ORIGINAL

COMMONWEALTH OF PENNSYLVANIA

PUBLIC UTILITY COMMISSION

Letter of Notification of Philadelphia Electric Company Relative to reconstructing and rebuilding of the existing 138 kV line to Operate as a Woodbourne-Heaton 230 kV line in Montgomery and Bucks Counties: Further Hearings.	Docket No. A-110550F055

Pages 1533 through 1630

Hearing Room No. 1
State Office Building
Philadelphia, Pennsylvania

Thursday, May 27, 1993

Met, pursuant to notice, at 10:04 a.m.

BEFORE:

HERBERT SMOLEN, Administrative Law Judge

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EXHIBITS

E X H I B I T S (CONTINUED)

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P R O C E E D I N G S

ADMINISTRATIVE LAW JUDGE HERBERT SMOLEN: Good morning, ladies and gentlemen. This is a hearing in the remanded proceeding in Docket A-110550, Folder 055.

I note from the appearance sheet that appearances have been entered on behalf of Philadelphia Electric Company by Paul Bonney and Ward Smith, Esquires, as well as Tom Watson, Esquire; on behalf of the Commission's Law Bureau Prosecutory Staff by Patricia Krise Burket, Esquire; on behalf of the Office of Consumer Advocate by Tanya J. McCloskey and Dianne Dusman, Esquires; and on behalf of Pennsylvania Power & Light by Jesse Dillon, Esquire.

I received a telephone call this morning from Charles Hoffman, Counsel for the Office of Trial Staff, who indicated to me that OTS will not be represented today in the hearing room because of conflicts of all its attorneys assigned in this case. However, OTS intends to be present and monitor the remainder of the hearings and expects to be present tomorrow, at which time Mr. Hoffman will further make his position clear.

Having said that, are we prepared to proceed with testimony?

MR. BONNEY: Yes, Your Honor.

JUDGE SMOLEN: Please call your witness, the first

of your witnesses.

MR. BONNEY: Your Honor, as the only preliminary matter, we sent a letter on May 25 with a proposed order of witnesses and I just would mention that we intend to follow that. The OCA's witness, Mr. Janes, is here as well and I understand that the OCA would like to have him testify and we would be happy to fit him in.

JUDGE SMOLEN: First? Before Dr. Bockman?

MR. BONNEY: I think he may go after our witnesses. But if time does not permit for some reason then we would fit him in earlier.

JUDGE SMOLEN: Let's proceed.

MR. BONNEY: The company calls as its first witness Dr. Bockman.

Mr. Smith will be conducting the examination.

JUDGE SMOLEN: All right.

Good morning.

You testified in the previous hearing?

DR. BOCKMAN: In November of '91.

JUDGE SMOLEN: I will swear you in again.

Whereupon,

RICHARD STEVEN BOCKMAN

having been duly sworn, testified as follows:

JUDGE SMOLEN: Please have a seat and keep your voice up. And for this record state your name and

address.

THE WITNESS: My name is Richard S. Bockman. My address is 535 East 72th Street, New York, New York 10021.

JUDGE SMOLEN: Mr. Smith, go ahead.

MR. SMITH: Your Honor, we have already distributed to Counsel, yourself and to the court reporter copies of PECo Direct on Remand No. 3, the direct testimony on remand of Richard Steven Bockman on behalf of Philadelphia Electric Company. I ask that that be marked for identification.

JUDGE SMOLEN: Let me just get my copies of it.

(Pause.)

JUDGE SMOLEN: It will be marked for identification as you have indicated.

(Whereupon, the document was marked as PECo Direct on Remand No. 3 for identification.)

JUDGE SMOLEN: That is marked as PECo Direct on Remand No. 3.

DIRECT EXAMINATION

BY MR. SMITH:

Q. Dr. Bockman, do you have before you a copy of the document that has just been marked for identification as PECo Direct on Remand No. 3?

A. Yes, I do.

Q. Was this document prepared by you or under your direction and supervision?

A. Yes, it was.

Q. If I were to ask you today the questions set forth in that document would your answers be the same as those contained therein?

A. They would be the same.

Q. And would your answers be true and correct to the best of your knowledge, information and belief?

A. They would be.

MR. SMITH: Your Honor, I ask that PECo Direct on Remand No. 3 be admitted into the record pending timely objections.

JUDGE SMOLEN: It is received with those qualifications.

(Whereupon, the document marked as PECo Direct on Remand No. 3 was received in evidence.)

JUDGE SMOLEN: Are you ready for cross-examination?

MR. SMITH: Yes, Your Honor.

JUDGE SMOLEN: Law Bureau.

MS. BURKET: I have no questions.

JUDGE SMOLEN: PP&L.

MR. DILLON: No questions, Your Honor.

JUDGE SMOLEN: OCA.

MS. McCLOSKEY: Thank you, Your Honor.

CROSS-EXAMINATION

BY MS. McCLOSKEY:

Q. Good morning, Dr. Bockman. My name is Tanya McCloskey and I represent the Office of Consumer Advocate.

If you could turn to page two of your testimony, where you reference a study by Parkinson and Sulik, who attempted to replicate some earlier research on ion cyclotron resonance effects on diatoms, was the work that Parkinson and Sulik attempting to replicate the work of Smith, et al., that was conducted at Montana State University?

A. I have to say I don't remember that specific detail. It was work in which Dr. Liboff was an author. Maybe if you give the full thing or even the reference, we could look at it.

Q. Sure. I have the Parkinson and Sulik paper with me and it is basically about the middle of the first introductory paragraph.

(Document handed to witness.)

A. Yes.

Q. Now, are you familiar --

A. Reference two is the paper we are referring to, in Bioelectromagnetics with Liboff as one of the authors.

Q. And Smith also was one of the authors?

A. Smith was the lead author, yes.

Q. Now, are you familiar with any other recent work involving magnetic field exposure and diatom mobility such as the paper published by Reese, et al. entitled Evaluation of Diatom Mobility After Exposure to 16 Hertz Electromagnetic Fields?

A. I don't recall that paper. No, I'm not familiar with that paper.

Q. If you would look at the second column on page 319 of the Parkinson and Sulik study I have handed you, in about the middle of the page do you see there the reference to the diatom work of Reese as discussed by Parkinson and Sulik?

(Witness perusing document.)

A. Yes.

Q. And do you see there a...

(Witness perusing document.)

Q. Okay. The sentence that begins, "However, a positive result at 16 hertz has recently been reported by the group at Batelle Pacific Northwest Laboratories"?

A. Correct.

Q. That is referring, then, to the work by Reese that we just discussed, correct?

A. It seems to be, yes.

Q. And would you agree with me, then, that the

results of recent studies on the effects of magnetic fields on diatom mobility have given mixed results?

A. I would say that there are different reports of results. I'm not familiar with the -- I don't recall the Reese paper. Perhaps we should look at it as to what the end points were that were being studied. Perhaps it is relevant; perhaps it's not.

Q. I will show you a copy of the Reese paper entitled Evaluation of Changes in Diatom Mobility After Exposure so 16 Hertz Electromagnetic Fields, and that was published in Bioelectromagnetics, 12:21-25, dated 1991. I will show a copy to your Counsel.

(Document handed to Mr. Smith.)

MR. SMITH: Thank you.

(Witness perusing document.)

BY MS. McCLOSKEY:

Q. You had asked to review that, and I think the question that I asked you was would you agree with me that the results of recent studies on the effects of magnetic fields on diatom mobility have given mixed results.

A. I think your statement is correct. I think it is worth qualifying what mixed results are.

They admit that -- in this Reese paper, that while the effect at 16 hertz -- which, again, is not related to

60 hertz, that is clearly a different frequency -- was significant, the percentage of cells that actually moved was not significant. So in a sense that incorporates what Parkinson and Sulik had reported. So both of these studies that you have given me disagree with the study of -- the original study of Smith.

So your statement is correct. There are inconsistencies. I think in all fairness one has to ask what the biological relevance of this is, the movement of calcium containing small organisms in the presence of a non-power frequency field. And I don't think it really has very much biological relevance. And I certainly don't think that the weight of data that is available in the literature would argue that the cyclotron resonance theory cannot be upheld by the experiments that are currently present.

Even if you interpreted the Reese paper as suggesting that the field has some influence, it certainly didn't influence the bulk of the particles but only that there was some obvious difference at 16 hertz. Okay. But that could arise just by chance, you understand. That when you make a random number of measurements, by chance you are likely to find something that is going to change.

The bottom line is that even if you -- if this

change was confirmable by others, which it has not been, that it does not then prove that Liboff's theory of cyclotron resonance is correct.

So, I'm sorry. I just wanted to put it in that context. I agree with your statement, but in that context.

Q. And, Dr. Bockman, since we are in a new phase of the proceeding, it just occurred to me I think we may have discussed this the last time you were on the stand, but could you briefly just explain diatom mobility so that this record is complete and people can understand it, in as layman's terms as possible?

A. Okay. I think to do that we have to go back a little bit. Because one of the arguments is that electric and magnetic fields may transduce or couple to biological systems through their ability to interact with calcium and calcium movement. That would be very important and a very important finding if it were true because calcium is a very critical cation in controlling a number of different cell functions. So this has become a focus point for much of the literature.

A hypothesis has been put forth by Dr. Liboff that indeed electric and magnetic fields can influence calcium through a process, a physical process, known as cyclotron resonance. Many, many physical scientists disagree with

the hypothesis on very sound theoretical grounds, which we can discuss.

But this diatom system, which probably couldn't be further away from human systems, are small organisms that contain a large amount of calcium and they kind of live as free little organisms in the environment. And the concept is that changes in calcium concentration within these organisms would alter the way they move in a rather dense system. The system that is used is an agar system, which is like a jello if you want to think of it that way, and you put these particles into this thick jello. If you did something to them so that they moved in a coordinated fashion, that would be a way of sort of measuring or assessing that you had some uniform effect, possibly on calcium.

That's another thing, is that these studies aren't directly measuring changes in calcium. And I have cited studies that do measure changes -- that there are not changes in calcium.

So it is an indirect measurement in an intact organism in jello showing its movement under the influence of what are non-power frequency fields. That was a long sentence, but you get the gist of the sentence is that we are talking about not human systems and we are talking systems that are -- that may or may not be

involved with the issue at hand, which is calcium and calcium movement. And we are looking at a strange measure, which is a movement through jello-like substance. If you can somehow extrapolate that piece of information back to safety or non-safety of electric-magnetic fields, that takes a long jump. But it is doable, I suppose.

Q. And just to come full circle, then, you know, apart from the mechanisms which we have been discussing, then, the Reese paper did report some movement and the Smith paper reported some movement, yet the Parkinson and Sulik paper reported no movement or does not report movement?

(Witness perusing document.)

A. That was sort of a complicated question. That is one of those things you would have to diagram out.

What the Reese paper shows is that they claim there is some effect at 16 hertz but that the cell movement was not sufficiently reproduceable, okay, to allow examination of frequency dependence. That would seem to negate whatever result they found.

In other words, they say they have an effect at 16 hertz but then they say that the movement that occurred in this jello was sufficiently random that they could not say that there really was a significant movement. That

seems to negate their whole study. So I would say this study sort of self-destructs and I am not sure it is worth then comparing to the other studies.

You know, I think we lose the issue here. The issue is what is the evidence that calcium is being perturbed or altered. And you are right, the last time we discussed this we talked about the eflux experiments, which we agreed were studies of dead and dying tissues and didn't have biological relevance. And since that time a hypothesis has been put forth and a number of studies have been done to see whether or not electric and magnetic fields actually alter calcium movement within cells. In the studies that are in a sense the most incisive, the ones that look directly at calcium movement, such as studies that use a technique called patch-clamps, which was published by Hojevik and his colleagues, as well as studies that looked at changes in the concentration of calcium within the cytoplasm or the inside of the cell, and I have quoted those studies, those studies do not show changes in the calcium.

So I think these studies are far too indirect and provide very weak kind of an associative evidence but don't measure what we are really interested in, which is calcium. And when we do measure calcium, we don't see the change.

So you have to take it in that larger context. I have to say, in all fairness, I don't put that much weight on these diatom experiments.

MS. McCLOSKEY: Thank you, Your Honor. I have no further questions.

MR. SMITH: No redirect, Your Honor.

JUDGE SMOLEN: Anybody else? Any other Counsel in the hearing room have any further questions of this witness?

(No audible response.)

JUDGE SMOLEN: Hearing no response, the witness is excused. Thank you very much for appearing and testifying, sir.

(Witness excused.)

MR. SMITH: The company calls as its second witness Mr. Charles Boeggeman.

JUDGE SMOLEN: Good morning. You also previously testified but we are going to swear you in again.

Whereupon,

CHARLES J. BOEGGEMAN

having been duly sworn, testified as follows:

JUDGE SMOLEN: Please have a seat. State your full name and address.

THE WITNESS: Charles J. Boeggeman, 2301 Market Street, Philadelphia, Pennsylvania 19101.

JUDGE SMOLEN: Counsel.

MR. SMITH: Your Honor, we have previously distributed to Counsel, yourself, and the court reporter two documents related to Mr. Boeggeman's testimony. The first is PECo Direct on Remand No. 2, direct testimony on remand of Charles J. Boeggeman on behalf of Philadelphia Electric Company. I ask that that be marked for identification.

JUDGE SMOLEN: So marked.

(Whereupon, the document was marked as PECo Direct on Remand No. 2 for identification.)

MR. SMITH: The second document is PECo Rebuttal on Remand No. 2, rebuttal testimony on remand of Charles J. Boeggeman on behalf of Philadelphia Electric Company. I ask that that document also be marked for identification.

JUDGE SMOLEN: So marked.

(Whereupon, the document was marked as PECo Rebuttal on Remand No. 2 for identification.)

DIRECT EXAMINATION

BY MR. SMITH:

Q. Mr. Boeggeman, by whom are you employed and in what capacity?

A. Philadelphia Electric Company. I am an electrical engineer working for Transmission and

Distribution Services Department.

Q. Now, do you have before you a copy of a document that was just marked for identification as PECo Direct on Remand No. 2?

A. Yes, I do.

Q. And do you have in front of you a copy of a document that was just marked for identification as PECo Rebuttal on Remand No. 2?

A. Yes, I do.

Q. Were these documents prepared by you or under your direct supervision?

A. Yes, they were.

Q. If I were to ask you today the questions set forth in these documents would your answers be the same as those contained therein?

A. They would be the same.

Q. And would your answers be true and correct to the best of your knowledge, information and belief?

A. Yes, they would.

MR. SMITH: Your Honor, I ask that PECo Direct on Remand No. 2 and PECo Rebuttal on Remand No. 2 be admitted into the record subject to timely objections.

JUDGE SMOLEN: They are received subject to those qualifications.

(Whereupon, the documents marked as PECo Direct on Remand No. 2 and Rebuttal on Remand No. 2 were received in evidence.)

MR. SMITH: The witness is available for cross-examination.

JUDGE SMOLEN: Ms. Burket.

MS. BURKET: No questions, Your Honor.

JUDGE SMOLEN: Mr. Dillon.

MR. DILLON: No questions, Your Honor.

JUDGE SMOLEN: Ms. McCloskey.

MS. McCLOSKEY: Ms. Dusman will be conducting the cross.

JUDGE SMOLEN: Ms. Dusman.

MS. DUSMAN: Thank you, Your Honor.

CROSS-EXAMINATION

BY MS. DUSMAN:

Q. Good morning, Mr. Boeggeman. I am Dianne Dusman of the Office of Consumer Advocate.

Would you you please refer to your statement at page two, where you begin your discussion of existing magnetic field standards?

A. Okay.

Q. At lines 16 to 17 of that page you refer to the New York interim standard of 200 milligauss at edge of right-of-way, is that correct?

A. That's correct.

Q. Mr. Boeggeman, how familiar are you with New York's interim standard as it is described in the State of New York's Public Service Commission Statement of Interim Policy on Magnetic Fields of Major Electric Transmission Facilities?

A. Somewhat familiar. I have reviewed it in the past, although not recently.

Q. Not in preparation for testimony here today?

A. No.

Q. Are you aware that that statement was issued in September of 1990?

A. Yes.

Q. Do you recall how the 200 milligauss edge of right-of-way level was calculated?

A. Yes. It was calculated on maximum conductor rating, winter normal conductor rating. They surveyed the existing 345 kV transmission lines in New York and set the standard based on the edge of right-of-way fields for those ratings.

Q. So the winter normal conductor standard is the reference point for that 200 milligauss level?

A. That is my recollection.

Q. Do you know what percentage of the time their study showed the transmission circuits operate at their

winter normal conductor rating?

A. I do not recall.

Q. Can you accept subject to check that it was less than 0.1 percent of the time?

A. I would certainly accept that.

Q. Do you recall that the New York study on which that interim policy statement was based showed that for 99 percent of the time the magnetic field at the edge of right-of-way for 345 kV transmission circuits was less than 55 milligauss?

A. I could accept that also.

Q. Mr. Boeggeman, referring to your initial testimony in this case and PECo Exhibit No. 2 which was already offered -- do you happen to have that with you?

A. I believe I do.

Q. Would you please look at Exhibit No. 2, pages six to nine, and the calculations that you provide on Table 2 showing different loading conditions with respect to this line?

A. I'm there.

Q. Can you tell us, Mr. Boeggeman, whether any of the calculations you provide here are equal to the winter normal conductor rating which we stated was the basis for the interim New York standard?

A. These are not based on winter normal conductor

ratings. The reason for that is the transmission line, the limit of the rating is at the connection points, the substations, not the actual conductor itself. We don't necessarily put up a size conductor that we intend to use that rating. We purchase conductor based on a cost analyses of various conductors, the strength of conductor, that type of thing.

Q. Okay. So if none of your calculations can be said to be equal to the rating used to devise the New York standard, to support the New York standard, interim standard, are any of your calculations close to approximating that standard?

A. No. Specifically the maximum conductor rating, the rating of that conductor is 1,780 amperes. If you did the math, rounded out to 1,800 amperes, you could multiply 1.8 times the thousand ampere figures and come up with the figures at 1,800 amperes.

Q. Would it be possible for you to make that calculation for the edge of right-of-way for this line based on your table here?

A. Well, better yet, I will take the 600 ampere rating and multiply by three.

Q. Okay.

(Witness performing calculations.)

A. Roughly 127 milligauss.

Q. And would you state how you made that calculation so that the record is complete?

A. I multiplied the 600 ampere calculations, the magnetic field from the 600 ampere calculations, by three. Three times 600 is 1,800. It is a direct multiplication.

And I multiplied that by the number at plus-30 feet, 42.21 -- I'm sorry. I was looking at the plus-30 feet rather than the minus.

(Witness performing calculations.)

A. Roughly 181 milligauss.

Q. I'm sorry. Would you repeat that?

A. 181 milligauss, in round figures.

Q. If we were to use the figures in column five, which relates to loading of a thousand amps, we would multiply those figures by 1.8?

A. 1.8, correct.

Q. I believe earlier when you described how the New York interim standard as arrived at you stated that it was based upon 345 kV lines?

A. Correct.

Q. And the New York standard does not generally apply to 230 kV lines, does it?

A. I believe it does. My recollection is that it does.

Q. And does it, to the best of your recollection, does it have the same -- apply the same level to the 230 kV line as a 345 kV line?

A. I believe it does. I may be wrong, but...

MS. DUSMAN: If I may, Your Honor --

A. It has been a while since I reviewed that.

MS. DUSMAN: -- I have a copy of the New York interim standard. Perhaps the witness could review that.

JUDGE SMOLEN: Why don't you show it to Counsel first.

(Document handed to Mr. Smith.)

MS. DUSMAN: Your Honor, I am just presenting the witness with the New York standard and specifically the section that contains its conclusions.

JUDGE SMOLEN: Go ahead.

THE WITNESS: Before I read this, I realized I made a mathematical error in my calculation. I multiplied the thousand amperes figure by three, okay? It would be 1.8 times 60.47 milligauss, okay, or three times 36.21.

BY MS. DUSMAN:

Q. And what does that yield?

(Witness performing calculations.)

A. 109 milligauss for round figures.

Which part -- did you want me to read the whole page?

Q. The conclusions.

(Witness perusing document.)

JUDGE SMOLEN: Before you read it, since there are a lot of interruptions on the record why don't you restate the question so that it is clear, the question and the answer.

BY MS. DUSMAN: Well, I previously asked the question to the best of your recollection does the New York standard specifically apply to 130 kV lines, and the witness responded that he believed that it did.

So I have presented him with conclusions of the New York policy statement so that he can refresh his recollection and at the moment there is no question on the table.

JUDGE SMOLEN: All right.

(Witness perusing document.)

A. I still believe it does apply to 230 kV lines.

BY MS. DUSMAN:

Q. So you believe this applies, the 200 milligauss level, applies equally to a 345 kV line and a 230 kV line?

A. That is my interpretation.

MR. SMITH: Your Honor, if they are done with that, could we ask to look at it during cross-examination?

JUDGE SMOLEN: You can ask.

MS. DUSMAN: Just one moment.

JUDGE SMOLEN: And you have asked.

MS. DUSMAN: Your Honor, I don't have any further questions for this witness.

JUDGE SMOLEN: Maybe there will be some redirect possibly. Do you want to take a look at that?

MR. SMITH: Yes.

JUDGE SMOLEN: I want to give Mr. Sugarman, who has entered an appearance during the cross-examination of this witness here, do you want to cross-examine this witness, sir?

MR. SUGARMAN: Just a little bit, Your Honor. Thank you.

CROSS-EXAMINATION

BY MR. SUGARMAN:

Q. Pursuing Ms. Dusman's last question, Mr. Boeggeman, could you identify the language in that statement that to your interpretation makes it applicable to 230 kV lines? Do you still have a copy of that?

A. I don't have it.

JUDGE SMOLEN: Somebody has it.

MR. WATSON: We have it.

MR. SUGARMAN: Okay. Here is another copy.

(Witness perusing document.)

A. Article 4, Circuits, takes into consideration a

230 kV line. It becomes apparent that the 230 kV line is part of this when it states if there is no edge of right-of-way it states take, "Article 4 transmission circuit operating at 230 kV" -- or "Sixty foot from centerline of structures supporting an Article 4 transmission circuit operating at 230 kV if there is no edge of right-of-way defined."

BY MR. SUGARMAN:

Q. What does the term no edge of right-of-way mean in your interpretation?

A. In the State of New York I am really not sure what it means. I believe it means if there is no defined -- actually, I have to say I don't know exactly what that means in the State of New York.

Q. Is there an edge of right-of-way in the Woodbourne-Heaton line?

A. There is an easement that was purchased from Conrail that designates an edge of right-of-way that is within the Conrail property.

Q. And you are applying the standard that is not applicable to -- I'm sorry. Let me rephrase it. You are using or relating to a standard that is only applicable where there is no edge of right-of-way defined, is that correct?

A. No.

MR. SMITH: Objection, Your Honor. That is argumentative.

JUDGE SMOLEN: Overruled. He has already answered.

Go ahead.

BY MR. SUGARMAN:

Q. Go ahead.

A. No, I don't agree with that. I was just pointing out that a 230 kV line was designated in the language there.

Q. Right.

A. That is how I conclude that 230 kV lines are included in the New York standard for edge of right-of-way magnetic field standards.

Q. I see.

Now, in your testimony is it your testimony that the Granger Morgan prudent avoidance concept applies here as if this were an existing line?

A. Yes.

Q. And why do you apply the standard that this is an existing line?

A. Because it is an existing line on an existing right-of-way.

Q. In reaching that opinion have you considered the import of the Commonwealth Court's action in remanding the matter to the Public Utility Commission?

A. I don't understand your question. Could you explain further?

Q. Well, if it was an existing line in an existing right-of-way why do you understand that the Commonwealth Court found the Commission's procedures to have been inadequate?

MR. SMITH: Objection, Your Honor. That is argumentative and beyond the scope.

JUDGE SMOLEN: Sustained.

MR. SUGARMAN: I will come back to my other question. That question was really more to answer your question what did I mean by that.

BY MR. SUGARMAN:

Q. What I am asking is when you say that you applied the concept of prudent avoidance as if this were an existing line in an existing right-of-way, my question is did you consider the import of the Commonwealth Court's decision in your decision to apply the standards of an existing line in an existing right-of-way?

MR. SMITH: Objection, Your Honor. That calls for legal analysis by the witness.

MR. SUGARMAN: It is just a question, did he consider it.

JUDGE SMOLEN: Overruled.

You may answer. Did you consider it?

A. I don't understand the question. Consider the import of --

BY MR. SUGARMAN:

Q. The Commonwealth Court decision.

A. Could you direct some language to me that tells me what the decision was, please?

Q. The conclusion of the decision that the matter be remanded because the Protestants had not had an opportunity for hearing.

MR. SMITH: Objection, Your Honor. Argumentative.

MR. SUGARMAN: That's not argumentative. That is a description of what the Court did.

JUDGE SMOLEN: I am not sure that that is related to your original question. Why don't you start from the beginning again. I will sustain right now. Start all over again.

BY MR. SUGARMAN:

Q. Did you consider the implication of the Commonwealth Court's action in remanding the matter? Yes or no?

A. I still don't understand the question. The line is an existing line. It is tangibly there and it is on an existing right-of-way.

Q. Did you consider the Commonwealth Court's decision?

MR. SMITH: Asked and answered, Your Honor.

MR. SUGARMAN: Never answered. It was asked several times in different ways, but now I'm asking just the basic, bare question:

BY MR. SUGARMAN:

Q. Did you consider the Commonwealth Court's decision?

A. I read the decision.

Q. What did you understand it to mean with respect to whether this is an existing line in an existing right-of-way?

MR. SMITH: Objection, Your Honor. That calls for a legal analysis by the witness.

JUDGE SMOLEN: Well, it does call for a legal analysis.

THE WITNESS: Did you say Commonwealth Court or the Commission?

MR. SUGARMAN: The Commonwealth Court.

THE WITNESS: Oh, I'm sorry. Yes, I read it a long time ago. I thought you meant this remand.

BY MR. SUGARMAN:

Q. No. I meant the Commonwealth Courts' remand from May, 1992.

A. I have no opinion on the remand.

Q. So the Commonwealth Court's decision, if the

legal implication -- this is a hypothetical question, I am not asking you to say whether it is or isn't -- if the Commonwealth Court's decision carries the necessary implication that this line should not be considered an existing line in an existing right-of-way, then would you agree that you would have to apply a different test under the concept of prudent avoidance?

MR. SMITH: Objection, Your Honor. There is no basis in evidence for the conjecture in his question.

MR. SUGARMAN: The foundation is that the Morgan report states that prudent avoidance also calls for not locating new lines near highly built-up, highly populated areas.

MR. SMITH: The objection is that there is no basis for his conjecture about the decision.

JUDGE SMOLEN: I am going to sustain the objection. But I want to move it along without unnecessary delay. Are you really asking that if it is not an existing line would a different standard be applicable?

MR. SUGARMAN: That's right.

JUDGE SMOLEN: Why don't you ask it that way without reference to the Commonwealth Court.

BY MR. SUGARMAN:

Q. If the line were not considered to be an existing line in an existing right-of-way would a

different standard be applicable under the concept of prudent avoidance that you applied?

A. No. The reason for that is many. This line was proposed before it was built to go down a common corridor of occupation, which is something that has been encouraged in the past. Condemnation has been discouraged in the past, introduction of new rights-of-way. We were able to build a compact delta system on that right-of-way and mitigate or to reduce magnetic field levels. I still would have come to the same conclusion in my part of the decision that it is prudent application of that transmission corridor.

Q. In your supplemental testimony -- I believe it was your supplemental testimony received in the last two days --

JUDGE SMOLEN: Let's get it clear for the record. You mean his rebuttal testimony or the direct on remand?

MR. SUGARMAN: The rebuttal testimony, I guess it is called. It was the one paragraph relating to underground.

BY MR. SUGARMAN:

Q. Was it your testimony as to the cost of going underground?

A. I refer to another's testimony. The cost is in my testimony. I have not prepared the estimate of that

cost. I do refer to it.

Q. Is that the construction -- the $38 million, right?

A. That is the additional cost, I understand, to construct the line underground.

Q. Did you consider -- first of all, did you understand that the 38 million was additional to what? When you say it is additional cost, what do you mean? Additional on top of what?

A. It is conjecture on my part. It is 38 million on top of what was spent thus far, but I am not sure.

Q. All right. So assuming that the 38 million is the total cost of underground construction apart from the costs that have already been spent, have you calculated the savings, or have you determined whether there would be any savings over the life of the use of the line that might reduce that $38 million investment or might compensation in part for it?

MR. SMITH: Objection, Your Honor. This is outside the scope of Mr. Boeggeman's testimony. He accepted the figure that Mr. Oedemann calculated.

JUDGE SMOLEN: So the dollar figures, the cost estimates, were through another witness?

MR. SMITH: Yes, sir.

BY MR. SUGARMAN:

Q. I am just asking did you, Mr. Boeggeman, calculate or estimate or project any difference in lifetime costs as distinquished from initial investment.

MR. SMITH: And I understood that that was Mr. Sugarman's question and I objected to it because it is still outside the scope of Mr. Boeggeman's testimony.

MR. SUGARMAN: Well, his testimony is, and I quote from lines 32 and 33, "Again, that is not a small or modest investment." And I am testing that opinion by attempting to elicit what offsetting lifetime savings there might be --

JUDGE SMOLEN: It's not through this witness.

MR. SUGARMAN: -- in giving this opinion that this is not a small or modest investment.

JUDGE SMOLEN: This witness has accepted, as I understand it, the testimony --

MR. SUGARMAN: As initial cost.

JUDGE SMOLEN: As initial cost.

MR. SUGARMAN: Right. But then he goes on and gives an opinion of his own that says that is not a small or modest investment. I'm asking if in reaching that opinion of his he considered the operating savings or the long-time savings in reaching that opinion. So I am questioning that opinion.

JUDGE SMOLEN: I will permit that question. I

overrule the objection.

A. I don't understand what you mean by long-term operating savings.

BY MR. SUGARMAN:

Q. Well, the savings that would be associated from not having an overhead line and not having to perform repairs and maintenance and the upkeep costs associated with exposure to weather and what have you in an overhead line, as well as the reduced liability to personal injury and property damage claims that would occur from having an underground line and the lower milligauss.

MR. SMITH: Objection. It assumes fact not in evidence.

MR. SUGARMAN: I am not assuming. He didn't understand what I'm talking about. I'm only asking if he considered such things.

MR. SMITH: Objection, Your Honor.

MR. SUGARMAN: How could I put facts in evidence at this time?

JUDGE SMOLEN: The question when read by a reader of this record seems to place facts in the record which are not there. You are trying to ascertain from this witness what if anything he considered.

MR. SUGARMAN: That's right.

JUDGE SMOLEN: Now, I understand this is

cross-examination and you are permitted to use leading questions rather than a question as I have just phrased it. So I am going to sustain this objection and ask you to rephrase that question again to see if you can elicit the information you're attempting to elicit.

MR. SUGARMAN: Mr. Boeggeman, did you attempt to estimate the cost differential of an underground line versus an overhead line over its lifetime with respect to maintenance and accidents?

MR. SMITH: Objection. Outside the scope of this witness' testimony.

MR. SUGARMAN: Then I move to strike his opinion that this is not a small or modest investment.

JUDGE SMOLEN: I overrule the objection. You can answer.

A. I have not done that estimate.

BY MR. SUGARMAN:

Q. Did you attempt to estimate the cost savings that might, or any cost savings that might occur from a reduction in exposure to liability suits as a result of having lower milligauss from having the line --

MR. SMITH: Objection.

JUDGE SMOLEN: Sustained.

BY MR. SUGARMAN:

Q. Did you make any estimate of that kind?

JUDGE SMOLEN: I sustained the objection.

BY MR. SUGARMAN:

Q. Did you make any estimate of the difference in projected costs associated with liability from overhead lines versus underground lines?

MR. SMITH: Objection, Your Honor.

JUDGE SMOLEN: Well, I am going to allow that question. He does say it is not -- what was the terminology again?

MR. SUGARMAN: I asked if he considered --

JUDGE SMOLEN: No, I mean of the opinion which you are seeking to test.

MR. SUGARMAN: Oh, the opinion. Again, that is not a small or modest investment. In other words, an additional 38.5 million.

JUDGE SMOLEN: Now you can ask the question.

MR. SUGARMAN: I beg your pardon?

JUDGE SMOLEN: You can ask a question.

MR. SUGARMAN: Thank you.

BY MR. SUGARMAN:

Q. The question is did you consider whether there would be cost savings or any estimate -- did you estimate any cost savings that might occur from reduced liability for personal -- reduced exposure to personal liability judgments as a result of an underground line and lower

milligauss?

MR. SMITH: Objection, Your Honor. It assumes that there would be liability under either case.

JUDGE SMOLEN: Sustained.

MR. SUGARMAN: It doesn't not assume it. I'm asking --

JUDGE SMOLEN: Well, I sustained it.

MR. SUGARMAN: I will rephrase it.

BY MR. SUGARMAN:

Q. Did you consider whether there might be any savings in liability to personal injury claims as a result of having underground with lower milligauss?

MR. SMITH: Objection, Your Honor.

JUDGE SMOLEN: It assumes there are going to liability claims and possible savings if it is underground. It does make that assumption, that there will be claims or there may be liability claims.

MR. SUGARMAN: I'm trying to ask the question did he consider whether there would be. So let me try to phrase it again.

BY MR. SUGARMAN:

Q. Did you consider whether there might be more exposure to personal injury liability with an overhead line as a result of higher milligauss?

MR. SMITH: Objection, Your Honor. This is asked

and answered. The witness testified he didn't do calculations. Subparts of the calculations have already been --

MR. SUGARMAN: Well, do you want to stipulate that that was not considered?

JUDGE SMOLEN: No. What was your last statement? That could be stipulated to because you stated what you believe the witness said. Why don't you repeat that.

MR. SMITH: I think we should stipulate to his answer that he did not do calculations, that he accepted Mr. Oedemann's calculations.

JUDGE SMOLEN: That he did no calculations whatsoever but accepted the calculation of another PECo witness?

MR. SMITH: Yes, sir.

BY MR. SUGARMAN:

Q. Well, then, did you consider without doing calculations, did you consider in reaching your opinion that it's not a modest or small investment, did you consider whether there might be offsetting savings in exposure to liability suits?

A. It is a legal question that I can't answer.

Q. In reaching your conclusion based on Mr. Frieman's testimony that the cost of purchasing the Protestants' properties would, I think there is a word

missing here on page four, line 20, I assume the word would be "be", would be over 160 million.

A. Yes.

Q. Did you consider the offsetting -- did you consider whether there would be any offset from being able to use the purchased properties in some other fashion? In other words, that they might be developed in some other way.

MR. SMITH: Objection, Your Honor. It assumes facts not in evidence.

MR. SUGARMAN: Again, I am asking the question did he consider whether there would be.

JUDGE SMOLEN: Did you develop the figure?

THE WITNESS: No.

MR. SUGARMAN: That is not my question, Your Honor. Again, it is a net versus a gross. I am not questioing him on the $160 million cost. I am accepting that Mr. Frieman came up with that cost and Mr. Boeggeman simply -- but his opinion that is given, is, quote, that is not a small or modest investment and I thus conclude that the proposal is not consistent with the concept of prudent avoidance."

My question is did he consider whether the purchased property could be reused and therefore whether the 160 million was in fact or would be in fact the cost,

the total net cost.

MR. SMITH: We object to that question, Your Honor. If he is challenging the 160 million as a net or gross then he's on the wrong witness. And if he is not challenging that, then he is assuming facts that are not in evidence, that this land can be redeveloped.

MR. SUGARMAN: I am not assuming any such facts. I'm asking him if he considered --

JUDGE SMOLEN: I will permit the question and you can answer it.

A. It is an after the fact thing. I never considered it, no.

BY MR. SUGARMAN:

Q. I'm sorry?

A. That consideration is after the fact. The line is there. So there would be no reason for me to consider that.

Q. Let me clarify. I don't think you understood my question. It probably wasn't clear.

In your testimony you state that the cost of Protestants' proposal to purchase properties would be over $160 million.

A. That is the figure that was --

Q. I'm accepting that that would be the expenditure that would have to be made for purposes of

this question.

A. Okay.

Q. You then go on to give an opinion: that is not a small or modest investment, and I thus conclude that the proposal is not consistent with the concept of prudent avoidance.

My question is in your hypothetical that you were testifying about the cost being 160 million, and on which you gave the opinion that that is not a small or modest investment, I am asking did you consider whether the property could be reused and if so what value it would have for reuse?

A. No, I did not.

Q. Why not?

A. Again, it was after the fact of the line being there. The design of the line, the width of the right-of-way, the achievement of reduced fields beyond existing standards that are out there tells me that $5 more spent would would be not prudent.

Q. Now, do you consider yourself an expert on what the concept of prudent avoidance means, or were you simply applying the standard that you took from the Granger Morgan report?

A. I am applying the standard that was generated by the Morgan report to whatever analyses were performed

on our systems.

MR. SUGARMAN: Thank you. I don't have any further questions. Thank you very much.

MR. SMITH: May we have just a moment for redirect?

JUDGE SMOLEN: Certainly.

(Pause.)

MR. SMITH: Your Honor, would it be possible to show this to the witness so that the witness could read the New York magnetic field standard before redirect?

JUDGE SMOLEN: Any objection?

(No audible response.)

JUDGE SMOLEN: Then let's take a short break. How much time do you need?

MR. SMITH: Ten, 15 minutes.

JUDGE SMOLEN: It's approximately 11:10. I may be a little fast. Let's come back at 11:20.

(Recess.)

JUDGE SMOLEN: We are back on record.

Go ahead. Any redirect?

MR. SMITH: Yes, Your Honor.

JUDGE SMOLEN: Go ahead.

REDIRECT EXAMINATION

BY MR. SMITH:

Q. Mr. Boeggeman, during the break did you have the opportunity to review the New York Interim Magnetic

Field Standard?

A. Yes, I did.

Q. Is it still your opinion that it applies to 230 kV transmission lines?

A. Yes. As a matter of fact on page one, if I can quote from the document it says, "The interim standard by analogy to the Commission's 1978 decision on electric fields is intended to ensure that magnetic fields at the edge of future major electric transmission facility rights-of-way will be no stronger than the fields typically of the many existing 345 kV lines operating throughout the state."

Q. Thank you.

And could you also turn to paragraph one of the conclusions of the standard?

A. Yes.

Q. Could you read it?

A. It says, "Future Article 7 transmission circuits shall be designed, constructed and operated such that magnetic fields at the edge of their rights-of-way (measured one meter above ground level) will not exceed 200 milligauss when the circuit phase currents are equal to the winter normal conductor rating (as defined by the New York power pool)."

Q. Could you take a look at paragraph two of the

conclusions and read that, please?

A. "Where there is no edge of right-of-way defined, the field levels shall not exceed the valves specified in paragraph one above at a horizontal distance of, (a), 75 feet from the centerline of the structure supporting an Article 7 transmission circuit operating at 345 kV; (b), 60 feet from the centerline of the structure supporting an Article 7 transmission circuit operating at 230 kV; and, (c), 50 feet from the centerline of the structure supporting an Article 7 circuit operating at a lower voltage."

Q. And do you read that to say that this standard does or does not apply to 230 kV transmission lines?

A. It applies to it because it specifically refers you back to paragraph one, which states that it will not exceed 200 milligauss when circuit phase currents are equal to the winter normal conductor rating.

Q. Thank you.

Now, do you recall a few moments ago during the cross-examination by the Office of Consumer Advocate being asked about the winter conductor rating of this line?

A. Yes.

Q. Do you recall testifying about some physical constraints on this line other than the winter conductor

rating?

A. Yes. There is physical constraints at the substations, and my understanding from people involved in the substations is that equipment at the substations limits this loading to a thousand amperes maximum for emergencies.

Q. So can this line operate above a thousand amperes given those physical constraints?

A. My understanding is that, no, it cannot.

Q. And just so the record is clear, the calculations that you conducted using the winter conductor rating for this line, using those calculations does this line still meet the New York standard?

A. Yes, it does.

MR. SMITH: No further questions.

JUDGE SMOLEN: Recross?

MS. DUSMAN: I have no questions, Your Honor.

JUDGE SMOLEN: All right.

Mr. Sugarman?

MR. SUGARMAN: No questions, Your Honor.

JUDGE SMOLEN: Anything further of this witness? PP&L? Law Bureau?

MR. DILLON: No, Your Honor.

MS. BURKET: No, Your Honor.

JUDGE SMOLEN: The witness is excused. Thank you

very much for appearing and testifying.

(Witness excused.)

MR. BONNEY: Your Honor, the company calls as its next witness Ronald J. Oedemann. He has been previously sworn and has testified.

JUDGE SMOLEN: I am going to swear him in again.

Whereupon,

RONALD J. OEDEMANN

having been duly sworn, testified as follows:

JUDGE SMOLEN: Please have a seat. State your full name and address.

THE WITNESS: My name is Ronald J. Oedemann, 2301 Market Street, Philadelphia, Pa. 19101.

MR. BONNEY: Your Honor, the company has previously distributed to yourself, the parties and the court reporter copies of a document marked in the upper right-hand corner PECo Direct on Remand No. 1, the direct testimony on remand of Ronald J. Oedemann, and a second document, PECo Rebuttal on Remand No. 1, rebuttal testimony of Ronald J. Oedemann. I ask that those two documents be marked for identification.

JUDGE SMOLEN: They are so marked PECo Direct on Remand No. 1 and PECo Rebuttal on Remand No. 1.

(Whereupon, the documents were marked as PECo Direct on Remand No. 1 and PECo Rebuttal on Remand No. 1 for identification.)

DIRECT EXAMINATION

BY MR. BONNEY:

Q. Mr. Oedemann, by whom are you employed and in what capacity?

A. I'm employed by the Philadelphia Electric Company. I am a senior engineer in the T & D engineering department.

Q. Do you have before you copies of the documents that have just been marked for identification as PECo Direct on Remand No. 1 and PECo Rebuttal on Remand No. 1?

A. Yes, I do.

Q. Were these documents prepared by you or under your direction and supervision?

A. Yes, they were.

Q. If I were to ask you today the questions set forth in these documents, would your answers be the same as those contained therein?

A. Yes, they would.

Q. Would your answers be true and correct to the best of your knowledge, information and belief?

A. Yes, they would.

MR. BONNEY: Your Honor, at this time I ask that these two documents, PECo Direct on Remand No. 1 and PECo Rebuttal on Remand No. 1, be admitted into the record subject to timely motions and cross-examination.

JUDGE SMOLEN: They are both received subject to the qualifications which you have just articulated.

(Whereupon, the documents marked as PECo Direct on Remand No. 1 and PECo Rebuttal on Remand No. 1 were received in evidence.)

MR. BONNEY: Mr. Oedemann is available for cross-examination.

JUDGE SMOLEN: Law Bureau.

MS. BURKET: No questions, Your Honor.

JUDGE SMOLEN: PP&L.

MR. DILLON: No questions, Your Honor.

JUDGE SMOLEN: OCA.

MS. DUSMAN: Just a few questions, Your Honor.

JUDGE SMOLEN: All right.

CROSS-EXAMINATION

BY MS. DUSMAN:

Q. Good morning, Mr. Oedemann.

A. Good morning.

Q. At page three, lines six to ten, of your statement on remand you describe the width of both the Conrail utility corridor and the right-of-way for the Woodbourne-Heaton line, is that correct?

A. Yes.

Q. And you also state on that page that at 12 of the 238 poles supporting the line one side of the

narrower Woodbourne-Heaton right-of-way is coterminous with the edge of the utility corridor. Is that accurate?

A. Yes.

Q. Now, when you are talking about those 12 poles where the edge of the corridor and the edge of the right-of-way are coterminous, you state that the adjoining land uses consist of commercial property, an electrical contractor and land with abandoned vehicles and construction equipment, is that correct?

A. That's correct.

Q. To the best of your knowledge are those uses both at the poles and through the distances between the 12 poles?

A. Yes.

Q. With respect -- one other point of clarification. As to the 12 poles where the corridor and the right-of-way have a coterminous edge, are those 12 poles all in a line or are they scattered throughout the 12-plus miles?

A. They are three distinct locations along the line.

Q. With respect to the residential properties abutting the right-of-way what is the shortest distance from any residential property line to the center of the Woodbourne-Heaton right-of-way?

MR. BONNEY: Your Honor, if I may interrupt for clarification, which right-of-way are you referring to? The Woodbourne-Heaton right-of-way or the utility corridor right-of-way?

MS. DUSMAN: The question stated Woodbourne-Heaton right-of-way.

MR. BONNEY: Okay. Thank you.

A. You are talking now the distance from the property line of the resident to the edge of our 60 foot right-of-way, is that correct?

BY MS. DUSMAN:

Q. I will restate the question.

With respect to any of the residential properties abutting the right-of-way, what is the shortest distance from any residential property line to the center of the Woodbourne-Heaton right-of-way?

A. The smallest distance is about 40 feet.

Q. Now, do you likewise know the shortest distance between the center of the Woodbourne-Heaton right-of-way and any dwelling on any residential property?

A. Of the Protestants that testified -- this was all given out almost two years ago -- my recollection is the nearest residence to the center of our transmission line might be 125 feet.

Q. So your testimony now is based not upon your

own observation but your recollection of what the transcript says from the earlier hearings?

A. It's a recollection of both. I mean, I have been at all the locations and that number just sticks out in my mind, that -- I mean, like I said, that is the closest. Most of them were further away. But I would say that is an accurate figure.

Q. Do you know how many different residential tracts of land abut the right-of-way?

A. I don't have that answer.

Q. Do you know whether there is any undeveloped land zoned for residential use that abuts the Conrail utility corridor?

A. I don't know that answer.

MS. DUSMAN: Your Honor, I have no further questions.

JUDGE SMOLEN: Mr. Sugarman.

CROSS-EXAMINATION

BY MR. SUGARMAN:

Q. Mr. Oedemann, in response to Ms. Dusman you indicated that the closest residence of the Protestants is, to the best of your recollection, 125 feet from the line itself?

A. That's correct.

Q. Okay. And were you being specific in saying

Protestants as distinquished from any residents? In other words, were you limiting your testimony to the residences of those that you know to be Protestants?

A. Yes.

Q. So there might be other residences of people who are not Protestants that might be closer?

A. It is possible, yes.

Q. And is it your testimony that you personally at one time or another inspected the properties of all of those that you knew to be Protestants?

A. I have been -- yes. I have been at locations on the railroad where all the Protestants live, yes.

Q. Now -- and you knew which house was which? In other words, you knew when you looked at a given residence you knew that is Protestant Jones or Protestant Smith?

A. Yes.

Q. And what did you use to have that information? Did you have a property owner -- a map showing the names of the property owners?

A. Well, the Protestants all had their addresses on the list that was originally given out and I just looked and saw where they lived by the mailbox.

Q. So you actually went down the streets to the front of the house?

A. In many cases I did, yes.

Q. Well, it must have been in every case, right?

A. Yes.

Q. And then you went back around to the railroad tracks to see how far it was, using the appearance of the dwelling to make sure it was the same property? In other words, you went down the mailbox and the houses in most cases front away from the tracks. So you go down the street where the mailbox is, you look at the number on the mailbox, then you have to go back around and out and around to the nearest access to the railroad tracks and walk down the railroad tracks and look back at the back of the house. How do you know if it is the same house?

A. Well, in most cases the house was maybe one of two or three houses and you could just tell which house belonged to who.

Q. Did you make any effort to ascertain the proximity of any non-Protestant houses to the line?

A. No.

Q. Your testimony, your rebuttal testimony, is that the cost of underground cable in that corridor would be 38.5 million, is that correct?

A. Not exactly. Let me get that testimony out again. I said it would cost a minimum of approximately $38.5 million.

Q. Okay. Now, I take it that did not include any lifetime costs of maintenance or repair or any other costs after it was constructed, is that correct?

A. Like I said, the 38.5 million was a minimum figure. That figure will go up when you figure when you have to consider the additional maintenance that you are going to have to do on an underground transmission line. It is going to make it cost more, if anything.

Q. Right. Did you make any effort to ascertain whether there would be a more economical corridor to use if you were going underground to connect Woodbourne and Heaton? Or did you simply assume that you were going to use the Conrail utility corridor?

A. I assumed the shortest distance between the two substations, and like I stated almost two years ago the most direct route between those two substations is the Conrail corridor.

Q. And what did you assume with respect to the engineering characteristic of the cable construction? In other words, was it going to be a three phase line?

A. This would be a cable in a steel pipe filled with oil, three phase cable in the pipe.

Q. And how close together would the cables be in the pipe?

A. My guess, they would be approximately three

inches apart.

Q. Is that the configuration that is normally used by PECo in connection with a 230 kV underground installation?

A. Yes.

Q. And is it currently used by PECo in other applications, that is, at other locations?

A. Yes.

Q. Now, did you estimate the cost -- or let me say it has been constructed so are you familiar with the cost of the overhead line that was constructed?

A. Yes, I am.

Q. And what was it?

A. The cost of that line between the two substations is approximately $15-and-a-half million.

Q. And does that include the cost of legal proceedings that have been incurred so far?

A. No, it does not.

Q. Do you know what that cost is?

A. I don't know that.

MR. SUGARMAN: That is all I have. Thank you very much.

MR. BONNEY: No redirect, Your Honor.

JUDGE SMOLEN: Anything further of this witness by any Counsel?

(No audible response.)

JUDGE SMOLEN: Hearing no response, the witness is excused. Thank you very much for appearing and testifying.

(Witness excused.)

MR. BONNEY: Your Honor, the company calls as its next witness Donald S. Frieman.

Whereupon,

DONALD S. FRIEMAN

having been duly sworn, testified as follows:

JUDGE SMOLEN: Please have a seat. State your full name and address.

THE WITNESS: Donald S. Frieman, 2301 Market Street, Philadelphia, Pennsylvania 19101.

MR. BONNEY: Your Honor, we have previously distributed to yourself, the parties and the court reporter a document entitled PECo Rebuttal on Remand No. 3, the rebuttal testimony of Donald S. Frieman. I ask that it be marked for identification as such at this time.

JUDGE SMOLEN: So marked.

(Whereupon, the document was marked as PECo Rebuttal on Remand No. 3 for identification.)

DIRECT EXAMINATION

BY MR. BONNEY:

Q. Mr. Frieman, by whom are you employed and in what capacity?

A. Philadelphia Electric Company as manager of the Real Estate Department.

Q. Do you have before you a copy of what has just been marked for identification as PECo Rebuttal on Remand No. 3?

A. Yes.

Q. Was this document prepared by you or under your direction and supervision?

A. Yes, it was done under my supervision.

Q. Do you have any revisions or corrections to make to this document?

A. Yes, I do.

On page two, on my first answer at the top, in the third line down, I refer to "aerial photographs". That should be "tax maps".

Q. Just to be clear, you would subsitute for the words "aerial photographs", "tax maps"?

A. That's correct.

Q. If I were to ask you today the questions set forth in PECo Rebuttal on Remand No. 3 with that correction would your answers be the same as contained

therein?

A. Yes, they would.

Q. Would they be true and correct to the best of your knowledge, information and belief?

A. Yes, they would.

MR. BONNEY: Your Honor, I ask that PECo Rebuttal on Remand No. 3 be admitted into the record at this time subject to timely motions and cross-examination.

JUDGE SMOLEN: They are received with that qualification.

(Whereupon, the document marked as PECo Rebuttal on Remand No. 3 was received in evidence.)

MR. BONNEY: Thank you, Your Honor. Mr. Frieman is available for cross-examination.

JUDGE SMOLEN: Law Bureau.

MS. BURKET: No questions, Your Honor.

JUDGE SMOLEN: PP&L.

MR. DILLON: No questions, Your Honor.

JUDGE SMOLEN: OCA.

MS. DUSMAN: Just a few questions, Your Honor.

CROSS-EXAMINATION

BY MS. DUSMAN:

Q. Good morning, Mr. Frieman.

A. Good morning.

Q. How many parcels of residential property would

be affected by electromagnetic fields from this line of greater than one milligauss more than five percent of the time?

MR. BONNEY: Your Honor, I object. I don't understand the word affected and I am not sure that that assumes a fact not in evidence, that the parcels will be affected.

JUDGE SMOLEN: Well, you used the word affected.

MS. DUSMAN: Your Honor, I'll rephrase it.

BY MS. DUSMAN:

Q. Mr. Frieman's statement is that, at lines 26 to 28 of page one, that he is addressing the suggestion that the company should purchase all properties, any portion of which would be within levels of one milligauss more than five percent of the time.

Now, with that reference how many properties, residential properties, would be within levels of one milligauss from this line more than five percent of the time?

A. I didn't specifically focus on residential. As I stated, I focused on all property.

Q. Okay. How many different parcels of property, whether residential or not, would be within these levels?

A. There were approximately 314 parcels, which included from residential through industrial, commercial,

institutional. The usual mixture you would find.

Q. Now, you said that you used tax maps to identify all the parcels, did you not, on page two?

A. Yes.

Q. Did those tax maps reflect the manner in which the properties you were checking are zoned?

A. No.

Q. Did they in any manner indicate to you whether they were residential, commercial or industrial properties?

A. No, they did not.

Q. Do you know, then, Mr. Frieman, of the 314 parcels that you used to develop your figure how many of those parcels are owned by one or more of the Protestants?

A. No, I do not.

Q. Therefore, I guess you cannot possibly know what portion of the $160 million would consist of the fair market value of the property of the Protestants in this case, can you?

A. No.

Q. Focusing on page two, lines 17 to 18, you state that, quote, for the portion of the property which is residential PECo would not be able exercise eminent domain, end quote. Is that accurate?

A. That is accurate.

Q. By making that statement, Mr. Frieman, are you referring to the fact that eminent domain cannot be exercised to force sales of dwellings surrounded by a reasonable curtilage?

A. Yes, I am.

Q. Isn't it true, then, that eminent domain power can be exercised to take portions of parcels not falling into the category of dwellings surrounded by a reasonable curtilage?

A. The curtilage is 300 feet from the edge of right-of-way to dwelling. And the only properties I considered were properties within the 500 feet that I described in my answer. So that I assumed they would be dwellings within that purview that would not be condemnable. I didn't ascertain exactly how many, but there are residences that fall within that area.

Q. Mr. Frieman, assuming for a moment that Protestants' proposal would be adopted and PECo would purchase all or some portion of the residential properties at issue here up to a fair market value of $160 million, have you attempted to calculate what the net cost of such a venture would be?

A. To Philadelphia Electric Company?

Q. Yes.

A. No, I did not. This would be -- this is really a minimal value and if I were to put together a proposal in the normal fashion for approval it would be considerably higher because there are a lot of other factors that would have to be taken into consideration on such a large purchase project.

Q. And what type of factors are you referring to?

A. Well, first of all, you would be buying these properties over a two or or three year period. The act of acquisition in itself changes your supply and demand which raises the value in the community. My experience over the years indicates that an awful large number of the owners elect to stay in the same area and so you really have a very large active real estate market develop around any one of our transmission line acquisitions. And this has the effect of raising property value during your acquisition.

The costs of condemnation are extremely high. You have your legal expense. And you have a different level of preparation with appraisals, quality of appraisals. The cost of appraisals is higher because the type of appraisal required for a court action is different than the type of appraisal one would normally receive for the fair market value.

In addition, there is relocation involved with

condemnation, especially when you look at your commercial and your central sites that, you know, just looking at it would be very difficult to calculate, very expensive. This area has a predominance of large industrial customers. And so that in estimating just compensation, fair market value is only one of the elements.

So there would be a lot of considerations. And even by buying amicably you have to take into consideration those same factors for an unwilling seller.

Q. When you buy amicably, then, you can buy amicably without incurring the costs of condemnation?

A. You can eliminate the costs of the condemnation and usually what you are doing is substituting for that the incentive for an unwilling seller to sell. So that you're really paying above market to induce an unwilling seller to sell.

Q. Mr. Frieman, now that you have told us some various factors that could drive that $160 million figure up, can you likewise tell us what factors would bring that $160 million figure down?

A. There are no factors that I can give you that would drive that figure down. It would be substantially higher.

Q. Well, if PECo purchased these properties, which you have calculated have a fair market value of $160

million, the company would then obviously own those properties, wouldn't it?

A. Yes.

Q. And it would have those properties as an asset, would it not?

A. My feeling -- yes, the real estate would be an asset. The question of demolition of improvements would be another expense and the reuse of the vacant land in that corridor would probably be very minimal.

Q. I don't understand your comment about demolition of the property. I don't think that was part of any proposal.

A. Well, I am -- your question was was I considering additional savings or value to the company on the ownership of the property. My assumption is if we are buying this for a transmission corridor and the purpose is to keep it clear that there would be no continued uses that we purchased, because that would be the purchase of our acquisition. Normally when we buy property in a corridor, that is a consideration.

Q. You are talking about property within a corridor, however.

A. That is what I'm speaking of here. There might be some small pieces that are on the outside where there were partials that there could be some resale value on

the edges.

Q. Have you reviewed other testimonies of other witnesses for PECo in this matter?

A. Over the past I did.

Q. Mr. Frieman, with reference to your prior answer, that answer assumed, I believe, that PECo would purchase all of these properties, these residential properties, demolish any existing structures thereon and utilize that entire tract of land simply for a utility line corridor.

A. Well, you referred to residential. I was referring to all of the improvements.

Q. No, I just said structures. I didn't say residential. But am I accurately characterizing your testimony?

A. I'm sorry. I don't want to argue with you. You did say residential.

Q. I'm sorry. I stand corrected.

A. In answer to your question asking me if I considered that there would be value in that property once we bought it, my answer was no, I did not consider that there would be value because if I were asked in real estate to acquire all of these properties because they could not continue their use with our corridor there then my assumption is that we would tear down the

improvements, which would be industrial, commercial, residential, institutional, whatever those improvements might be. Otherwise I would question why I bought them.

Q. Is it accurate to state, then, that the assumption that these properties would no longer be used as they are currently is what drives your total figure of $160 million?

A. No. No. The $160 million is my estimate of the current fair market value of those properties as they are being used. If the use changed to a utility corridor use which would be devoid of those uses, the value would drop substantially. Your loss of value would be tremendous. I didn't even attempt to calculate it, but it would be very low.

Q. Just for a moment, Mr. Frieman, going back to the rebuttal testimony of Carter Van Dyke for Philadelphia Electric Company, which is Rebuttal Statement No. 5 --

MS. DUSMAN: And just to shorten, this, Your Honor, if I may, I will just read a section of Mr. Van Dyke's testimony.

MR. BONNEY: I'm sorry. If I may interrupt, what page are you reading from?

MS. DUSMAN: Page 15.

MR. BONNEY: Thank you.

MS. DUSMAN: Lines nine to 17.

BY MS. DUSMAN:

Q. "Some prospective purchasers in the corridor study area may consider the EMF issue among other issues in deciding whether to purchase in the area. This does not suggest, however, that the market or the market value will be affected but, rather, only that the issue might be considered. And as I have indicated, my analysis of this region does not reveal any impacts on land use, zoning or property values that would suggest such consideration of the EMF issue if it is occurring has had any effect on these land use factors."

And Mr. Van Dyke further goes on to conclude that he expects no impacts on future land uses as well if the line is energized.

Assuming for a moment all of those statements, Mr. Frieman, would that change the $160 million in the sense that PECo would be owning the properties and then be able to sell them as they are currently used?

MR. BONNEY: Your Honor, I am going to object at this point. Mr. Frieman's testimony is in response to a proposal or a position statement by Mr. Sugarman. The position is that PECo purchase all of the properties, any portion of which would be within levels above one milligauss more than five percent of the time. That is

what his testimony is referring to. This is outside the scope of his testimony which address that proposal because it is adding other elements to the proposal.

MS. DUSMAN: Your Honor, if I may respond.

JUDGE SMOLEN: You may respond.

MS. DUSMAN: It is this witness that is adding other elements to the proposal. All the Protestants said is -- all they suggested is that the company could purchase all properties any portion of which would be within such levels.

JUDGE SMOLEN: I hear the arguments of both sides, both parties here, and I am wondering whether or not your line of questioning assumes that PECo could condemn for the purpose of resale rather than condemn for the purposes of -- for utility purposes. It seems to me that if the company has the right to condemn for utility purposes then they would not have the right to resell the properties as they are. And that is what I seem to see that you are driving at.

MR. BONNEY: Your Honor, if I may add this, the proposal is that the line is somehow dangerous and that we need to purchase the property because of that danger. I think the assumption that you would resell it is inconsistent with that proposal.

MR. SUGARMAN: Your Honor, it is my proposal that

is the subject of the testimony. May I be heard as to the intent of the proposal?

JUDGE SMOLEN: Yes, but let Counsel first -- did you understand what I said?

MS. DUSMAN: Yes, I do, Your Honor.

JUDGE SMOLEN: You are saying they should condemn and then hold the property and couldn't they resell it. Well, they can't -- could they have the right to condemn and keep the properties and resell? Or is condemnation for a public purpose, namely for an utility purpose. If it is for an utility purpose then it is for the corridor. Would they not have to then either keep the properties as they are and not resell or demolish the properties and keep them for a utility corridor?

MS. DUSMAN: My first comment, Your Honor, is that condemnation is not necessarily a part of this proposal. If Protestants are proposing that the company purchase, I think we could reasonably assume there would be some willing sellers there.

And secondly, I am merely testing the validity of the $160 million figure that Mr. Frieman arrived at. He is saying that would be the cost to PECo of adopting this proposal. And I think that number is seriously in question because he has assumed that the properties would then be valueless.

MR. BONNEY: Your Honor, his testimony is simply that the approximate market value of those properties would be over $160 million. He is not assuming all these other items, resale, et cetera. He has simply calculated what the market value was. That is his testimony. He has responded to questions that tried to characterize other aspects of it.

JUDGE SMOLEN: Okay. Now let Mr. Sugarman speak.

MR. SUGARMAN: Your Honor, maybe I can avoid some of the effort that is being made to formulate what is the issue by clarifying what my intention was in the proposal.

MR. BONNEY: Your Honor, I object. You ordered that the Protestants and other parties indicate formally their position statement. They have done that. I don't think they should be permitted to elaborate and perhaps change it at this point. It says what it says and we have responded to that in testimony.

JUDGE SMOLEN: Well, I am going to allow Counsel to explain what his position is.

MR. SUGARMAN: To elaborate, just to clarify the question.

JUDGE SMOLEN: It's not testimony.

MR. SUGARMAN: Exactly.

Mr. Frieman, if you take the word purchase --

JUDGE SMOLEN: Well, wait. We will give you a chance to cross-examine when they are finished.

MR. SUGARMAN: Okay.

MS. DUSMAN: I think I will try to limit it to one final question.

I guess there is an outstanding objection on the question that I posed to Mr. Frieman assuming the truth of Mr. Van Dyke's testimony earlier in the proceeding. And I guess Your Honor didn't rule on it.

JUDGE SMOLEN: Everybody probably forgot the question, so why don't you try it again.

MS. DUSMAN: Okay. I will try it again.

BY MS. DUSMAN:

Q. Mr. Frieman, assuming that Mr. Van Dyke is correct that energization of this line will have no impact on value, will have no impact on future use, your figure of the value of the properties at $160 million would remain unchanged if PECo owned those properties, would it not?

A. Based on my understanding of the reason we would purchase, circumstances would change from what he purported. I agree with what he said, and what he said was that the energization of the line as it is and with the way the properties are would have no adverse effect on the value. And I agree with that. However, if

circumstances changed and we were ordered to buy this property within certain limits that were established by the Commission, that would then change the use because it would become a utility corridor and the value always changes when you change the use.

Now, I can't predict what that would be but my supposition is that if it became a utility corridor it would be treated like our other utility corridors and there would be a dramatic change in the use. So that the use would be more related to utility uses as a longitudinal corridor and, yes, there would be value for supplementary uses like pipelines, maybe a highway and so forth. But initially the value would probably drop off because of the removal of the improvements and then ultimately it would recycle and come back to what it is and maybe go higher later than if there were uses. But there is way to predict those uses, or even if the regulations would prohibit such uses. So that is an unknown factor.

So it is very difficult for me to relate what I said specifically to what he said. I do agree with what he said, but the circumstances here are entirely different.

Q. Nonetheless, if PECo purchased property worth $160 million today and retained that property for

whatever purpose, PECo would then own that amount of property and that would have some value, would it not?

A. The cost to carry property by a public utility to our customers, assuming it is utility property and it would be in the rate base, at the present time runs about 16 percent when you count all the factors, taxes, the whole gamut of those costs. So that when you consider the undeveloped land that we would be buying and the present real estate market, I think it would be catastrophic on the effect to the company on the losses just on the carrying costs.

MS. DUSMAN: No further questions, Your Honor.

JUDGE SMOLEN: Mr. Sugarman.

MR. SUGARMAN: Thank you, Your Honor.

CROSS-EXAMINATION

BY MR. SUGARMAN:

Q. Mr. Frieman, in the first part of your answer, your first part of your answer is not affected by any assumption as to condemnation one way or the other, right, through to line 16? That is just market value?

A. Yes.

Q. And the second part of your answer, lines 17 to line 22, deals with the condemnation assumption or condemnation alternative, is that correct?

A. That's correct.

Q. Now, did you make any effort to ascertain the aggregate market value by your methodology of the Protestants' properties?

A. No, I did not.

Q. Did you make any effort to ascertain the market value of properties that would need to be acquired if the test were any other test than one milligauss five percent of the time?

A. No, I did not.

Q. Now, did you make any effort to consider whether uses -- bearing in mind that the Protestants' position was that, and I quote from my letter, the impact of electromagnetic fields on children has been demonstrated, end of quote, did you make any effort to value the property for reuses that would not entail residences, that would include every allowable use other than residences for children or schools?

A. No, I did not.

MR. SUGARMAN: That is all I have. Thank you.

MR. BONNEY: We have no redirect, Your Honor.

JUDGE SMOLEN: Anything further of this witness?

(No audible response.)

JUDGE SMOLEN: The witness is excused. Thank you very much for appearing and testifying, sir.

THE WITNESS: Thank you.

(Witness excused.)

MR. BONNEY: Your Honor, that concludes the presentation of the company's case for today. We have two witnesses from out of town who are available on other days only, but as we previously mentioned at the start, I believe that the OCA wanted to call its witness, Mr. Janes.

JUDGE SMOLEN: Before we get to the OCA, what do we have scheduled for tomorrow?

MR. BONNEY: We have Dr. Cole and Dr. Gelmann for the company. Dr. Cole is tomorrow. Dr. Gelmann is available next Tuesday.

JUDGE SMOLEN: I understand. But tomorrow, then, you are scheduled for Dr. Cole?

MR. BONNEY: Yes.

JUDGE SMOLEN: And that would be your sole witness?

MR. BONNEY: Correct.

JUDGE SMOLEN: And now we want to go to OCA?

MS. McCLOSKEY: Yes, Your Honor.

JUDGE SMOLEN: Let's go ahead.

MS. McCLOSKEY: The Office of Consumer Advocate calls David Janes to the stand.

Whereupon,

DAVID E. JANES

having been duly sworn, testified as follows:

JUDGE SMOLEN: Please have a seat. Keep your voice. State your full name and address for the record.

THE WITNESS: David E. Janes, 6723 Whittier Avenue, McLean, Virginia 22101.

JUDGE SMOLEN: Counsel.

MS. McCLOSKEY: Thank you, Your Honor.

Your Honor, we may have some brief oral surrebuttal testimony as well, but the more logical progression here may be to have our cross-examination on his additional direct testimony and then only if necessary would we do the brief oral surrebuttal.

JUDGE SMOLEN: Any objection.

MR. SMITH: That's fine, Your Honor.

JUDGE SMOLEN: All right. Let's proceed in that fashion.

MS. McCLOSKEY: Your Honor, I would like to have marked for identification OCA Statement No. 1B, which is the additional direct testimony of David E. Janes on remand.

JUDGE SMOLEN: So marked for identification.

(Whereupon, the document was marked as OCA Statement No. 1B for identification.)

DIRECT EXAMINATION

BY MS. McCLOSKEY:

Q. Mr. Janes, do you have before you a copy of

your prepared prefiled additional direct testimony in this case?

A. I do.

Q. Consisting of 17 pages of questions and answers?

A. I do.

Q. And a two page listing of references?

A. Yes, I do.

Q. And was this testimony and these references prepared by you or under your direct supervision?

A. It was.

Q. And do you have any additions, corrections or modifications to make to your testimony at this time?

A. I do.

On page 14 of the testimony, at line ten, in the table, the figure that is identified as 1,200 amps as the figure heading should be a thousand. It is a typographical error.

Q. Now, subject to that correction, is the testimony true and correct to the best of your knowledge, information and belief?

A. It is.

Q. And subject to that correction, is the testimony -- if I were to ask you these questions today under oath would your answers be the same?

A. They would.

MS. McCLOSKEY: Your Honor, we would ask that OCA Statement No. 1B be admitted into evidence subject to cross-examination and timely motions by opposing Counsel.

JUDGE SMOLEN: It is received with that qualification.

(Whereupon, the document marked as OCA Statement No. 1B was received in evidence.)

JUDGE SMOLEN: Let me ask, have the reporter's copies been corrected?

MS. McCLOSKEY: No, they have not. But I can make that correction.

JUDGE SMOLEN: Why don't we do that so that the record copies are correct as well.

MS. McCLOSKEY: Certainly. We will make those corrections.

JUDGE SMOLEN: All right.

MS. McCLOSKEY: And Mr. Janes is available for cross-examination.

JUDGE SMOLEN: Mr. Sugarman, do you have any questions of the witness?

MR. SUGARMAN: I do, Your Honor

CROSS-EXAMINATION

BY MR. SUGARMAN:

Q. Mr. Janes, in your prepared testimony on page

four, line 20, you state that the most troublesome of these new results is the association between childhood leukemia and magnetic field exposure in the Swedish residential study. When you say the most troublesome, do you mean the most difficult to accept or do you mean the most troublesome from the point of view of causing concern about exposure? Or some other meaning of the term the most troublesome?

A. From my reading of the epidemiological literature to this point, the most consistent observation across these studies is an association between exposure to magnetic fields and the incidence of leukemia. Whether the association is statistically robust is another question. But that seems to be a fairly consistent observation across the studies.

Q. So what does the term the most troublesome mean here? Does it mean the most troublesome with respect to public health impacts or the most troublesome with respect to scientific validity or what? What does the term the most troublesome mean in this context?

A. Perhaps it is a poor choice of words.

Q. No, I'm not saying it is. I just don't -- because of the way it is written here I'm not sure what it means.

A. It is an observation on the basis of this

consistency which I feel needs further investigation.

Q. But what does the term most troublesome mean?

A. I think I explained that. As I said, maybe it was a poor choice of words. The observation is consistent or fairly consistent across studies. It is an observation that needs to be looked at some more detail. And that is what troublesome meant to me.

Q. I see.

You mention the Swedish study. Did you review the Danish study as well?

A. Superficially in the sense that there really is not enough there for me to get -- it is an unpublished preliminary report from my understanding. The copy I had is certainly unpublished. And I can draw no conclusions from that study.

Q. Now, you mention the EPA role -- I'm sorry -- the federal government role at page ten of your testimony.

A. Yes.

Q. And you mention the Federal Energy Policy Act, which identified the Department of Energy and the National Institute of Environmental Health Sciences. Since the time of your testimony has there been any progress on the implementation of the studies by these agencies? You mention on line 12 that the committees

have not yet been appointed. Has that condition changed since the time you prepared your testimony?

A. I don't know.

Q. Now, on page 11, line 18, you indicate that a health-based standard cannot be established at this time.

A. Yes.

Q. Because the uncertainties are just too great. And you mention some of the uncertainties that exist.

Do you have a recommendation as to what actions should occur at this time by way of public policy in view of your evaluation of the existing knowledge and existing evidence?

A. A recommendation as to...?

Q. As to what should be done with respect to new proposed powerlines.

(Pause.)

Q. I realize in your testimony you have asked and answered the question posed by Counsel, specifically, could similarity and prudence concepts be incorporated into the regulatory process. But that question is not an open-ended question. I am asking you a more open-ended question.

Do you have a recommendation as to what measures should be taken, if any, with respect to construction of new powerlines and exposure of children to them?

MR. SMITH: I object, Your Honor. The question goes to all powerlines and this case goes to this transmission line.

MR. SUGARMAN: Well, I think I am entitled to ask him a general question as to his opinion and then to see if it applies to this particular powerline. It tests his overall --

JUDGE SMOLEN: I am going to sustain. Let's limit it to this line.

I think that was your original question, what should be done with this -- what is his opinion as to what should be done with this line.

MR. SUGARMAN: Well, the question that is asked on page 14 is not limited to this line. It is the same generality of the question that I asked. His answer is both general and then specific. So I was starting the same way and asking him for a generality first.

JUDGE SMOLEN: All right. In view of the fact -- upon rereading the question, I think Mr. Sugarman is correct. Therefore, I am going to reconsider my prior ruling and permit the witness to answer the question.

MR. SUGARMAN: Thank you, Your Honor.

BY MR. SUGARMAN:

Q. Do you remember the question, Mr. Janes?

A. Why don't you repeat it.

Q. The question is bearing in mind your opinion that a health-based standard cannot be developed at this time, do you have a recommendation as to what if anything should be done to limit exposure of children to magnetic fields in connection with new powerlines?

A. In an attempt to be responsive to what I thought the Commission's concerns were, I treated two things in the testimony. One was --

Q. Mr. Janes, I'm not asking you to be responsive to the Commission's concerns as you understand them. I am asking you a more general question, similar to the one OCA asked you: do you have a recommendation as to what should be done if anything with respect to exposure of children? Maybe it is the same answer. But the question I want is unconstrained by your interpretation of what the Commission wants.

A. All right. In the testimony I treated two issues. I treated a general issue and I treated a specific issue. Now, there are a number of prudence things that are laid out in the testimony that I adopted from Dr. Rosenbaum's previous testimony which go to the issue of prudence. And those are laid out here on page 15.

Q. Sixteen. And those are your unconstrained opinions as to what should be done with respect to

exposure to new powerlines?

A. Yes. I don't know that, you know, on reflection that one might not add to this list. But at the moment this is the list, yes.

Q. Now, on page 16, lines 28 to 30, you talk about the possibility of an interim standard. Now, in considering the interim standard is your consideration -- what does your consideration assume as to the need for the facility in question during the interim period?

A. I have no information on the need for the facility.

Q. So would you agree that consistent with your testimony an interim standard should consider whether the particular new line is needed? That is to say that prudent avoidance would by your testimony entail avoiding the construction of new lines and consequent exposure if they were not needed in this interim period?

A. That is a hypothetical, I suppose.

Q. That is a hypothetical.

A. To push it as far as I could, if there were no need for the line it would not be built, I suppose. If one does a risk analyses, then one gets into a situation where one balances or attempts to balance risk and benefits, and I have not looked at the benefit side of this equation at all.

Q. Would you agree that in the interim period where uncertainty is a factor, that the benefits side should be looked at?

A. I would not want to make a judgement on selecting a level, if one was to push this this far, without having some understanding of what the benefit was.

MR. SUGARMAN: Thank you very much.

I have no further questions.

JUDGE SMOLEN: Mr. Dillon.

MR. DILLON: Just a couple of questions, Your Honor.

CROSS-EXAMINATION

BY MR. DILLON:

Q. Good morning, Mr. Janes.

A. Good morning.

Q. Excuse me for being behind you.

At pages 16 to 17 of your remand testimony you describe a methodology which could be used to set a similarity-based edge of right-of-way magnetic field standard should the Commission chose to do so. Do you recall that testimony?

A. Yes.

Q. Based on your experience in such matters would you expect that a similarity-based edge of right-of-way

magnetic field standard established for this line in the manner you described be set at a level below one milligauss?

A. What I have described here is a process for arriving at the number and there are a number of determinations that go into that, to evolving that piece. For prudence applied to a number that would determine a similarity base, I doubt that one would find themselves going as low as one milligauss, but I don't know. I am not in a policy making position.

Q. I understand that.

Would you agree with me, though, that based on what experience you do have and what knowledge you do have that a standard established for this line in the manner that you described could be set at a substantially higher level than one milligauss? Five, 10, 20 milligauss? I'm not trying to pin you down.

A. Well, I am not trying to recommend a number. That is the point that I am trying to stay away from. Because as I said earlier balancing the risks and benefits are things that go into that equation and I don't have those. So that the number that one develops is going to come out of the process and the process would have to take place and one would have to make judgements at the end and the number could fall anyplace as a policy

issue. I hope that is responsive.

MR. DILLON: No further questions.

JUDGE SMOLEN: Law Bureau.

MS. BURKET: No questions, Your Honor.

JUDGE SMOLEN: PECo.

MR. SMITH: One moment, Your Honor.

(Pause.)

CROSS-EXAMINATION

BY MR. SMITH:

Q. Mr. Janes, you have just been asked some questions about your testimony on policy and prudent avoidance by a number of parties. Just to make sure that the record is clear, your testimony as stated on pages 15 through 17 of your direct written testimony, is that still your opinion and your testimony after those questions?

A. Yes. If I understand what you are asking me, yes.

Q. Do you want to change any of that testimony?

A. No.

Q. Could you please turn to page two, lines 13 through 19, of your written testimony?

Now, at the end of that paragraph you refer to three extensive reviews of the literature that were conducted since you last testified, correct?

A. That's correct.

Q. You refer to them as supporting the conclusion that the science is unclear or that -- I will leave it there, that the science is unclear.

A. Yes.

Q. One of those documents or reports that you referred to is a report by the Oak Ridge Associated Universities?

A. That's correct.

Q. And by way of background, what is the Oak Ridge Associated Universities?

A. Oak Ridge -- I will describe this for you generically. It is a consortium of universities. I don't recall how many.

This particular document that was developed was developed for a federal government committee by the Oak Ridge Associated Universities, and for that committee the Oak Ridge Associated Universities provides the technical support for the committee. There is an office in Washington. It is staffed by some technical employees of the university and it provides information to something that is called the Committee on Inter-Agency Radiation Research and Policy Coordination that consists of two groups, a policy group which essentially is the assistant administrator level across a number of federal agencies,

I think 14. And then there is a science panel that is adjunct to that which has representatives from federal agencies at the scientific level. For example, when I was at EPA I was the EPA representative on that science panel.

Q. Now, the report that you referred to is titled Health Effects of Low Frequency Electric and Magnetic Fields?

A. That's correct.

Q. And that was prepared in June, 1992?

A. Yes.

Q. I would like to read a paragraph to you from the executive summary of this and ask you if you think this is a fair characterization or a fair summary of this document based on your review.

A. Okay.

Q. "This review indicates that there is no convincing evidence in the published literature to support the contention that exposures to extremely low frequency electric and magnetic fields generated by sources such as household appliances, video display terminals and local powerlines are demonstrable health hazards." Do you think that that is a fair characterization or a fair choice for summary of this document?

MR. SUGARMAN: I would object to that because I don't know what the words "local" in that document means.

MS. McCLOSKEY: And I would ask that Mr. Janes be allowed to look at the document.

JUDGE SMOLEN: All right. Let Mr. Janes look at it.

MR. SMITH: Yes.

MR. SUGARMAN: Your Honor, I would further object to the question on the ground that the document speaks for itself and the witness -- it would be a violation of the best evidence rule for the witness to characterize whether a single sentence is a fair summary of the entire book, which appears to be about 300 pages thick.

MR. SMITH: Your Honor, the document is --

JUDGE SMOLEN: Let Counsel have a chance to look at the document.

(Pause.)

JUDGE SMOLEN: Now, let's have the objection again.

MR. SUGARMAN: The objection, Your Honor, is that it is inappropriate and objectionable as being an opinion that the witness should not be asked to give when the document is in evidence as to whether a single sentence in there is a summary of 300 pages. The document speaks for itself.

MS. McCLOSKEY: And, Your Honor, I would have to

say that I think that the question needs to be more focused if you pull one sentence, whether it is a summary of an entire document or sections of a document or what exactly Counsel believes that one sentence is referring to, what portion of the document.

JUDGE SMOLEN: Now.

MR. SMITH: With regard to Mr. Sugarman's objection, I would like to respond that the document itself is not in evidence and in fact it is exactly Mr. Janes' opinion about what this document means that we are seeking here and that we should be seeking here.

Ms. McCloskey's objection, she asks that the question be more focused. That is not an objection. She can redirect on that. If the witness does not understand the question, he can so answer. But it's not an objection to the question.

MR. SUGARMAN: I would further reiterate my earlier objection that the document with the sentence out of context does not define the word local, which is a critical element as related to this particular proceeding. And therefore I object to it on the ground it is a vague question.

MS. McCLOSKEY: And I think my objection is an objection. It is that the question is overbroad and vague and unable to be answered as stated.

MR. SMITH: Mr. Sugarman can't object to --

JUDGE SMOLEN: I am going to overrule Mr. Sugarman. However, I am going to sustain the OCA.

Now, if you want to clarify it and make it more specific, I will permit you to do so.

MR. SMITH: Yes, Your Honor.

JUDGE SMOLEN: Go ahead.

BY MR. SMITH:

Q. Mr. Janes, when you reviewed the document a few moments ago did you note that this -- that the sentence that I read to you appears in the executive summary?

A. Yes.

Q. Did you note that it is the first paragraph under the heading Conclusions and Recommendations?

A. Not particularly, but that's --

Q. Would you take that subject to check?

A. I would take that subject to check, yes.

Q. Do you agree with this statement based on your review of this report, that this review indicates that there is no convincing evidence in the published literature to support the contention that exposures to extremely low frequency electric and magnetic fields generated by sources such as household appliances, video display terminals and local powerlines are demonstrable health harzards?

A. I think that statement is consistent with the position that -- I mean, it is stated a different way but I said in my first testimony that there were cellular effects, they were observable, they were difficult to interpret in terms of effects seen in animal systems but effects were seen in animal systems, that it was difficult to find lacking a mechanism a way to extrapolate these observed and I think now uncontested, and certainly as far as this document is concerned uncontested, effects.

The situation with respect to effects from the exposure to these fields is unclear. That is what I said. I think that is perfectly consistent with the statement that there has not been a demonstrable health hazard.

Q. I understand.

A. I think it is a consistent statement.

Q. Mr. Janes, in your testimony you describe a process or method by way the Commission, you say, could set edge of right-of-way magnetic field standards for the Woodbourne-Heaton line, is that correct?

A. That's correct.

Q. Do you recommend that edge of right-of-way magnetic field standards should be developed for the Woodbourne-Heaton 230 kV line?

A. I received that question in an interrogatory and I think it is probably best that I just read into the record the statement that I made at that time.

And it says, "No, I am not recommending that the Commission set a standard for magnetic fields at the edge of the Woodbourne-Heaton right-of-way. As stated in my direct testimony, it is premature to set a health-based standard because of scientific uncertainty about whether exposure to power frequency magnetic fields is harmful."

"However, in an attempt to be responsive to the Commission's concerns I did two things. First, I reiterated a number of prudence measures I feel should be considered in all siting proceedings, including new applications. Second, I identified a process that the Commission might use to chose a numerical limit if for reasons other than health protection the Commission finds it necessary to set a standard for the Woodbourne-Heaton line. The process would incorporate prudence in the selection of numerical limits to the extent it gives weight to newer lines that include field reductions as a design parameter."

That is my statement with respect to that issue.

MR. SMITH: No further cross-examination.

JUDGE SMOLEN: Go ahead. Now you are going to redirect and then go into -- we will give everybody a

chance. Finish up on this testimony and then you go into your rebuttal or surrebuttal.

MS. McCLOSKEY: Sure. Could I just have a minute, though, with Mr. Janes?

JUDGE SMOLEN: Oh, yes. Let's take a five minute break, then.

(Recess.)

JUDGE SMOLEN: Back on the record.

MS. McCLOSKEY: Thank you, Your Honor.

We have no redirect.

JUDGE SMOLEN: All right.

MS. McCLOSKEY: And we would have no need to do oral surrebuttal either at this time.

JUDGE SMOLEN: Then is there anything further of this witness?

(No audible response.)

JUDGE SMOLEN: Hearing no response, the witness is excused. Thank you very much for appearing and testifying today.

THE WITNESS: Thank you.

(Witness excused.)

JUDGE SMOLEN: I would assume that would conclude today's hearing, is that correct?

MR. BONNEY: Yes, Your Honor.

JUDGE SMOLEN: There are no further witnesses to be

presented today?

MR. BONNEY: Yes, Your Honor.

JUDGE SMOLEN: So tomorrow we have scheduled only one witness?

MR. SMITH: Yes, Your Honor. Dr. Cole.

JUDGE SMOLEN: Dr. Philip Cole, is that correct?

MR. SMITH: Yes, Your Honor.

JUDGE SMOLEN: All right. Then we will resume again tomorrow at 10:00 a.m. for that testimony and cross-examination.

So we stand adjourned until 10 o'clock tomorrow.

Thank you very much.

(Whereupon, at 12:30 p.m., the hearing was adjourned, to be reconvened at 10:00 a.m. on Friday, May 28, 1993, in Philadelphia, Pennsylvania.)

C E R T I F I C A T E

I hereby certify, as the stenographic reporter, that the foregoing proceedings were taken stenographically by me and thereafter reduced to typewriting by me or under my direction; and that this transcript is a true and accurate record to the best of my ability.

COMMOMWEALTH REPORTING COMPANY, INC.

By: Robert J. Stonaker

Robert J. Stonaker

PECO Direct on Remand No. 3

A-110550F053
5/27/93 Phila., PA
R/S

BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

DIRECT TESTIMONY ON REMAND

OF

RICHARD STEVEN BOCKMAN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

May 12, 1993

DIRECT TESTIMONY OF RICHARD S. BOCKMAN

I. **Introduction and Background**

Q. Please state your name and business address.

A. Richard S. Bockman, 520 East 72nd Street, Apartment Lobby S, New York, New York, 10021.

Q. What is your occupation?

A. I am a medical doctor, a researcher, and a teacher in the fields of Endocrinology and Immunology.

Q. Have you previously testified in this proceeding?

A. Yes. I submitted written testimony (PECO Rebuttal Statement No. 1) in November 1991. My previous testimony addressed the Endocrine system, the Immune system, and the electric and/or magnetic field ("EMF") research related to those subjects.

II. **Scope of Testimony**

Q. Dr. Bockman, what were you asked to do for the remanded hearings in this proceeding?

A. I was asked to review the EMF research which has come to my attention since my previous testimony in my areas of expertise of Endocrinology and Immunology.

III. **Recent EMF Research on the Endocrine System**

Q. Dr. Bockman, what new EMF research on the Endocrine system will you discuss?

A. I will discuss new EMF research related to: (1) the neuroendocrine system, (2) biological rhythms, and (3) reproduction and development.

A. Recent EMF Research on the Neuroendocrine System

Q. Please describe the recent EMF research on the neuroendocrine system.

A. In the area of neuorendocrine research, there is new research on perception of magnetic fields and on calcium metabolism.

Research on Perception

Q. Please describe the recent research on perception of magnetic fields.

A. A recent study exposed rats to 30,300 mG magnetic fields and observed no change in their avoidance behavior (Lovely et al., 1992). With respect to magnetic fields, there remains no evidence to date to indicate that humans can perceive power frequency magnetic fields at levels associated with transmission lines or even at levels that far exceed levels associated with transmission lines.

Research on Calcium Metabolism

Q. Please describe the recent EMF research on calcium metabolism.

A. Two studies attempted to replicate prior calcium research under the ion cyclotron resonance hypothesis, one using diatoms (Parkinson & Sulik 1992), the other using human lymphocytes (Prasad et al. 1991). In both cases, the researchers were unable to replicate the results of prior research.

In addition, Bruckner-Lea et al. (1992) exposed solutions to power frequency magnetic fields and found no alteration in the way a synthetic and naturally occuring calcium-binding substance interacts with calcium in the presence of a magnetic field.

These developments are consistent with my previous conclusion regarding EMF and calcium metabolism that 60 Hz electric and/or magnetic fields do not modulate cell function or Endocrine system function by altering calcium metabolism.

B. Recent EMF Research on Biological Rhythms

Q. Please describe the recent research on biological rhythms.

A. One of the biological rhythms that has been studied with regard to EMF is the circadian rhythm of the hormone

melatonin. In a recent study, Soriano et al. (1992) exposed rats to 52,000 milligauss magnetic fields and then measured a neuro-anatomical correlate of melatonin rhythms (presence of "pineal synaptic ribbons"). They observed a decrease in the number of synaptic ribbons after 15 and 21 days of exposure.

This research involved magnetic field levels many times higher than could be associated with a transmission line (i.e., 52,000 milligauss) and it thus has little weight in determining the effects of transmission line fields on melatonin rhythms. For the reasons stated in my previous testimony (PECO Rebuttal Statement No.1, p. 18) (e.g., there are no known biologic consequences of the reported change in melatonin levels, the changes in melatonin are not associated with changes in other biological rhythms and, in any event, have not been shown to occur in humans), I continue to conclude that the rat melatonin studies do not provide a basis for concluding that power frequency fields lead to adverse effects on human biologic rhythms.

C. Recent EMF Research on Reproduction and Development

Q. Please describe the recent research on reproduction and development.

A. Additional research has been conducted using chick embryos to determine whether exposure to 60 Hz fields affects fetal malformations (Martin 1992) or temporal aspects of development (Koch & Koch 1991). As with previous research on chick embryos using power frequency sinusoidal fields, there were no significant differences between the exposed and control groups.

While I am not an expert in epidemiology, I note that Dlugosz et al. (1992) conducted an epidemiological study of reproductive effects and found no association between use of electric bed heating and congenital defects.

As described in my previous testimony, the endpoints addressed in these studies already had been extensively tested in previous EMF research, with negative results. These additional negative studies are consistent with those prior results.

IV. Recent EMF Research on the Immune System

Q. Please describe the recent research on EMF and the immune system.

A. In my previous testimony, I discussed an experiment by Conti et al. (1983) looking at the effect of exposing isolated human lymphocytes to magnetic fields and plant lectins (PECO Rebuttal Statement No. 1, p. 23). Research with human lymphocytes has continued, using magnetic fields alone (Prasad et al. 1991, Persson et al. 1991) and magnetic fields and plant lectins (Yost & Liburdy 1992). Some reports have been positive, others have been negative. There is no clear biologic relevance of these studies using unusual plant lectins on naked cells.

Research using whole animals continues to provide much more accurate reflection of the functional integrity of the immune system. McLean et al. (1991) examined tumor promotion and immune response in intact animals and showed that a 20,000 milligauss 60 Hz magnetic field had no effect on host immune response when natural killer cell activity was followed.

V. Recent Reviews of the EMF Research and Conclusions Regarding the EMF Research

Q. Dr. Bockman, are you familiar with any recent reviews of the EMF research?

A. Yes, a number of such reviews were made available in the last year. For example, a scientific panel known as the Electro-Magnetic Health Effects Committee was asked by the Texas Public Utility Commission to provide a review of the EMF

research. With regard to Endocrine and Immune functions, its review, released in 1992, concludes that:

> "Research evidence presented to date appears to reject the hypothesis that acute or prolonged exposure to EMF equivalent or several times stronger than fields experienced under high-voltage AC transmission lines results in biologic disruption of endocrine or immunologic systems."

Q. Do you agree with this conclusion?

A. Yes, I do.

VI. Right-of-Way Width Standards

Q. Dr. Bockman, based on your review of the research in your areas of expertise, do you have an opinion as to whether magnetic field right-of-way width standards can be scientifically justified?

A. Since it is my opinion that power frequency electric and/or magnetic fields several times stronger than those experienced under transmission lines do not disrupt the Endocrine or Immune systems, I see no reason from the Endocrine or Immune science for setting such standards.

Q. Does this conclude your testimony?

A. Yes.

Dr. Richard Bockman

References

Bruckner-Lea, C., C.H. Durney, J. Janata, C. Rappaport & M. Kaminski, "Calcium binding to metallochromic dyes and calmodulin in the presence of combined, AC-DC magnetic fields," 13 Bioelectromagnetics 147-162 (1992)

Dlugosz, L., et al., "Congenital defects and electric bed heating in New York State: a register-based case-control study," 135 Am. J. Epi. 1000-1011 (1992)

Electro-magnetic Health Effects Committee, "Health effects of exposure to powerline-frequency electric and magnetic fields" Report prepared for the PUC of Texas, Austin (1992)

Koch, W.E. & B.A. Koch, "Exposure of chicken embryos to selected magnetic fields," 10 J Bioelectricity 65-80 (1991)

Lovely, R.H., J.A. Creim, W.T. Kaune, M.C. Miller, R.D. Phillips & L.E. Anderson, "Rats are not aversive when exposed to 60-Hz magnetic fields at 3.03 mT," 13 Bioelectromagnetics 351-62 (1992)

Martin, A.H., "Development of chicken embryos following exposure to 60-Hz magnetic fields with differing waveforms," 13 Bioelectromagnetics 223-230 (1992)

McLean, J.R.N., M.A. Stuchley, R.E.J. Mitchel, D. Wilkinson, H. Yang, M. Goddard, D.W. Lecuyer, M. Schunk, E. Callary & D. Morrison, "Cancer promotion in a mouse-skin model by a 60-Hz magnetic field: II. Tumor development and immune response," 12 Bioelectromagnetics 273-287 (1991)

Parkinson, W.C. & G.L. Sulik, "Diatom response to extremely low frequency magnetic fields," 130 Rad. Res. 319-30 (1992)

Persson, B.R.R., et al., "Interaction of low-level combined static and extremely-low-frequency magnetic fields with calcium ion transport in normal and transformed human lymphocytes and rat thymic cells," Chapter 11, pp. 199-209 in Interaction Mechanisms of Low-level Electromagnetic Fields in Living Systems, B. Norden and C. Ramel, eds. (1992)

Prasad, A.V., M.W. Miller, E.L. Carstensen, Ch. Cox, M. Azadniv & A.A. Brayman, "Failure to reproduce increased calcium uptake in human lymphocytes at purported cyclotron resonance exposure conditions," 30 Radiat. Environ. Biophys. 305-320 (1991)

Soriano, F.M., M.G. Gonzalez, E. Armanazas, A.R. Torner, "Pineal 'Synaptic Ribbons' and Serum Melatónin Levels in the Rat Following the Pulse Action of 52-Gs (50-Hz) Magnetic Fields: An Evolutive Analysis Over 21 Days," 143 Acta Anat 289-293 (1992)

Yost, M.G. & R.P. Liburdy, "Time-varying and static magnetic fields act in combination to alter calcium signal transduction in the lymphocyte," 296 FEBS Letters 117-22 (1992)

COPY

PECO Direct on Remand No. 2

A-110550 F055

5/27/93

Phila., PA

R/S

BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

/

DIRECT TESTIMONY ON REMAND

OF

CHARLES J. BOEGGEMAN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

MAGNETIC FIELDS ASSOCIATED WITH
THE WOODBOURNE-HEATON RIGHT-OF-WAY

May 12, 1993

DIRECT TESTIMONY OF CHARLES J. BOEGGEMAN

I. Introduction and Background

Q. Please state your name and business address.

A. Charles J. Boeggeman, 2301 Market Street, Philadelphia, Pennsylvania 19101.

Q. Have you previously testified in this proceeding?

A. Yes. I submitted written testimony (PECO Direct Statement No. 2) in August 1991. My previous testimony addressed the electric and magnetic fields expected to be produced by the Woodbourne-Heaton transmission line.

Q. Since your previous testimony, have you made any presentations regarding EMF?

A. Yes. In June 1992, as Chair of PECO's EMF Task Force, I testified before the Department of Energy regarding its Draft National EMF Research and Communications Strategy.

II. Scope of Testimony

Q. What is the purpose of your testimony in these remanded hearings?

A. First, I will briefly review some of the basic characteristics of magnetic fields.

Second, I will discuss existing standards for magnetic field levels at the edge of transmission line rights-of-way and compare the magnetic fields from the Woodbourne-Heaton line to those standards.

Third, I will discuss the concept of "prudent avoidance" as it applies to the right-of-way for this transmission line.

III. Review of Magnetic Fields

Q. Could you please provide a brief review of magnetic fields?

A. Magnetic fields are created by the flow of electric current

through a conductor. The unit of measure of the magnetic field is expressed in milligauss ("mG"). A number of factors contribute to the strength of the magnetic field associated with a transmission line at any point in time and space, including the amount of current flowing through the conductors ("amperage"), the configuration (or design) of the transmission line, and distance from the line.

IV. Existing Magnetic Field Standards

Q. Mr. Boeggeman, in the previous hearings in this proceeding, evidence was heard on the similarity-based magnetic field standards in New York and Florida. Have any additional standards been enacted for magnetic field levels at the edge of transmission line rights-of-way?

A. I am not aware of any standards other than the Florida standard (for 230 kV transmission lines, 150 mG at the edge of right-of-way) and the New York interim standard (200 mG at the edge of right-of-way). Since the record in this proceeding closed, several states have considered whether to enact magnetic field regulations. To my knowledge, none of these states has adopted standards that require a specific right-of-way width or magnetic field level at the edge of right-of-way.

Q. Please compare the magnetic fields from the Woodbourne-Heaton line to the existing magnetic field standards.

A. While the Administrative Law Judge and the Commission have already found that this line meets the Florida and New York standards, it is worth noting that the magnetic fields at the edge of the PECO right-of-way for the Woodbourne-Heaton line not only meet but are <u>well below</u> the magnetic field levels of those standards. For the Woodbourne-Heaton line, the magnetic fields expected under normal operating conditions (i.e., the conditions that will exist over 90% of the time) will not exceed 26 mG at the edge of the right-of-way.

Moreover, as discussed in Mr. Oedeman's testimony (PECO Direct on Remand No. 1) the existing Conrail-owned utility corridor extends beyond the PECO right-of-way for most of the length of the line. At the edge of the wider utility corridor in which the PECO right-of-way is located, the expected magnetic fields at normal operating conditions will be in the range of approximately 19 mG to well under 0.5 mG.

V. The Concept of Prudent Avoidance

Q. Mr. Boeggeman, could you provide a summary review of the concept of prudent avoidance?

A. The concept of prudent avoidance is one approach that can be used when considering whether to take steps to limit EMF exposure. Prudent avoidance means limiting exposures when this can be done with small, or modest, investments of money or effort. Prudent avoidance should be evaluated according to the facts of each particular situation -- a particular effort or measure could constitute prudent avoidance in one situation, but not in a second situation.

Q. In your opinion, is the right-of-way for the Woodbourne-Heaton line consistent with the concept of prudent avoidance?

A. Yes. As I explained earlier in this testimony, several factors affect magnetic field strength at any point in time and space, including amperage, line design, and distance from the line. Right-of-way width can, of course, be viewed as one way of characterizing distance from the line.

When the design, amperage load, and right-of-way width for the Woodbourne-Heaton line are evaluated as a whole, it is clear that the combination of these factors, including the projected load on the line and the use of the compact delta design for this line, has resulted in magnetic fields that are far below existing standards.

In addition, the location of the Woodbourne-Heaton right-of-way within the wider, existing Conrail-owned utility corridor means that, for that vast majority (over 95%) of the line, the fields at the edge of the utility corridor are even lower, and in many cases substantially lower, than at the edge of the PECO right-of-way.

This result of low fields at the edge of the right-of-way was achieved at modest or no cost, as the concept of prudent avoidance suggests. I therefore conclude that the existing right-of-way is consistent with the concept of prudent avoidance.

Q. Does this conclude your testimony?

A. Yes.

BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

REBUTTAL TESTIMONY ON REMAND

OF

CHARLES J. BOEGGEMAN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

REBUTTAL TESTIMONY TO
DIRECT TESTIMONY OF OCA WITNESS MR. DAVID JANES
AND TO
PROTESTANTS' POSITION STATEMENT

May 20, 1993

REBUTTAL TESTIMONY OF CHARLES J. BOEGGEMAN

I. Introduction and Background

Q. Please state your name and business address.

A. Charles J. Boeggeman, 2301 Market Street, Philadelphia, Pennsylvania 19101.

Q. Have you previously submitted testimony in the remanded portion of this proceeding?

A. Yes. I submitted written testimony (PECO Direct on Remand No. 2) on May 12, 1993.

II. Scope of Testimony

Q. What is the purpose of this rebuttal testimony?

A. First, I will comment on Mr. Janes' testimony about a possible method for setting edge of right-of-way magnetic field standards. Second, I will comment briefly on whether the measures proposed in Protestants' position statement (purchase of property and undergrounding) are consistent with the concept of prudent avoidance.

III. Comments on Mr. Janes' Testimony

Q. In his testimony, Mr. Janes discussed several ways that prudent avoidance might be incorporated into a "similarity-based" standard. (OCA Statement No. 1B, pp. 15-17). Do you have any comments on Mr. Janes' discussion of this idea?

A. Yes. Mr. Janes describes a number of possible prudence measures, such as continued "research into the effects of electric and magnetic fields" and "informing the public." PECO generally supports these measures and, indeed, practices many of them. In my view, however, while these measures may be worth consideration as ways to implement prudent avoidance for future lines, they are unrelated to whether the Commission should set right-of-way width standards for <u>this</u> line, and also appear to be unrelated to any <u>process</u> for setting right-of-way width standards for <u>this</u> line.

Specifically, the following suggestions by Mr. Janes do not appear to be related to setting right-of-way width standards for this line: (1) requiring utilities in future applications to address field levels by the chosen and alternative designs, as well as actions actively taken to reduce fields (OCA Statement No. 1B, p. 15, lines 8-12); (2) continued research (id., p. 15, lines 17-18); (3) informing the public about the latest information (id., p. 15, lines 20-24); (4) increasing public involvement early in the transmission line siting process (id., p. 15, lines 26-30); (5) consideration of costs and effects before construction (id., p. 15, lines 32-35); and (6) a series of measures that Mr. Janes describes as measures that should be considered "before construction." (Id., p. 16, lines 1-14).

Q. Mr. Janes also suggests that the Commission, if it should undertake to develop right-of-way width standards for this line, may wish to consider using a process in which the "similarity" basis for the standard is set using "only newer transmission line designs that minimize electric and magnetic fields." (OCA Statement 1B, p. 15, lines 5-8). Do you have any comments on this idea?

A. Yes. First, I would like to note that this appears to be the only factor mentioned by Mr. Janes that is actually related to the question of setting right-of-way width standards.

Second, while Mr. Janes' idea is an interesting concept, in my view there would be many problems in attempting to use the process he describes to develop a similarity-based standard. To give but a few examples: How do you determine whether a line has sufficiently incorporated field mitigation techniques to be counted as a "newer transmission line design" for purposes of setting this standard? How do you take into consideration the different constraints that exist on transmission lines being built in urban, suburban, and rural

areas? If, as Mr. Janes suggest, lines from other states should be used, how do we decide which states and which lines should form the basis for "similarity" in Pennsylvania? Should the "similarity" level for this "common corridor" transmission line be based only on other "common corridor" transmission lines? If a line which is heavily loaded but uses a field mitigation design has higher field levels than a line which is lightly loaded but does not use a field mitigation design, which should be used to establish the "similarity" level?

Third, this transmission line uses a "newer transmission line design that minimizes electric and magnetic fields" -- the compact delta. That is one of the reasons that it meets all existing magnetic field standards.

IV. Comment on Protestants' Position Statement

Q. In their position statement, Protestants suggest that PECO should "purchase . . . all properties any portion of which would be within levels above one milligauss more than 5% of the time." At what distance from the transmission line will the specified milligauss levels exist?

A. The specified magnetic field levels would exist out to approximately 230-250 feet on either side of the transmission line. (The background information on magnetic field levels at specified distances from the transmission line, as well as the amount of time specified magnetic fields are expected to exist, is contained in my August 1991 direct testimony and the exhibits attached to that testimony. PECO Direct No. 2 and PECO Exhibit No. 2.)

Q. In your opinion, would purchase of these properties be consistent with the concept of prudent avoidance?

A. No, for two reasons. First, the researchers at Carnegie Mellon University who formulated the concept of prudent

avoidance have stated that moving to get away from a transmission line goes beyond prudence:

> "If you are buying a new home it might be prudent to consider the location of distribution and transmission lines as one of many things you consider. However, remember that even if fields are ultimately demonstrated to pose a health risk, things like traffic patterns in the streets and radon levels in the house are likely to be more important for your own or your children's safety than anything related to fields. If you are already in a home, moving in order to get away from existing lines goes beyond what we would consider prudent."

(Carnegie Mellon Brochure, 1989, p. 27) (emphasis added). Protestants' proposal is simply a way for them to move in order to get away from a line. That goes beyond prudence.

Second, the concept of prudent avoidance suggests considering actions that can be done with "small or modest" investments of effort and money. As discussed in Mr. Frieman's testimony (PECO Rebuttal on Remand No. 3), the cost of Protestants' proposal to purchase properties would over $160 million. That is not a "small or modest" investment and I thus conclude that the proposal is not consistent with the concept of prudent avoidance.

Q. Protestants also suggest replacing the overhead 230 kV Woodbourne-Heaton line with an underground line. In your opinion, is that proposal consistent with the concept of prudent avoidance?

A. No. As discussed in Mr. Oedemann's testimony (PECO Rebuttal on Remand No. 2), the additional cost of building the suggested underground line would be approximately $38.5 million at a minimum. Again, that is not a "small or modest" investment.

Q. Does this conclude your testimony?

A. Yes.

PECO Direct on Remand No. 1

A-110550F0055 PWD, PD

5/27/93 RJS

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BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

DIRECT TESTIMONY ON REMAND

OF

RONALD J. OEDEMANN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

FACTUAL BACKGROUND ON THE RIGHT-OF-WAY FOR THE WOODBOURNE-HEATON 230 KV TRANSMISSION LINE

May 12, 1993

Direct Testimony of Ronald J. Oedemann

I. Introduction and Background

Q. Please state your name and business address.

A. Ronald J. Oedemann, 2301 Market Street, Philadelphia, Pennsylvania 19101.

Q. Have you previously testified in this proceeding?

A. Yes. I submitted written testimony (PECO Direct Statement No. 1) in August 1991. I am the Lead Project Engineer for the Woodbourne-Heaton 230 kV transmission line. My previous testimony addressed the design, construction, and maintenance of the line, the safety considerations incorporated in the line, and alternative line designs.

II. Scope of Testimony

Q. What is the purpose of your testimony in these hearings on remand?

A. I will provide factual background on certain aspects of the Woodbourne-Heaton line, including: (1) a brief review of the design and physical characteristics of the Woodbourne-Heaton transmission line, and (2) a description of the right-of-way for the Woodbourne-Heaton line and the utility corridor in which that right-of-way is located.

III. Factual Background on the Woodbourne-Heaton Line

Q. Could you briefly review the design and physical characteristics of the Woodbourne-Heaton transmission line?

A. A detailed description of the Woodbourne-Heaton line is contained in my previous testimony (PECO Direct Statement No. 1, p. 3, line 13 to p. 11, line 2) and in PECO's Letter of Notification (PECO Exhibit No. 1). To review some of the important aspects of that description:

The Woodbourne-Heaton line is a fully constructed 230 kV

transmission line which electrically connects the Woodbourne Substation to the Heaton Substation. The line is 12.8 miles in length.

The Woodbourne-Heaton line was constructed using 238 existing transmission line structures ("poles") from an existing, de-energized, Conrail transmission line. (As described in my previous testimony, some of these poles were replaced during construction.)

The design of the Woodbourne-Heaton line is a "compact delta" configuration. The "ruling span" (the nominal distance between poles) is 300 feet.

Q. Please describe the right-of-way for the Woodbourne-Heaton transmission line.

A. The right-of-way for the Woodbourne-Heaton line is an easement acquired by PECO from Conrail. The easement gives PECO rights to aerial space required for the line, as well as to surface and subsurface space for the foundations for the transmission line structures. We determined the amount of aerial space necessary for this line by reference to the National Electrical Safety Code ("NESC). For this line, the NESC requires a right-of-way width of approximately 60 feet (approximately 30 feet on either side of the transmission line). This 60-foot right-of-way is contained within a wider, existing utility corridor owned by Conrail.

Q. Please describe the Conrail-owned utility corridor within which the Woodbourne-Heaton right-of-way is located?

A. The existing utility corridor has several existing or recent public utility uses, including: (1) an active freight rail system operated by Conrail (this freight rail system consisted of two railroad tracks until 1991, when Conrail removed one track and routed all railroad freight traffic to a single

track); (2) until 1986, an electric 132 kV transmission line operated by Amtrak as part of its bulk power system; (3) a power feed and signal communications system operated by Conrail, and (4) the Woodbourne-Heaton 230 kV transmission line.

The existing utility corridor between the Woodbourne and Heaton substations, as measured at the transmission structures, is approximately 100 feet wide at its narrowest points and approximately 995 feet wide at its widest points. The average width of the corridor is approximately 310 feet.

Q. Please describe the location of the Woodbourne-Heaton right-of-way within the wider, existing utility corridor?

A. As I stated, the transmission line has 238 poles. At 12 of these poles, one side of the Woodbourne-Heaton right-of-way is coterminous with the edge of the utility corridor. At the points along the utility corridor where the edge of the Woodbourne-Heaton right-of-way is the same as the edge of the Conrail-owned utility corridor, the adjoining land uses consist of commercial property, an electrical contractor, and land with abandoned vehicles and construction equipment.

For the remaining 226 poles the Conrail-owned utility corridor extends beyond the edge of the Woodbourne-Heaton right-of-way on both sides of the transmission line. For these 226 poles, the distance from the Woodbourne-Heaton transmission line to the edge of the Conrail-owned utility corridor ranges from approximately 40 feet to approximately 740 feet.

Q. Does this conclude your testimony?

A. Yes.

PECO Rebuttal on Remand No. 1

A-110550F055 Phila, PA

5/27/93 RPS

BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

REBUTTAL TESTIMONY ON REMAND

OF

RONALD J. OEDEMANN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

REBUTTAL TESTIMONY TO
PROTESTANTS' POSITION STATEMENT

May 20, 1993

Rebuttal Testimony of Ronald J. Oedemann

I. Introduction and Background

Q. Please state your name and business address.

A. Ronald J. Oedemann, 2301 Market Street, Philadelphia, Pennsylvania 19101.

Q. Have you previously submitted testimony in this remanded proceeding?

A. Yes. I submitted written testimony (PECO Direct on Remand No. 1) on May 12, 1993. I am the Lead Project Engineer for the Woodbourne-Heaton 230 kV transmission line.

II. Scope of Testimony

Q. What is the purpose of your rebuttal testimony?

A. I will briefly address the suggestion in Protestants' position statement of May 14, 1993, that the overhead Woodbourne-Heaton 230 kV transmission line be replaced with an underground line.

III. Information on Undergrounding

Q. Have you made an estimate of the cost of placing an underground cable on the Conrail utility corridor to electrically connect the Woodbourne and Heaton Substations?

A. Yes. Taking into consideration costs for materials (e.g., pipe, cable, pumping stations, thermal fill), basic engineering, installation of the cable, and general overheads, I estimate that placing an underground cable on the Conrail utility corridor to electrically connect the Woodbourne and Heaton Substations would cost a minimum of approximately $38.5 million.

Q. Do you have an estimate of how long it would take to construct such an underground line?

A. I estimate that it would take approximately 2 years after commencement of engineering.

Q. Does this conclude your testimony?

A. Yes.

COPY

PECO Rebuttal on Remand No. 3

5/27/93 RLS

Phila, PA

A-110550F055

BEFORE THE

PENNSYLVANIA PUBLIC UTILITY COMMISSION

REBUTTAL TESTIMONY ON REMAND

OF

DONALD S. FRIEMAN

ON BEHALF OF

PHILADELPHIA ELECTRIC COMPANY

REBUTTAL TESTIMONY TO
PROTESTANTS' POSITION STATEMENT

May 20, 1993

Rebuttal Testimony of Donald S. Frieman

I. Introduction and Background

Q. Please state your name and business address.

A. Donald S. Frieman, 2301 Market Street, Philadelphia, Pennsylvania 19101.

Q. By whom are you employed and in what capacity?

A. I am the Manager of the Real Estate Department of Philadelphia Electric Company.

Q. Please describe your professional experience?

A. I have been employed by Philadelphia Electric Company for over 40 years in the Real Estate Department. My duties as Manager of the Real Estate Department include employee administration, corporate administration of all real estate needs within the corporation, and the preparation of budgets, project estimates, route and property studies, planning activity reports and work flow regulation. In addition, I direct the preparation of legal documents involving all real estate matters, and I direct evaluation of real property values and negotiations with private and public owners for acquisition, sale, lease, etc. of real property.

Q. Have you previously submitted testimony in this proceeding?

A. No.

II. Scope of Testimony

Q. What is the purpose of your rebuttal testimony?

A. I will briefly address the suggestion in Protestants' position statement of May 14, 1993, that the Company should purchase all properties any portion of which would be within levels of one milligauss more than 5% of the time.

III. Information on Protestants' Purchase Proposal

Q. Have you estimated of the market value of the properties that would have to be acquired under Protestants' proposal?

A. Yes. According to Mr. Boeggeman's testimony, the specified field levels will exist out to approximately 250 feet on either side of the transmission line. Using ~~aerial photographs~~ maps of the length of the line, I identified all parcels that would be affected by Protestants' proposal (i.e., parcels that have a portion of the property within 250 feet on either side of the transmission line.) From county records I then determined the assessed value for the properties, as well as the accepted ratio in each county of assessed value to market value (this ratio is known as the "common level ratio"). Based on that method, I determined that the approximate market value of the properties affected by Protestants' proposal would be over $160 million.

For the portion of this property which is residential, PECO would not be able to exercise eminent domain. Consequently, one refusal to sell -- by any residential landowner -- would prevent the use of this line. To comply with this condition would require legislation to permit taking of homes by utilities through the exercise of eminent domain.

Q. Does this conclude your testimony?

A. Yes.

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the following parties and in the manner indicated below in accordance with the requirements of 52 Pa. Code § 1.54:

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Dated: May 20, 1993

W:\WLS\WH\PLD\COS

OCA STATEMENT NO. 1B

5/27/93 Phila., PA

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

PENNSYLVANIA PUBLIC UTILITY COMMISSION	:	
v.	:	A-110550F055
PENNSYLVANIA ELECTRIC COMPANY	:	

ADDITIONAL DIRECT TESTIMONY OF
DAVID E. JANES
ON BEHALF OF THE
OFFICE OF CONSUMER ADVOCATE

MAY 1993

ADDITIONAL DIRECT TESTIMONY OF DAVID E. JANES

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. David E. Janes, Risk Analysis Corporation, Suite 202, 6723 Whittier Avenue, McLean, Virginia 22101.

Q. BY WHOM ARE YOU EMPLOYED?

A. I am Vice President of Risk Analysis Corporation.

Q. FOR WHOM ARE YOU APPEARING?

A. I am testifying at the request of the Office of Consumer Advocate of the Commonwealth of Pennsylvania.

Q. WHAT ARE YOUR QUALIFICATIONS TO TESTIFY AS AN EXPERT?

A. I have over thirty years of experience in analyzing the effects and risks of exposure to ionizing radiation and electromagnetic fields. My personal resume was included with my previous testimony[1].

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to discuss the policies various states have used to deal with the possibility that exposure to power frequency electric and magnetic fields may adversely affect human health and to recommend a process the Pennsylvania Public Utility Commission could use to set edge-of-the-right-of-way standards for power frequency electric and magnetic fields.

Q. DOES EXPOSURE TO THE ELECTRIC AND MAGNETIC FIELDS PRODUCED BY TRANSMISSION AND DISTRIBUTION LINES AFFECT HEALTH?

A. In my previous testimony[1], I noted that weak electric and magnetic fields can affect cellular and animal systems. I also noted that the weak field effects observed in animals are subtle and often transient or reversible; therefore the connection between these effects and any harm to human health is unclear. This conclusion is still valid. Since I testified in 1991, there have been three extensive reviews of the literature that support this conclusion[2, 3, 4].

Q. HAVE YOU READ DAVID ROSENBAUM'S TESTIMONY ON PRUDENT POLICY IN THE FACE OF UNCERTAIN RISK?

A. Yes. In particular I noted his summary of the current state of knowledge of the effects of power frequency fields on people, namely[5]:

> The present epidemiological evidence is suggestive, but far from conclusive. Several studies by well qualified epidemiologists have reported associations between what may be surrogates for long-term average field strength and various types of cancer. Sometimes there is no apparent correlation when actual measured (short term) field strength is used instead of the surrogate. Other studies have reported either no significant correlation or no relationship between fields or field surrogates and cancer. Authors of one study have observed negative correlations between exposure to high magnetic fields and cancer. Another study reports increased cancer, but lower total death rates (due to less cardiovascular disease for those exposed to high fields). One study reports higher cancer incidence for people farther from a power line than for people closer to a power line. Excesses of different cancer show up in different studies (references to original literature in Rosenbaum[5]).

Q. WHAT DO YOU CONCLUDE FROM THIS SUMMARY?

A. I agree with Dr. Rosenbaum that the epidemiological studies are confusing and that "It is not even clear that even if exposure to power lines does increase the risk of cancer, it is the average magnetic field that is the cause[5]?"

Q. HAVE ADDITIONAL EPIDEMIOLOGICAL STUDIES OF MAGNETIC FIELDS BEEN REPORTED SINCE DR. ROSENBAUM PREPARED HIS TESTIMONY?

A. Yes. I have not done an exhaustive search, but I am familiar with four recent reports: two case control studies in Sweden[6, 7], a case-control study in Denmark[8] and a cohort and case-

control study of electric utility workers in the United States[9].

Q. DO THESE STUDIES RESOLVE THE CONFUSION ABOUT WHETHER EXPOSURE TO POWER FREQUENCY MAGNETIC FIELDS AFFECTS HUMAN HEALTH?

A. No, they do not. With respect to adult leukemia, the Swedish occupational study[7] reports a positive association between exposure to magnetic fields and the incidence of chronic lymphocytic leukemia while in the Swedish residential study[6] the association appears to be negative. For childhood disease, the results of the Swedish residential study, namely an association between magnetic field exposure and childhood leukemia but no association for brain tumors, are at variance with the earlier Swedish study of Tomenius[10] who saw only three-tenths of the expected number of cases of leukemia in those more highly exposed to magnetic fields and an increase in the incidence of brain tumors and benign childhood tumors among those with higher field readings and those nearer power lines[5]. The most troublesome of these new results is the association between childhood leukemia and magnetic field exposure in the Swedish residential study. This result must be interpreted with caution because, as demonstrated by the results of the Swedish residential study for brain cancer, associations found in one study may not be found in subsequent studies.

Q. WHAT DO YOU CONCLUDE FROM YOUR OVERALL ANALYSES?

A. At this time, biophysical mechanisms for how weak fields might interact with biological systems to produce harm have not been demonstrated experimentally. Without a viable biophysical mechanism to connect them, the results of the epidemiological, animal, and cellular level studies alone are not strong enough to establish a causal link between exposure to power frequency fields and harmful effects. On the other hand, the experimental evidence makes the hypothesis of harmful effects plausible, and the possibility of harm cannot be summarily dismissed. This results in the unfortunate situation that even after considerable investigation and research, we are uncertain about whether or not exposure to weak power frequency electric and magnetic fields can cause harm.

Q. WHAT POLICY ALTERNATIVES DO STATE REGULATORS HAVE TO CONTROL EXPOSURE TO POWER FREQUENCY FIELDS FROM TRANSMISSION LINES?

A. For a number of years, Dr. Granger Morgan and his colleagues in the Department of Engineering and Public Policy at Carnegie Mellon University have been studying how to assess the risk from exposure to power frequency fields and how risk assessments can be used to develop public policy for dealing with real and perceived risks. In a background paper prepared for the U.S. Congress Office of Technology Assessment[11] (OTA

report) they identified five policy alternatives. The policies that state regulators have adopted fall into one or more of these five alternative policies.

Q. WHAT ARE THESE POLICY ALTERNATIVES?

A. The policy alternatives identified in the OTA report are as follows[11]:

1. Do nothing until the science becomes better.
2. Make public information available but take no additional actions.
3. Adopt a field strength safety standard approach to transmission line fields based on the fiction that the numbers are supported by a review of the science....
4. Adopt a "similarity" based approach to transmission line fields which makes the exposures that people receive to these fields "similar" to those they receive from other sources in modern life....
5. Adopt a "prudent avoidance" strategy. That is look systematically for strategies which can keep people out of 60 Hz fields arising from all sources but only adopt those which look to be "prudent" investments given their cost and our current level of scientific understanding about possible risks.

Q. HAVE STATE REGULATORY AGENCIES ADOPTED ANY OF THESE POLICY ALTERNATIVES?

A. State agencies have dealt with the uncertainty about possible harm from exposure to power frequency electric and magnetic fields in several different ways. Some states have set standards for electric and/or magnetic field strengths on or at the edge-of-the-right-of-way. Others have decided that standards are not warranted at this time and have active programs for monitoring and evaluating the results of research. Still others have explicitly or implicitly adopted a "prudent avoidance" approach. Recent state activities are summarized and discussed in reference 4.

Q. WHICH STATES HAVE ADOPTED STANDARDS?

A. Seven states: Florida, Minnesota, Montana, New Jersey, New York, North Dakota, and Oregon, have established standards to regulate electric field strength on or at the edge of the right-of-way. Florida and New York have standards that regulate magnetic field strength at the edge of right-of-way. Table 1 lists these states together with the adopted field levels[12]. Neither Florida nor New York, the two states that have adopted standards for both electric and magnetic fields, represent these standards as "health" based standards. They

fit more logically into Option 4, the similarity based approach.

Q. WHAT OTHER ACTIONS HAVE STATE AGENCIES TAKEN?

A. Many states and other groups have conducted or are conducting detailed studies, e.g., California, Colorado, Connecticut, Illinois, Kansas, Florida, Maryland, Minnesota, New York, Oregon, and Virginia have or are in the process of evaluating the results of biological effects research. Some of these evaluations are updated on mandated schedules, often annually. California, New York, and Maryland have supported or are supporting biological effects research, and Maryland has supported work on shock and corona related effects. The State of Washington has examined research needs for the reduction of electric and magnetic fields and work on techniques to mitigate magnetic field strength is being supported by state agencies or utilities in Florida, New York, and Rhode Island.

Table 1. Summary of Existing and Interim Standards for Transmission Line Electric and Magnetic Field Strength (Adapted from reference 12).

State	Electric Field		Magnetic Field
	On Right-of-Way	Edge of Right-of-Way	Edge of Right-of-Way
Florida	8 kV/m[1] 10 kV/m[2]	2 kV/m	150 mG (max. load)[1] 200 mG (max. load)[2] 250 mG (max. load)[3]
Minnesota	8 kV/m		
Montana	7 kV/m[4]	1 kV/m	
New Jersey		3 kV/m	
New York	11.8kV/m	1.6kV/m	200 mG[5]
North Dakota	9 kV/m		
Oregon	9 kV/m		

[1] For 230-kV or smaller lines.
[2] For 500-kV lines.
[3] For 500-kV double-circuit lines.
[4] Max. for highway crossings
[5] Interim standard.

The California and the Maryland Public Service Commissions have taken the position that standards are not warranted at this time. The Colorado Public Utilities Commission has adopted a rule that stresses prudent avoidance but does not set numeric limits. In its proposed regulations, Ohio is requiring that applicants for certification of electric transmission facilities address possible health effects in its consideration of EMF design alternatives.

Q. WHAT ROLE DOES THE FEDERAL GOVERNMENT HAVE IN REGULATING POWER FREQUENCY FIELDS?

A. Federal agencies are devoting increasing attention to the potential harm from exposure to power frequency electric and magnetic fields. The Energy Policy Act, signed last October, identifies two federal agencies to lead a 5 year, $65 million EMF research effort. The Department of Energy is responsible for engineering research and the National Institute for Environmental Health Sciences is responsible for health effects research. The two committees authorized by the act to advise on the research programs have not yet been appointed, which may delay the efforts of these two agencies to implement this new program. Other federal agencies with programs or interests in this area include the Department of Defense, Department of Transportation, Environmental Protection Agency, Federal Energy Regulatory Commission, National Institutes of Standards and Technology, Occupational Safety and Health Administration, and Rural Electrification Administration.

No single federal agency has a clear mandate to regulate exposure to power frequency electric and magnetic fields. If federal regulation were needed, legislation assigning regulatory responsibility to an agency would be the most straightforward approach. Even without new legislation, the Environmental Protection Agency could provide guidance to

federal agencies using its Federal Guidance Authority. Each federal agency responsible for transmission lines would then have to develop its own regulations in a manner similar to how each federal agency has developed its own regulations for implementation of its responsibilities under the National Environmental Protection Act (NEPA). EPA developed federal guidance would not apply directly to states, but it could set a precedent for state action. Alternatively, EPA or others could, in consultation with the states, develop model state regulations. Impetus for federal action would most likely come from a desire to have uniform standards, especially for lines that cross state boundaries.

Q. IN YOUR OPINION, CAN A HEALTH BASED STANDARD FOR POWER FREQUENCY ELECTRIC AND MAGNETIC FIELDS BE ESTABLISHED AT THIS TIME?

A. No. The uncertainties are just too great. In addition to the uncertainties about whether exposure to these fields is harmful that I have discussed above, there are two other major problems. First, we don't know what aspect of exposure (dose) to control. Should it be the average electric field? The average magnetic field? Should it be the peak values? Second, the shape of the response function is also unknown. Is there a threshold field strength for effects? Are there frequency and intensity windows as some cellular level

experiments suggest? In my opinion these uncertainties preclude the possibility of setting a credible health based standard at this time.

Q. ARE THE FLORIDA AND NEW YORK STANDARDS BASED ON AVOIDANCE OF ADVERSE HEALTH EFFECTS?

A. No. They are engineering standards. For example the New York standard is based on measurements taken on 345 kV lines in New York. It has some of the aspects of a "similarity" standard. Morgan and coworkers define the similarity concept as follows[11]:

> Similarity based control sets out to make people's exposures to transmission line fields as "similar" as possible to the exposures we receive from all the other fields in our day-to-day lives: exposure from the fields from power lines out in the street, the wiring in the buildings we live and work in, and the appliance we use during the day and sleep with at night.
>
> ....
>
> A similarity based approach to transmission line field control can be justified on two possible grounds:
>
> 1. "Acceptability" - In this case the argument is that the fields to which we are all exposed from other sources constitute a socially acceptable level of risk. By making transmission line field exposures similar, we make them socially acceptable.
>
> 2. "Equity" - In this case the argument is that if transmission line fields are made similar to the fields to which we are all exposed from other sources then we are not

> asking residents who live along transmission line right-of-ways to bear field related risks that are any different from those born (sic) by all members of modern society.

One could also argue that the New York standard incorporates some prudence, since the standard was set at the average values of electric and magnetic fields rather than the maximum values to which some New York citizens are exposed. However, in choosing the standard the fields were made similar to other transmission line fields, not to fields from other sources such as distribution lines or appliances.

Q. HOW DO THE ELECTRIC AND MAGNETIC FIELDS PRODUCED BY THE WOODBOURNE-HEATON 230 KV LINE COMPARE TO THE STANDARDS THAT HAVE BEEN ADOPTED BY NEW YORK AND FLORIDA?

A. According to PECO, the maximum electric field on the right-of-way and the maximum electric field at the edge of the right-of-way are 1.9 kV/m and 1.2 kV/m respectively[13]. The maximum values of the magnetic field depend upon the line loading, see Table 2. If the line operates as indicated[14], namely, 90 % at "light" and "normal" loads, 0.05 % (4 hours) at "emergency maximum", and the remaining time at "heavy" load, then the maximum annual average fields on the right-of-way and at the edge of the right-of-way should not exceed 45 and 27 milligauss, respectively. Under "emergency maximum" operating conditions the maximum fields on the right-of-way and at the edge-of-the-right-of-way are 120 and 70 milligauss,

respectively. None of these values exceed the Florida or New York standards, see Table 1.

Table 2. Calculated Electric and Magnetic Fields for Woodbourne-Heaton 230-kV Transmission Line (From reference 13).

Location	Electric Field (kV/m)	Magnetic Field (mG) 180 Amps	360 Amps	600 Amps	1000 ~~1200~~ Amps
Edge of Right-of-Way	1.2	13	25	42	70
Maximum on Right-of Way	1.9	21	42	70	120

Q. IF A HEALTH BASED STANDARD CANNOT BE DEVELOPED AT THIS TIME, COULD SIMILARITY AND PRUDENCE CONCEPTS BE INCORPORATED INTO THE REGULATORY PROCESS?

A. Yes. For example, Pennsylvania could adopt the approach used by the state of New York to derive electric and magnetic field values. For the particular case of 230 kV transmission lines, the process would require determining the maximum electric and magnetic fields at the edge of the right-of-way for a representative sample of 230 kV transmission lines, not necessarily only those in Pennsylvania. From the results of such a study, values of electric and magnetic field strength could be selected that would be typical or similar to values elsewhere in the state.

Q. IF ONE WERE TO CONDUCT A STUDY OF TYPICAL FIELD STRENGTHS AS A BASIS FOR A "SIMILARITY" BASED STANDARD, HOW COULD PRUDENCE BE INCORPORATED INTO THE PROCESS?

A. There are several ways prudence could be addressed. One could use only newer transmission line designs that minimize electric and magnetic fields in establishing similarity standards. In new applications, the Commission could require that utilities document the electric and magnetic fields produced by each of the alternative designs they considered as well as the actions actively taken to reduce electric and magnetic fields and the attendant costs. Other prudence measures were addressed by Dr. Rosenbaum earlier in this proceeding[5], and should be considered in all siting proceedings, namely:

- Research into the effects of electric and magnetic fields should be continued.

- The government and the industry should be aggressive in periodically informing the public about the latest information, stressing its uncertainty and changeability. This needs to be done in an absolutely impartial manner and before it is required.

- The public should be involved in the decision making process before critical decisions are made. This is not at all the same thing as having public meetings or private sessions with concerned individuals to convince them after the decision is made.

- At the very least, companies considering power line projects should consider the cost and effects of possible mitigative measures before any construction is decided on.

Mitigative measures that should be considered before construction begins may include, but are not limited to:

- avoiding heavily populated areas
- avoiding parks, schools, and other public facilities
- widening rights-of-way
- limiting public uses of rights-of-way
- using higher ground clearances
- designing the power lines to reduce the fields

- In planning one should err on the side of safety, but not without considering the cost.

Q. DO YOU HAVE A RECOMMENDATION FOR HOW THE COMMISSION MIGHT PROCEED TO SET A NUMERICAL STANDARD FOR ELECTRIC AND MAGNETIC FIELDS AT THE EDGE-OF-THE-RIGHT-OF-WAY FOR THE WOODBOURNE-HEATON 230 KV TRANSMISSION LINE, IF IT CHOOSES TO DO SO?

A. Yes, a qualified one. As I already have said, because of scientific uncertainty it is premature to set a health based standard. We cannot say that exposure above a certain level will have an adverse effect on health or that exposures below a certain level are completely safe. Nevertheless, if one is required to choose some numerical limit, three things need to be stated explicitly:

- First, the standard should be interim because considerable research on this issue is underway and much more is planned over the next five years.

- Second, because the present record was developed for a specific 230-kV line, the standard should be specific for that line only.

- Finally, it needs to be recognized and stated that the standard is not based on avoidance of health effects.

With these conditions, the Commission, as an interim measure, could adopt a similarity and prudence based standard for the Woodbourne-Heaton line using the fields produced by 230-kV lines of modern design as a basis, not necessarily just those in Pennsylvania. Using the fields produced by newer lines, where minimization of electric and magnetic fields has been included in the design, will incorporate a measure of prudence into the interim standard.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

REFERENCES

1. Janes DE (1991): The effects of power frequency fields on animal and cellular systems. OCA Statement No. 1.

2. ORAU Panel on Health Effects of Low-Frequency Electric and Magnetic Fields (1992): Health Effects of Low-Frequency Electric and Magnetic Fields. Available from National Technical Information Service (publication number ORAU 92/F-8) or United States Government Printing Office (publication number 029-000-00443-9).

3. Advisory Group on Non-ionising Radiation (1992): Electromagnetic Fields and the Risk of Cancer. Documents of the NRPB, Volume 3, number 1. National Radiological Protection Board, Chilton, Didcot, Oxon.

4. Energetics (1992): Status report on potential human health effects associated with power frequency electric and magnetic fields: Reporting period, June 1991-May 1992, Maryland Department of Natural Resources and Public Service Commission of Maryland, Annapolis, MD.

5. Rosenbaum DM (1991): Prudent policy in the face of uncertain risk. OCA Statement No. 2.

6. Feychting M, Ahlbom A (1992): Magnetic Fields and Cancer in People Residing Near Swedish High Voltage Power Lines. Stockholm: Instituted for miljomedicin, IMM-rapport 6/92.

7. Floderus B et al. (1992): Occupational exposure to electromagnetic fields in relation to leukemia and brain tumors. A case-control study. Solna, Sweden: PM 2nd edition: National Institute of Occupational Health.

8. Olsen J, et al. (1992): Residences Near High-Voltage Plants and the Risk of Cancer in Children. Copenhagen: Cancer Registry of the Fight Against Cancer: Background Report.

9. Sahl JD, Kelsh MA, Greenland S (1993): Cohort and Nested Case-Control Studies of Hematopoietic Cancers and Brain Cancer among Electric Utility Workers. *Epidemiology 4(2): 104-114.*

10. Tomenius L (1986); 50-Hz Electromagnetic Environment and the Incidence of Childhood Tumors in Stockholm County. *Bioelectromagnetics 7(2): 191-207.*

11. Nair I, Morgan MG, Florig HK (1989): "Biological Effects of Power Frequency Electric and Magnetic Fields: Background Paper" (Prepared for the U.S. Congress Office of Technology Assessment), Washington, DC: U.S. Government Printing Office.

12. Lee JM, Chartier VL, Hartman DP, Lee GE, Pierce KS, Shon FL, Stearns RD, Zeckmeister MT (1989): "Electrical and Biological Effects of Transmission Lines: A Review." Portland, OR: Bonneville Power Administration.

13. Boeggeman CJ (1991): Testimony before the Pennsylvania Public Utility Commission on Behalf of Philadelphia Electric Company, PECO Exhibit No. 2, p. 2 and pp. 7-8.

14. Boeggeman CJ (1991): Testimony before the Pennsylvania Public Utility Commission on Behalf of Philadelphia Electric Company, Direct Testimony, p. 8.