 Q. And you've seen that reaction in a
3 reference that I think you refer to as Harrison in
4 your report; is that correct?

5 A. That's correct.

6 Q. So if one of ordinary skill were to add
7 calcium hydroxide to the aqueous solution containing
8 KOH and KF in Slurry Tank 24, what would happen to
9 that aqueous solution?

10 A. The KF in that aqueous solution would get
11 converted to KOH. But not very efficiently unless
12 the concentration of KOH that went into the process
13 to begin with was pretty low because we -- in the
14 enricher, we now have a concentrated KOH. Remember,
15 Masayuki teaches us to concentrate this -- the
16 remaining dehydrohalogenating agent back to the same
17 concentration that went into the reactor through Line
18 2.

19 Now if I apply Smith, I have very little
20 KOH coming out of Line 4. So -- but I have a lot of
21 KF. So when I go into that enricher and I apply the
22 teaching of Masayuki, which doesn't seem logical to
23 do in this situation, but this is what Masayuki is
24 teaching, then you're going to have an unstable
25 process because you will be concentrating a small

1 amount of KOH back to its initial starting
2 concentration, but the concentration of that KF will
3 be increasing, too, so you will end up precipitating
4 KF/KOH probably to the point where you have very
5 little liquid and you're stirring a wet mixture of
6 cement.

7 So -- but if we ignore the enricher, then
8 what you're saying will work. We can then take that
9 KF/KOH and convert that large fraction of KF back to
10 KOH using lime.

11 Q. Yes, so let me be clear. I'm not
12 suggesting that we would remove the enricher. I
13 don't want you to think that we're removing the
14 enricher in this discussion.

15 A. Okay. Under most circumstances, I don't
16 think you could run Smith in this process and get
17 past Enricher 21 so that you would be able to
18 effectively convert KF to lime.

19 Q. Okay. Let's explore that a little bit.
20 Earlier, you said that the dehydrohalogenation
21 reaction disclosed in Smith creates additional water,
22 correct?

23 A. Yes.

24 Q. Okay. So if we conduct the process of
25 Smith in the flow diagram of Masayuki, when we get to

1 the enricher, the enricher does serve a purpose in
2 removing some water to get us back to the original
3 concentration of KOH plus KF as compared to the
4 original concentration of KOH going into the Reactor
5 19, correct?

6 A. It's not the concentration of KOH plus KF.
7 The formula that Masayuki has is a concentration of
8 DHA over DHA plus water. KF is not a factor in that
9 concentration.

10 Q. Okay. But you would agree that one
11 purpose the enricher could serve is to enrich the
12 aqueous solution of KOH and KF to a concentration
13 equal to the amount of KOH being introduced into the
14 dehydrohalogenation Reactor 19, correct?

15 A. Yes, but it is a mixture of KOH and KF
16 plus a small amount of water.

17 Q. So you agree that even if we were -- well,
18 let me start again.

19 So you agree that the enricher would serve
20 a purpose?

21 A. Yes. It -- it could be used to remove a
22 small amount of water that was formed in the
23 reaction. But just removing that amount of water
24 will not get you back to the starting concentration
25 of sodium -- of dehydrohalogenating agent in water.

1 Q. Another purpose the enricher would serve
2 in conducting the dehydrohalogenation reaction of
3 Smith in the flow diagram of Masayuki would be to
4 remove any 236 and 245 present, correct?

5 A. Well, as I said, Masayuki is silent to
6 removing organics through that flow path. But
7 outside of Masayuki, in my opinion, yes, that's what
8 would happen.

9 Q. Would one of ordinary skill in the art
10 understand that dissolved organics would be present
11 in the stream, the aqueous stream coming out of
12 Reactor 19 if one were to conduct the
13 dehydrohalogenation reaction of Smith in Reactor 19
14 of Masayuki?

15 MR. ROSE: Objection. Form.

16 THE WITNESS: Sir, would you state that
17 again, please?

18 MR. BAUM: Could you read that back,
19 please?

20 (Whereupon the Court Reporter read the
21 previous question.)

22 THE WITNESS: Yes.

23 BY MR. BAUM:

24 Q. And would -- strike that.

25 Would one of ordinary skill in the art

1 understand that it's desirable to remove dissolved
2 organics present in the aqueous stream being removed
3 from Reactor 19 if the -- if the process of Smith
4 were conducted in the flow diagram of Masayuki?

5 A. Yes.

6 MR. ROSE: Objection to form.

7 BY MR. BAUM:

8 Q. And would one of ordinary skill in the art
9 understand that those dissolved organics, because of
10 their boiling points, could be removed in the
11 enricher if it was operated at a temperature above
12 the boiling point of those organics?

13 MR. ROSE: Objection to form.

14 THE WITNESS: They -- yes, they would, but
15 they might question why Masayuki is silent. So they
16 may or may not want to model that system just to
17 confirm that that would happen.

18 BY MR. BAUM:

19 Q. But one of ordinary skill in the art would
20 understand that's a way to remove 236 and 245?

21 A. It's a possible way.

22 MR. ROSE: Objection to form.

23 BY MR. BAUM:

24 Q. Looking now at Slurry Tank 24. If we have
25 removed an amount of water in the enricher to bring

1 the combined combination of KF and KOH back to the
2 same level as the concentration of KOH going into
3 Reactor 19 -- strike that.

4 Let's go back to Slurry Tank 24 where
5 we've added lime. Would a concentration of
6 25 percent KF -- strike that.

7 Would an aqueous solution of 25 percent KF
8 and 25 percent KOH in Slurry Tank 24 include any
9 solid before lime is added?

10 A. Smith would probably not allow you to get
11 to a condition like that. So -- but assuming that
12 outside of using Smith in that reactor, I can answer
13 your question. Would a combination of 25 percent KF
14 and KOH precipitate in Slurry Tank 24? What is the
15 temperature of that slurry tank?

16 Q. Let's assume it's 100 degrees.

17 A. No, it would not precipitate.

18 Q. Would it precipitate at 50 degrees
19 Celsius?

20 A. It -- let's see if -- recalling what I
21 know about -- at 40 degrees, the solubility of KF and
22 KOH are about 57, 58 percent each. At about 60, it's
23 60 degrees. So a combined concentration of KOH and
24 KF at 50 percent concentration at 50 degrees C would
25 not precipitate, but it's probably getting close to

1 borderline.

2 MR. ROSE: The realtime stopped working.

3 MR. BAUM: Yeah.

4 VIDEOGRAPHER: Time is 2:32 p.m. We're
5 going off the record.

6 (A recess transpired from 2:32 p.m. until
7 2:34 p.m.)

8 VIDEOGRAPHER: Time is 2:34 p.m. and now
9 we're going back on the record.

10 BY MR. BAUM:

11 Q. Earlier, you said that you were looking to
12 something outside of Masayuki in determining whether
13 Smith would work in Masayuki.

14 A. Okay. I don't recall that.

15 Q. You said outside of Masayuki or outside of
16 Smith a couple of times. What did you mean by that?

17 MR. ROSE: Object to the form. Asked and
18 answered.

19 THE WITNESS: I meant outside of the
20 framework of Smith and Masayuki applying my expert
21 opinion and view on what is going on.

22 BY MR. BAUM:

23 Q. So you were looking beyond the explicit
24 disclosure of Masayuki or Smith when --

25 A. When -- yes.

1 Q. You were looking outside the disclosure of
2 Smith or Masayuki when you were saying that the
3 process of Smith wouldn't work in the flow diagram of
4 Masayuki; is that correct?

5 MR. ROSE: Objection. Mischaracterizes.

6 THE WITNESS: No, I don't think I said
7 that, but then I don't exactly remember that train of
8 conversation so I would not be comfortable trying to
9 resay that at this point.

10 BY MR. BAUM:

11 Q. Could you turn to page, or excuse me,
12 paragraph 136 of your report in the 916 IPR, please.

13 A. Sir, what paragraph again?

14 Q. 136.

15 A. Okay.

16 Q. The latter part of that paragraph says
17 that "at best, a 60 percent mixture of KF/KOH in
18 solution"?

19 A. Right.

20 Q. In -- open paren, "at the border of
21 solubility, close paren, plus a precipitant of KOH
22 and KF salts in Slurry Tank 24."

23 What did you mean by the borderline of
24 solubility?

25 A. In the slurry tank at the temperature that

1 it operates, the limiting solubility of KF and KOH is
2 about that amount, maybe 60, 65 percent.

3 Q. So you could have up to a combined amount
4 of 60 percent KF and KOH without any precipitant
5 according -- let me back up. Start again.

6 So you could have a combined amount of up
7 to about 60 percent KF and KOH in Slurry Tank 24
8 without precipitating any KF or KOH.

9 A. Well, first, before I comment on that, I'd
10 like to put paragraph 136 in context. We stated
11 earlier in the deposition that Masayuki and Smith
12 will not work because Smith teaches an efficient
13 process, and that in combination with the
14 concentration loop should make this whole thing
15 inoperable. We -- right here, we are -- we are
16 basically -- we went through an argument starting
17 here or starting in this section where we allowed,
18 even though Smith doesn't, for conversions that are
19 less than what -- and Smith teaches -- he teaches an
20 efficient process in order to make this argument.

21 So this is not a strictly Smith/Masayuki
22 example. It is an argument that we made, even though
23 we stated earlier on that the combination of Smith
24 and Masayuki wouldn't work. So when you see KF and
25 KOH at 30 percent concentration, that is our argument

1 and not a Smith/Masayuki in the strictest terms.

2 Q. Okay. Thank you for that. I'd like you
3 now to think about an aqueous solution of KOH and KF.

4 Could you have as much as 60 percent
5 mixture of KF and KOH in aqueous solution before a
6 precipitant would form?

7 A. Yes. At temperatures above 40 degrees --
8 40, 50 degrees.

9 Q. And that's the temperature in those -- in
10 the slurry tank of Masayuki?

11 A. I think the slurry tank is hotter, but I'm
12 saying that's the limiting solubility. So above
13 that, 60 percent is viable.

14 Q. Okay. So applying the reaction of Smith
15 in the flow diagram of Masayuki and focusing on the
16 slurry tank where we have an aqueous solution of KF
17 and KOH, if one of ordinary skill in the art were to
18 add lime to that slurry tank, I believe you said
19 before that you would precipitate out calcium
20 fluoride and you would be left with KOH in solution.

21 A. You would be left with a mixture of KF,
22 KOH, calcium fluoride and lime because the amount of
23 calcium fluoride that you need to add to that mixture
24 would become a very viscous wet cement. It would not
25 be a complete reaction.

1 Q. Now, what would the level of KF, KOH and
2 calcium fluoride have to be to have a wet cement in
3 the slurry tank?

4 A. Probably -- probably just as this example
5 says. With -- with 40 percent water remaining and
6 30 percent salts and now you're adding in a larger --
7 another large amount of a salt, the calcium fluoride,
8 your water in that system is at best maybe what,
9 about 25 percent less?

10 Q. So the consistency of that aqueous
11 solution is really going to depend on how much water
12 you remove in the enricher, correct?

13 A. Yes.

14 Q. And so one of ordinary skill could adjust
15 the amount of water that's being removed in the
16 enricher such that you would not have a cement or a
17 wet cement in the slurry tank, correct?

18 MR. ROSE: Objection to form.

19 THE WITNESS: If they moved away from what
20 Masayuki teaches, yes.

21 BY MR. BAUM:

22 Q. And so if one of ordinary skill in the art
23 were to exercise their own judgment, one of ordinary
24 skill could remove a small amount of water and still
25 have a solution that would flow?

1 A. Sure, but that one of ordinary skill would
2 probably take the enricher out at best or, at most,
3 put the enricher after the slurry tank so that they
4 could balance the concentration of that. I think
5 they would also add water into their calcium
6 hydroxide and -- because if you look at Harrison,
7 which we're doing here, Harrison is using fairly
8 dilute as weight percent concentrations of calcium
9 hydroxide in order to effect a good conversion of KF
10 to KOH.

11 So if one was to use their own judgment
12 and teach away from Masayuki, they would take the
13 enricher out where it is. They would go directly
14 into the slurry tank. They -- they would -- they
15 would then go -- add in their lime, take off their
16 calcium fluoride, send the KOH which is diluted
17 because, as I said, the calcium -- the lime would be
18 slurried with more water, and go into an enricher to
19 then remove water to bring the KOH up to the
20 concentration that it originally was when it entered
21 the reactor. That's how someone who would use their
22 own judgment and not follow implicitly Masayuki would
23 probably want to run this system.

24 Now that assumes that that they see a need
25 to even use Masayuki because Smith is teaching an

1 efficient reaction. And as we've defined spent KOH,
2 KOH -- here, let me go to the definition.

3 Q. Yeah, there's really no need to do that.

4 A. Okay, but just my one point. We've
5 defined it -- there is a point I want to make.
6 Spent -- spent unreacted -- oh, this is not mine, is
7 it?

8 Q. Yeah, that's the --

9 A. Okay. All right. Well, my point is,
10 spent -- spent KOH, which is an aqueous solution of
11 dehydrohalogenation and by-product salts, may not be
12 the same as by-product salts and some spent
13 dehydrohalogenating agent, and that's what you're
14 getting with Smith.

15 Q. So I'm not asking you to reconfigure,
16 reconstruct Masayuki. The questions I'm asking you
17 really are given the structure that's here, what
18 would one of ordinary skill would do?

19 MR. ROSE: Objection to form.

20 THE WITNESS: I understand. But you did
21 tell me that the one using your own judgment would
22 decide on the amount of water they wanted to take
23 out, and that's not following Masayuki. Masayuki,
24 by -- by his definition of what -- how they
25 concentrated the sodium hydroxide defines how much

1 water you have to take out. So . . .

2 BY MR. BAUM:

3 Q. So the changes that you've described, are
4 those changes that would be necessary to get Masayuki
5 to work?

6 A. Yes.

7 Q. And a person of ordinary skill in the art
8 in 2008 would have understood that those changes
9 would be necessary, correct?

10 MR. ROSE: Objection to form.

11 THE WITNESS: He would very likely -- he
12 would at least recognize that the enricher is a
13 significant problem following the teachings of
14 Masayuki and applying Smith and Masayuki.

15 BY MR. BAUM:

16 Q. Could one of ordinary skill in the art
17 operate the enricher in such a way as to remove only
18 the additional water generated in the
19 dehydrohalogenation reactor?

20 MR. ROSE: Objection to form.

21 THE WITNESS: If he doesn't follow
22 Masayuki, yes.

23 BY MR. BAUM:

24 Q. I'm asking you to apply the process of
25 Smith in the Masayuki flow diagram.

1 A. Okay. Yes, I -- I think I understand
2 that. But yes, if you just -- if you just remove the
3 water that's produced by reaction, you're not
4 following Masayuki, but using his own.

5 Q. Would one of ordinary skill in the art be
6 able to exercise his or her own judgment as to how
7 much water to remove in view of the differences
8 between the process taught and Smith and the process
9 of Masayuki?

10 MR. ROSE: Objection to form.

11 THE WITNESS: I believe so.

12 BY MR. BAUM:

13 Q. So one of ordinary skill in the art could
14 practice the process of Smith in the flow diagram of
15 Masayuki if proper concentrations of water were
16 chosen at the various stages of the process, correct?

17 MR. ROSE: Objection. Form.

18 THE WITNESS: Could you restate that,
19 please?

20 (Whereupon the Court Reporter read the
21 previous question.)

22 THE WITNESS: I don't know that there are
23 proper concentrations of water that will allow you to
24 follow the teachings of Smith and Masayuki and have
25 this process work for any length of time before it

1 becoming unstable. At the very least, that person of
2 ordinary skill would probably want to build a working
3 model or have this model through computer simulation
4 to see what happens.

5 BY MR. BAUM:

6 Q. But you believe that it's possible one of
7 ordinary skill could envision proper concentrations
8 of water at various stages in the process to get the
9 process of Smith to work in Masayuki?

10 MR. ROSE: Objection to the form.

11 THE WITNESS: No, I believe they could
12 build a model and do a computer simulation. I don't
13 know that they would find those concentrations.

14 BY MR. BAUM:

15 Q. So if one were to conduct the process of
16 Smith -- let me start again.

17 If one of ordinary skill were to conduct
18 the dehydrohalogenation reaction of Smith in the flow
19 diagram of Masayuki and we have in the Slurry Tank 24
20 a mixture of KOH and KF and calcium fluoride and that
21 aqueous mixture is inserted into Centrifuge 25, would
22 that centrifuge be able to separate out the solid
23 calcium fluoride from the aqueous solution?

24 MR. ROSE: Objection.

25 THE WITNESS: I can't answer that within

1 the context of Smith and Masayuki. But outside of
2 that, you would be able to separate.

3 BY MR. BAUM:

4 Q. So it's relatively easy to separate
5 calcium fluoride that's been precipitated out of
6 solution including KF/KOH; is that correct?

7 MR. ROSE: Objection. Form.

8 THE WITNESS: If concentrations are low
9 enough.

10 BY MR. BAUM:

11 Q. And then following the flow diagram of
12 Masayuki using the dehydrohalogenation reaction of
13 Smith, the aqueous solution recovered from the
14 centrifuge would then be returned to the
15 dehydrohalogenation reaction via Conduit 13 to
16 Conduit 2 and then into the reactor, correct?

17 MR. ROSE: Objection to form.

18 THE WITNESS: No, I don't think so because
19 I can't answer that in the context of Masayuki and
20 Smith. But yes, with outside of that, that aqueous
21 dehydrohalogenation could certainly go through 13
22 back up into 2 and into the reactor.

23 BY MR. BAUM:

24 Q. And that would effectively recycle spent
25 KOH to the Reactor 19 in Masayuki, correct?

1 MR. ROSE: Objection. Form.

2 THE WITNESS: Again, outside of context of
3 Masayuki, it would effectively recycle.

4 MR. BAUM: Let's take about a ten-minute
5 break. I'm getting close.

6 MR. ROSE: I was going to ask how long you
7 plan to go.

8 MR. BAUM: Yeah, I should be half an hour
9 I would think at the most.

10 VIDEOGRAPHER: The time is 2:53 p.m. and
11 we are now going off the record.

12 (A recess transpired from 2:53 p.m. until
13 3:14 p.m.)

14 VIDEOGRAPHER: Okay. The time is 3:14 and
15 we are going back on the record.

16 BY MR. BAUM:

17 Q. Dr. Lousenberg, you said several times
18 that the Smith reference teaches an efficient process
19 and a conversion rate of at least 90 percent. Can
20 you show me where in Smith it says that?

21 A. I didn't say that Smith teaches a
22 conversion rate of 90 percent, but my experience in
23 doing reactions with KOH in a phase transfer catalyst
24 is that's very easy to achieve.

25

[illegible]

21 A. No. All I can point to is the fact that
22 Smith teaches methods of achieving high efficiency
23 which -- which is conversion to desired products and
24 he doesn't state exactly what those efficiencies are.
25 He's silent to those efficiencies.

1 Q. Can you point to where Smith teaches
2 methods of achieving high efficiency and conversion?

3 A. Sure. On page 14, third paragraph, he
4 talks about the phase transfer catalyst. And he
5 says, "An effective amount of a phase transfer
6 catalyst should be used in order to effect the
7 desired reaction, influence selectivity to the
8 desired products or enhance the yield. Such an
9 amount can be determined by limited experiments once
10 the reactants, process conditions and phase transfer
11 catalysts are selected."

12 Q. That's a fairly common statement with
13 regard to phase transfer catalyst, isn't it?

14 A. Yes.

15 Q. In fact, you've said the same thing before
16 in your '630 patent which we marked as Exhibit 1024
17 earlier, didn't you?

18 A. Sorry. Can you say that again?

19 Q. You said the same thing in your '630
20 patent which we marked as Exhibit 1024 earlier?

21 A. I may have. I don't recall the exact
22 passages in the patent so it's possible.

23 Q. Can you point to any other portion of
24 Smith that teaches that the process is efficient or
25 has a conversion rate of at least 90 percent in your

1 opinion?

2 A. I can't point to a conversion rate of
3 90 percent because Smith is silent. He doesn't give
4 any of those examples.

5 Q. Either yesterday or today during breaks or
6 overnight, did you discuss your deposition at all
7 with anyone?

8 A. No. I was alone from the time I left
9 Alston & Bird until this morning.

10 Q. And did you eat lunch by yourself today?

11 A. No, I ate it in the break room, and
12 counsel was there.

13 Q. And what did you discuss during lunch?

14 A. I didn't discuss much of anything.
15 Counsel talked about sports for the most part. I did
16 comment that depositions are lonely.

17 Q. What else did you discuss with counsel?

18 A. We discussed going for a walk and we did
19 that, but there was no real discussion with me. It
20 was counsel talking amongst themselves as I walked
21 typically at some distance away from them.

22 Q. Were they talking about the deposition
23 while you were walking?

24 A. Not that I could hear.

25 Q. Did you discuss anything else with

1 counsel?

2 A. I don't believe so.

3 Q. Did you speak with counsel during the last
4 break about the teachings of the Honeywell reports?

5 A. No.

6 MR. BAUM: No further questions at this
7 time.

8 MR. ROSE: Okay. We're going to take a
9 little break and see if we have a little bit of
10 redirect.

11 MR. BAUM: All right.

12 VIDEOGRAPHER: We're going off the record.
13 It is now 3:22 p.m.

14 (A recess transpired from 3:22 p.m. until
15 3:47 p.m.)

16 VIDEOGRAPHER: Okay. Time is 3:47 p.m.
17 we're now going back on the record.

18 EXAMINATION

19 BY MR. ROSE:

20 Q. Welcome back, Dr. Lousenberg. I have a
21 few follow-up questions for you. I'd like to go to
22 your declaration you have in front of you. It's
23 in -- I think the one you have is the 916. I want to
24 talk briefly about the materials that you reviewed
25 and considered in preparing your declarations. Do

1 you recall giving testimony about that yesterday?

2 A. Yes.

3 Q. About what you reviewed or didn't review?

4 A. Yes.

5 Q. And if you will, turn to page 7 of your
6 declaration.

7 A. Sure.

8 Q. And it said, you have a section captioned
9 "Information Considered"?

10 A. Yes.

11 Q. Okay. And in scrolling down there in
12 paragraph 14 about the fourth line.

13 A. Yes.

14 Q. You list Exhibits 1001 through 1018.

15 A. Correct.

16 Q. Did you consider those exhibits to the
17 petition in these cases?

18 A. I -- yes, I did. I believe -- I -- my
19 memory works best when I refer to them by their --
20 their names in particular. So I have been confused
21 at times with numbers. I believe these numbers --
22 within these numbers are the reports for -- technical
23 reports for Honeywell that are exhibits.

24 Q. These are -- these are the Exhibits 1001
25 through 1018 which are the exhibits to the petition

1 filed by the petitioner in this case?

2 A. Oh, okay. Well, then the -- I'm
3 referring --

4 Q. I just want to know, did you review
5 exhibits, the exhibits listed here?

6 A. Yes, I did. Yes, I did. I did. I recall
7 that.

8 Q. Okay. Now, if you will pull out the
9 petition filed by the petitioner in this case. And
10 I'll direct your attention to -- that's your
11 declaration. Somewhere before you had the petition
12 filed by -- maybe it's that one with the binder.
13 Here we are.

14 A. Okay.

15 Q. Now, on page Roman numeral III is a
16 listing of those exhibits. Do you see that? Roman
17 numeral III?

18 A. Yes.

19 Q. Okay. And in that listing, Exhibit 1002
20 is the declaration of Dr. Manzer, correct?

21 A. Correct.

22 Q. And Exhibit 1015 is the file history for
23 the '282 patent, correct?

24 A. 10 -- sorry?

25 Q. 1015?

1 A. Yes.

2 Q. Okay. So those are exhibits that you did
3 review in preparing your declaration?

4 A. Yes.

5 Q. Thank you. Now, you were shown another
6 document yesterday which was marked I believe as
7 Exhibit 1021 which is an English translation of an
8 Italian document that appears to be authored by Dario
9 Sianesi and Renzo Fontanelli. Do you recall looking
10 at that document yesterday?

11 A. I did look at this document yesterday.

12 Q. And you gave some testimony about that
13 document yesterday, correct?

14 A. Yes, I did.

15 Q. Okay. And I'd like to turn to page 852
16 using the page numbers in the upper left-hand corner.
17 And you were asked in particular about the paragraph
18 in the middle of the page that starts with a B.

19 A. Yes, I was.

20 Q. And then states, "dehydrofluorination with
21 basic agents." Do you see that?

22 A. Yes, I do.

23 Q. Okay. And that paragraph states, "The
24 most immediate method for the dehydrofluorination of
25 C3F6H2 is found to be simple passage of the compound

1 in gaseous form through a liquid phase constituted of
2 an aqueous solution of KOH with a high titre, 70 to
3 80 percent, maintained at a temperature of about
4 150 degrees."

5 Do you see that?

6 A. Yes.

7 Q. Okay. How is that method performed in the
8 Sianesi document, the method of passing the gas
9 through the liquid phase?

10 A. Well, that might be answered from the
11 experimental section. I don't have it in my head
12 offhand, but I do recall reading the experimental
13 section that seemed to be very important.

14 Q. And did you come to a conclusion as to how
15 that method is performed?

16 A. Yes. They bubbled the C₃F₆H₂ through
17 80 percent KOH in a metal container that was heated
18 to 140 to 150 degrees C. "By means of a 5-centimeter
19 weighing tube, 600 grams of C₃F₆H₂ were bubbled into
20 this liquid phase over a period of one hour, the
21 exiting product being collected by condensation at
22 minus 78-degrees C."

23 Q. Is that a tube reactor?

24 A. It's a metal container with -- with a tube
25 in it. It is not specific to the dimensions, but the

1 reading of this seems to be consistent with a tube
2 reactor.

3 Q. Okay. And how was that different from
4 what is described in the Sedat reference?

5 A. The Sedat reference is a continuously
6 stirred tank reactor.

7 Q. And is that difference significant?

8 A. It can be.

9 Q. And why is that?

10 A. Because the length of contact time between
11 the reactant, the C₃F₆H₂ can be different from the
12 tube reactor. Or sorry. The C₃ -- the length of
13 contact time of the C₃F₆H₂ with the aqueous KOH can
14 be different.

15 Q. Do you have your declaration from the 915
16 case before you?

17 A. I don't think so, but I will look. Yes, I
18 do.

19 Q. I'd like you to turn to paragraph 127,
20 please. It's on page 42. Are you at paragraph 127?

21 A. Yes, I am.

22 Q. And you expressed your opinion that "A
23 person of ordinary skill in the art reading Sedat
24 would not find Sedat to be enabled for the purposes
25 of a dehydrofluorination reaction and thus would

1 expressly reject his teachings when preparing a
2 process for the manufacture of fluoroolefins alone or
3 in combination with any other references."

4 You see that?

5 A. Yes.

6 Q. Okay. Do you believe that your opinions
7 expressed here are incorrect because of what you read
8 in the Sianesi reference?

9 A. In the Sianesi reference, the contact time
10 between the materials is not stated, but the
11 dimensions of the reactor are different than in the
12 continually stirred tank reactor so even though
13 Sianesi says that there is -- well, back to page --
14 page 852. Even though he says that "The operation
15 gave a virtually quantitative dehydrofluorination,
16 the reaction product is only
17 1-hydropentafluoropropylene constituting mainly of
18 isomer I with minor contents, about five percent of
19 isomer II," I can't say that the contact time in this
20 reactor would be sufficient to give the same result.

21 Q. When you say "the contact time in this
22 reactor," you're talking about Sedat?

23 A. Yes.

24 MR. BAUM: Leading. Objection. Leading.

25

1 BY MR. ROSE:

2 Q. I want to talk a little bit about some
3 testimony you gave earlier today regarding the
4 combination of Smith and Masayuki --

5 A. Okay.

6 Q. -- this afternoon. And counsel had asked
7 you some questions regarding conducting the
8 dehydrohalogenation reaction of Smith using the
9 apparatus of Masayuki. Do you recall that?

10 A. Yes.

11 Q. Okay. And you testified that -- that at
12 one point, that the person of ordinary skill could
13 remove the evaporator from the Masayuki process
14 because it didn't need to be there for the Smith
15 process. Do you recall that, that a person of
16 ordinary skill could remove the evaporator?

17 MR. BAUM: Objection. Leading. Form.

18 THE WITNESS: I recall saying that they
19 could possibly remove all of the Smith process if --
20 in a high efficiency reaction, but if they move the
21 evaporator, it -- in the combination of Smith, what
22 would happen is they would avoid the concentration
23 loop difficulties.

24 BY MR. ROSE:

25 Q. Okay. So if the evaporator is removed,

1 then there would be no spent KOH ever passing through
2 the evaporator, correct?

3 MR. BAUM: Objection. Form. Leading.

4 THE WITNESS: Correct. If there's no
5 evaporator, spent KOH is not going through it.

6 BY MR. ROSE:

7 Q. And you -- do you recall also testifying
8 about the possibility of moving the evaporator to --
9 after the centrifuge?

10 A. Yes, I did.

11 Q. Now in that instance, the centrifuge is
12 used to remove the calcium fluoride, correct?

13 A. Correct.

14 MR. BAUM: Objection. Leading. Form.

15 BY MR. ROSE:

16 Q. So that would be after the conversion of
17 KF to CAF₂?

18 MR. BAUM: Objection. Leading. Form.

19 THE WITNESS: Correct.

20 BY MR. ROSE:

21 Q. Okay. And so at that point, there would
22 be no more spent KOH in the stream, correct?

23 MR. BAUM: Objection. Leading. Form.

24 THE WITNESS: Spent KOH, yes, there would
25 be no more spent KOH.

1 BY MR. ROSE:

2 Q. Okay. So if you have the evaporator
3 placed after the centrifuge, would any spent KOH go
4 through the evaporator?

5 A. No.

6 MR. ROSE: Okay. Thank you. I have no
7 further questions.

8 MR. BAUM: Take a short break and return.

9 VIDEOGRAPHER: Time is 3:59 p.m. We are
10 now going off the record.

11 (A recess transpired from 3:59 p.m. until
12 4:11 p.m.)

13 VIDEOGRAPHER: Okay. The time is
14 4:11 p.m. We are going back on the record.

15 MR. BAUM: Dr. Lousenberg, we have no more
16 questions for you at this time. Thank you very much
17 for your participation in this deposition.

18 THE WITNESS: You're welcome.

19 VIDEOGRAPHER: And this concludes the
20 deposition. Time is 4:12 p.m. We are off the
21 record.

22 (The deposition was concluded
23 at 4:12 p.m.)

24 (Signature reserved.)

25

SIGNATURE OF DEPONENT

DEPONENT: ROBERT D. LOUSENBERG, Ph.D.
DEPOSITION DATE: April 15, 2016, Volume 2
REPORTER: Karen K. Kidwell, RMR, CRR
CASE CAPTION: Arkema France v.
Honeywell International, Inc.

(Please return both Signature of Deponent pages)

I, the undersigned, ROBERT D.
LOUSENBERG, Ph. D., do hereby certify that I have
read the foregoing deposition and find it to be a
true and accurate transcription of my testimony, with
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ROBERT D. LOUSENBERG, Ph.D. Date

I, Karen K. Kidwell, Notary Public for the
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CERTIFICATE OF REPORTER

I, KAREN K. KIDWELL, Registered
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I further certify that I am neither
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This the 17th day of April, 2016.

Karen K. Kidwell, RMR, CRR
Registered Professional Reporter
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