

In The Matter Of:

*S. Fred Singer v.
Justin Lancaster*

*S. Fred Singer
September 24, 1993*

*Vol. I
pp. 1 - 235*

*Doris M. Jones & Associates, Inc.
Professional Court Reporters
59 Temple Place
Suite 406
Boston, MA 02111
(617) 542-0039*

Original File 0924sing.v1, 235 Pages

Word Index included with this Min-U-Script®

[1] Volume: I
[2] Pages: 1-235
[3] Exhibits: See Index
[4] COMMONWEALTH OF MASSACHUSETTS
[5] Middlesex, ss. Superior Court Department
[6]
[7] S. FRED SINGER,
[8] Plaintiff,
[9] v. Civil Action
No. 93-2219
[10] JUSTIN LANCASTER,
Defendant.
[11]
[12]
[13]
[14] DEPOSITION of S. FRED SINGER, a witness
called by counsel for the Defendant, taken pursuant
[15] to Rule 30 of the Massachusetts Rules of Civil
Procedure, before Kimberly A. Edwards, Registered
[16] Professional Reporter, Certified Shorthand Reporter,
and Notary Public in and for the Commonwealth of
[17] Massachusetts, at the offices of NUTTER, McCLENNEN &
FISH, One International Place, Boston, Massachusetts,
[18] on Friday, the 24th day of September, 1993,
commencing at 9:40 a.m.
[19]
[20]
[21]
[22] DORIS M. JONES & ASSOCIATES, INC.
Professional Shorthand Reporters
[23] 59 Temple Place
Boston, Massachusetts 02111
[24] (617) 542-0039

[1] I_N_D_E_X
[2]
[3] Deposition_of: Direct__Cross__Redirect__Recross
[4] S. FRED SINGER
[5] by Mr. Lancaster 8
[6]
[7]
[8] E_X_H_I_B_I_T_S
[9]
[10] No. Page
[11] 1 Galley Proof 50
[12] 2 Global and Hemispheric Annual
Temperature Anomalies (relative
to a 1950-79 reference period
mean) Trends '90 72
[13] 3 Global Temperature Anomaly
1861-1987 (CDIC/Jones and Wigley)
graph 79
[14] 4 Jones abs difs graph 79
[15] 5 AAAS talk - "What Can We Do About
Climate Change?" statement by
Professor Roger Revelle, 2-9-90 94
[16] 6 Letter dated 9-15-92 to "Letters
to the Editor" from S. Fred Singer 133
[17] 7 R. Revelle abstract for "Is The
Climate Changing?" Irvine - 2-28-90 136
[18] 8 Draft 1 dated 2-27-90 137
[19] 9 Draft 2 dated 3-5-90 143
[20]
[21]
[22]
[23]
[24]

[1] APPEARANCES:
[2] NUTTER, McCLENNEN & FISH
By: Joseph G. Blute, Esquire
[3] One International Place
Boston, Massachusetts 02110
[4] Counsel for the Plaintiff
[5] JUSTIN LANCASTER, Appearing Pro Se
[6]
[7]
[8]
[9]
[10]
[11]
[12]
[13]
[14]
[15]
[16]
[17]
[18]
[19]
[20]
[21]
[22]
[23]
[24]

Page 4		
[1]	E_X_H_I_B_I_T_S	
[2]	No.	Page
[3]	10	Draft 1 dated 2-27-90; comments by Chauncey Starr 147
[4]		
[5]	11	Draft 3 dated 3-19-90 148
[6]		
[7]	12	Article entitled "What To Do About Greenhouse Warming: Look Before You Leap" 174
[8]		
[9]	13	Letter dated 8-7-92 to Justin Lancaster, J.D., Ph.D. from S. Fred Singer, Ph.D. 185
[10]		
[11]	14	Article entitled "What To Do About Greenhouse Warming" 202
[12]		
[13]		
[14]		
[15]		
[16]		
[17]		
[18]		
[19]		
[20]		
[21]		
[22]		
[23]		
[24]		

Page 5		
[1]	P_R_O_C_E_E_D_I_N_G_S	
[2]		
[3]	Stipulation	
[4]	It is stipulated by and between counsel for the respective parties that the deposition is to be read and signed by the deponent before any notary; that the sealing and filing thereof are waived; and that all objections, except as to form, and motions to strike are reserved to the time of trial.	
[5]		
[6]		
[7]		
[8]		
[9]		
[10]		
[11]		
[12]	MR. BLUTE: Before we begin, let me	
[13]	just make a statement on the record about our	
[14]	discussions on the motion to compel. There were some	
[15]	issues that came up in written discovery where we	
[16]	objected to certain inquiries made by Dr. Lancaster.	
[17]	We've had some discussions about those, those issues,	
[18]	and I think we worked out — at least we'll see if we	
[19]	can work out today those issues.	
[20]	And if I can summarize them, there	
[21]	was an interrogatory directed to the sources of	
[22]	funding of the Science and Environmental Policy	
[23]	Project, an organization formed by Dr. Singer. We	
[24]	will — we objected to giving that information.	

Page 6

[1] I have informed Dr. Lancaster that
[2] we will permit him to — we will not press that
[3] objection today and that he will be permitted to
[4] inquire of Dr. Singer as to sources of funding of
[5] that organization.
[6] With respect to Dr. Singer's personal
[7] income, we objected to inquiry into his personal
[8] income. We reassert that objection. However, in the
[9] interest of trying to move this along without a
[10] fight, without a court battle, we've told Dr.
[11] Lancaster that he may inquire with very narrow
[12] directed questions to sources of income related to
[13] organizations that are at issue in this case, things
[14] such as the Western Fuel Alliance, and some other
[15] organizations and individuals that Dr. Lancaster has
[16] asserted are relevant to this case.
[17] To the extent they're limited and
[18] directed to that, I think we'll be able to avoid
[19] objections. However, if we do get an objection, I
[20] want to state that the way we'll handle it is I will
[21] inform you that I think it's beyond our agreement, we
[22] will reserve the right to go to court and to have the
[23] motion to compel ruled on, but we'll finish the
[24] deposition today, as much as we can today, so that we

Page 7

[1] don't have to interrupt the deposition.
[2] MR. LANCASTER: I agree. We'll
[3] continue the deposition with the reservations and
[4] keep the deposition open till they're resolved.
[5] MR. BLUTE: Right.
[6] MR. LANCASTER: I think that there's
[7] a significant chance that we won't finish today. I
[8] had hoped we would. But as I — as you might
[9] imagine, you get into writing questions and it
[10] extends. But I'll try to.
[11] MR. BLUTE: We'll do our best. And
[12] we'll see where we are at the end of the day. It
[13] took us more than one day to finish yours. But I
[14] don't intend to interfere with your completion of the
[15] deposition, within reason.
[16] Another item I wanted to mention,
[17] given the situation where you're representing
[18] yourself, you're acting pro se, I've asked Dr.
[19] Singer, whenever he's referring to you, to refer to
[20] "Dr. Lancaster" rather than "you" or "your," so that
[21] the record is clear. If it has to be read at some
[22] time at trial, the record will be clear.
[23] MR. LANCASTER: I've also planned to
[24] refer to myself as "the defendant" in the questioning

Page 8

[1] to try and keep that clear and also to help remind me
[2] that I'm going to try and conduct this part of the
[3] proceeding as an attorney representing myself rather
[4] than as a defendant with unrestrained passion.
[5] **MR. BLUTE:** All right. With that, I
[6] think that's all we should say at the outset. And go
[7] ahead.

[8]
[9] **S. FRED SINGER**

[10]
[11] a witness called for examination by counsel for the
[12] Defendant, being first duly sworn, was examined and
[13] testified as follows:

[14]
[15] **DIRECT EXAMINATION**
[16] **BY MR. LANCASTER:**

[17] **Q:** Just to start, could you please state your
[18] name for the record and your address?
[19] **A:** S. Fred Singer, 9812 Doulton Court,
[20] D-o-u-l-t-o-n, Fairfax, Virginia, 22032.
[21] **Q:** Dr. Singer, do you have a wife and
[22] children?
[23] **A:** I have a wife and she has children.
[24] **Q:** To your knowledge, you're not related to

Page 10

[1] **A:** Yes.
[2] **Q:** Are you also a journalist?
[3] **A:** What precisely does that mean?
[4] **Q:** Well, are you a journalist in the sense
[5] that you would be a freelance journalist writing
[6] articles for publication in many newspapers more
[7] frequently than a scientist would be expected to?
[8] **MR. BLUTE:** I object to the form, but
[9] go ahead and answer.
[10] **A:** That's a very vague question. I've
[11] written articles for newspapers, but I don't know
[12] whether these are more frequent than any other
[13] scientist that I know of.
[14] **Q:** Do you know of any scientist, colleagues,
[15] or other, who has written more articles in newspapers
[16] than yourself?
[17] **A:** Yes.
[18] **Q:** Can you name that scientist?
[19] **A:** Dr. Carl Sagan.
[20] **Q:** Can you think of any other scientist other
[21] than Dr. Sagan?
[22] **A:** Not at the moment.
[23] **Q:** Would you agree that one of the
[24] differences between — strike that.

Page 9

[1] the family of Isaac Merritt Singer or his
[2] descendants, the founder of the Singer Corporation?
[3] **A:** To the best of my knowledge, I'm not
[4] related to him.
[5] **Q:** Are you any relation to Thomas Eric Singer
[6] of the company in Boston, Thomas Singer and
[7] Daughters, to your knowledge?
[8] **A:** To my knowledge, I'm not related to him.
[9] **Q:** You initiated this suit against defendant
[10] in April of this year, correct?
[11] **A:** I believe so.
[12] **Q:** And it's a suit for libel, four counts of
[13] libel, is that correct?
[14] **MR. BLUTE:** Well, the complaint —
[15] **Q:** And one count of violation of
[16] Massachusetts civil rights?
[17] **A:** I'm not familiar with the technicalities.
[18] **Q:** Okay. You're aware that defendant has
[19] responded with a counterclaim for abuse of process?
[20] **A:** I've been so informed.
[21] **Q:** And are you familiar with the grounds for
[22] abuse of process, what has to be proved?
[23] **A:** No, I'm not.
[24] **Q:** Okay. Are you a scientist?

Page 11

[1] Is not one of the areas of your expertise
[2] the relationship of science and policy making?
[3] **A:** Yes.
[4] **Q:** And would you agree that one of the
[5] differences between science and the legal profession
[6] is the fact that the legal profession has an ethical
[7] code?
[8] **MR. BLUTE:** Objection. You can
[9] answer, if you can.
[10] **Q:** I'll break it down. Are you aware that
[11] the legal profession has an ethical code —
[12] **MR. BLUTE:** Objection.
[13] **Q:** — called the Code of Professional
[14] Responsibility?
[15] **MR. BLUTE:** I object. Go ahead.
[16] **A:** I'm not familiar with such a code.
[17] **Q:** Does the profession of science have an
[18] ethical code?
[19] **MR. BLUTE:** Objection. Go ahead.
[20] **MR. LANCASTER:** Grounds for
[21] objection?
[22] **MR. BLUTE:** I think the question
[23] is — the form of the question, I think, is improper,
[24] because code — there's written codes, there's

Page 12

[1] customs, and there's —

[2] **MR. LANCASTER:** Let me withdraw that

[3] and make it more specific.

[4] **BY MR. LANCASTER:**

[5] **Q:** Are you aware, in the scientific

[6] profession, of any requirement for scientists to be

[7] licensed to practice science?

[8] **A:** No, I'm not.

[9] **Q:** Is there, to your knowledge, any

[10] requirement that a scientist must state an adherence

[11] to principles of ethics in order to practice science?

[12] **A:** Could you rephrase that question?

[13] **Q:** Are you aware of any requirement for a

[14] professional scientist to adhere to any written

[15] ethical principles?

[16] **A:** No, I'm not.

[17] **Q:** Would it surprise you, in the legal

[18] profession, that practicing lawyers are required to

[19] constrain their behavior to a set of stated ethical

[20] principles?

[21] **A:** I'm not surprised.

[22] **Q:** Is it true that scientists and lawyers, in

[23] their practice, approach the notion of truth

[24] differently?

Page 13

[1] **MR. BLUTE:** I object.

[2] **MR. LANCASTER:** Okay. I'll withdraw

[3] it. Let me make it more specific.

[4] **MR. BLUTE:** My grounds are that I

[5] don't think Dr. Singer can testify as to what the

[6] practices of a lawyer are. He's not an attorney.

[7] But go ahead. I don't want to interrupt.

[8] **BY MR. LANCASTER:**

[9] **Q:** Okay. Let's back up. What is science?

[10] **A:** There are many definitions. To me,

[11] science is a search for evidence to develop the laws

[12] of the behavior of nature.

[13] **Q:** What is a scientist?

[14] **A:** One who practices.

[15] **Q:** Does a scientist search for truth in the

[16] behavior of nature?

[17] **A:** That's a very vague question. Truth can't

[18] be discerned until it has been tested. Searches for

[19] behavior and tests truth by further observations.

[20] **Q:** Is it true that once one becomes a

[21] professional scientist that one is always a

[22] professional scientist? Can you become — I'll just

[23] leave that.

[24] **A:** (No response)

Page 14

[1] **Q:** Okay. I'll withdraw it, rephrase it.

[2] If your career led you to the practice of

[3] science, would there be, in your mind, anything that

[4] would allow somebody to lose their qualification to

[5] call themselves a scientist?

[6] **A:** Yes.

[7] **Q:** And how would that occur?

[8] **A:** Falsification of data is an example.

[9] **Q:** Would there be any difference between a

[10] scientist who carried out multiple experiments and

[11] observations and a scientist who practiced only

[12] assembling other scientific information? Do you draw

[13] a distinction between those types of scientists?

[14] **A:** In one manner of speaking, yes. In

[15] another manner, no.

[16] **Q:** Can you explain?

[17] **A:** One would be an experimental scientist and

[18] the other would be a theoretical scientist.

[19] **Q:** In your career, you have been both, have

[20] you not?

[21] **A:** Yes, I have.

[22] **Q:** When did you carry out your experimental

[23] science?

[24] **A:** Starting approximately 1946 up to the

Page 15

[1] present time.

[2] **Q:** What is the most recent experiment you've

[3] carried out?

[4] **A:** The most recent experiment relates to

[5] measurements in a satellite of orbiting debris clouds

[6] circling the earth.

[7] **Q:** And you are carrying that experiment out

[8] with whom?

[9] **A:** With a group of collaborators.

[10] **Q:** And their names are?

[11] **A:** William Kinard, K-i-n-a-r-d, John Oliver,

[12] Charles Simon, Jerry Weinberg.

[13] **Q:** And where is Mr. Kinard, Dr. Kinard, his

[14] professional location, affiliation?

[15] **A:** Langley, Virginia.

[16] **Q:** Is he with NASA?

[17] **A:** Yes, sir.

[18] **Q:** Dr. Oliver's affiliation?

[19] **A:** University of Florida.

[20] **Q:** Dr. Simon's affiliation?

[21] **A:** Gainesville, Florida.

[22] **Q:** Is Dr. Simon with the university?

[23] **A:** I believe he has some kind of connection.

[24] **Q:** And Dr. Weinberg?

Page 16

[1] A: Gainesville, Florida.
[2] Q: Is the funding for this satellite
[3] experiment through NASA?
[4] A: That is correct.
[5] Q: And what is your role in this experimental
[6] science?
[7] A: I am a co-principal investigator.
[8] Q: And that's under current grant?
[9] A: Yes.
[10] Q: And the title, again, of the grant?
[11] A: The approximate title is something like
[12] "Analysis of Satellite Experiments Relating to
[13] Orbiting Debris Clouds."
[14] Q: What is an orbiting debris cloud?
[15] A: It is a group of particles circling the
[16] earth of sufficient density to form a cloud.
[17] Q: Is this experiment studying a certain set
[18] of particles?
[19] A: Yes.
[20] Q: What set of particles is that?
[21] A: The particles that are in the vicinity of
[22] the earth, in orbit around the earth.
[23] Q: At what elevation?
[24] A: At 400 kilometers.

Page 17

[1] Q: And you're using a NASA satellite or many
[2] NASA satellites?
[3] A: We have used a NASA satellite.
[4] Q: And currently the satellite is not
[5] gathering data?
[6] A: Correct, the satellite has returned to the
[7] earth.
[8] Q: And what satellite is that?
[9] A: LDEF, L-D-E-F. That stands for Long
[10] Duration Exposure Facility.
[11] Q: Prior to this experiment, were you working
[12] on another experiment?
[13] A: Yes.
[14] Q: And what was that and what years?
[15] A: In the middle '70s, I worked on a NASA
[16] experiment relating to particles in the vicinity of
[17] the earth.
[18] Q: At what elevation?
[19] A: Approximately 400 — low orbit, low earth
[20] orbit.
[21] Q: 100 to 200 kilometers?
[22] A: No, higher.
[23] Q: 200 to 400 kilometers?
[24] A: Possibly.

Page 18

[1] Q: Were you a principal investigator or a
[2] co-principal investigator on that experiment?
[3] A: I was principal investigator of the LDEF
[4] experiment.
[5] Q: On the current experiment, with Drs.
[6] Kinard, Oliver, Simon, and Weinberg, the grant pays
[7] you? Does the grant pay you?
[8] A: The grant has paid me from time to time
[9] whenever I did work.
[10] Q: So you're a consulting investigator?
[11] MR. BLUTE: Objection.
[12] Q: Is your relationship to this NASA contract
[13] on a pay-for-hours basis?
[14] A: Roughly.
[15] Q: And would Dr. Kinard, then, be the
[16] co-principal investigator who would administer those
[17] funds?
[18] A: No, the funds are administered by Dr.
[19] Weinberg.
[20] Q: Dr. Weinberg. What's the size of that
[21] grant; how many dollars?
[22] A: I'm not familiar with the details of the
[23] current grant, but it's of the order of 100,000. It
[24] is certainly not a million and it is not 10,000.

Page 19

[1] Q: And roughly, what percentage of that,
[2] or how many dollars of that, come to you for your
[3] work?
[4] A: I am paid all of my expenses, travel
[5] expenses. And I've received, to the best of my
[6] recollection, no more than — or less than \$5,000.
[7] Q: In theoretical science, what has been your
[8] work in the last two or three years, say three years,
[9] since 1990?
[10] A: I've calculated the greenhouse effects of
[11] high altitude cirrus clouds.
[12] Q: And have you published that research?
[13] A: Yes.
[14] Q: And the citations for those? Do you
[15] remember?
[16] A: I don't carry them in my head.
[17] Q: What journal?
[18] A: Meteorology and Atmospheric Physics.
[19] Q: How many articles?
[20] A: One.
[21] Q: And in what year?
[22] A: Approximately 1990.
[23] Q: Is that work that you are continuing now?
[24] A: Not the specific — not the specific

Page 20

[1] investigation. It's completed.
[2] Q: Was that investigation under grant or
[3] contract?
[4] A: No.
[5] Q: So you were not paid for that work?
[6] A: No, I was not paid.
[7] Q: What were your major conclusions in that
[8] paper? Do you remember the title of the paper?
[9] A: My conclusions were that high altitude
[10] cirrus could produce very strong greenhouse effects.
[11] Q: At what elevation?
[12] A: In the stratosphere.
[13] Q: Would that be the lower stratosphere?
[14] A: The lower stratosphere.
[15] Q: Roughly 15 to 20 kilometers? Or which
[16] elevation?
[17] A: I'd say 10 to 15 kilometers.
[18] Q: 10 to 15 kilometers. Would this be an
[19] altitude that water vapor could reach if convection
[20] in the atmosphere increased?
[21] A: Does your question refer to water vapor
[22] originating at a lower altitude?
[23] Q: Yes.
[24] A: It is possible.

Page 21

[1] Q: Do you know if water vapor originates at a
[2] higher altitude, 10 to 15 kilometers?
[3] A: Yes.
[4] Q: And how does that occur?
[5] A: Through the photochemical conversion of
[6] methane.
[7] Q: In the region of 10 to 15 kilometers,
[8] roughly what percentage of water vapor would be
[9] created from methane photo-oxidation?
[10] A: That percentage is not known. At least I
[11] don't know that.
[12] Q: Do you have any sense of it?
[13] MR. BLUTE: Objection.
[14] Q: Do you have a scientific guess that it
[15] would be less than 50 percent?
[16] MR. BLUTE: Objection.
[17] Q: Do you have any information that would
[18] lead you to make a scientific estimate of that amount
[19] of water vapor created by methane photo-oxidation?
[20] A: I estimated that it would be an important
[21] source.
[22] Q: What percentage of the source, in your
[23] mind, would qualify as important?
[24] A: More than 10 percent.

Page 22

[1] Q: Where would that methane come from?
[2] A: That methane originates in the lower
[3] atmosphere.
[4] Q: Does some of that methane come from the
[5] surface, the earth's surface?
[6] A: Yes.
[7] Q: Is some of that methane sequestered in
[8] soils at high latitudes?
[9] A: Not that I'm aware of.
[10] Q: You're not aware that tundra soils hold
[11] methane?
[12] A: They may hold methane, but I'm not aware
[13] that they're an important source of methane into the
[14] atmosphere.
[15] Q: If tundra soils were to warm?
[16] A: That's a hypothetical question.
[17] Q: Let me pose the hypothetical question. If
[18] tundra soils were to warm, in your scientific
[19] opinion, is there any risk of increased methane
[20] release from the soils?
[21] A: Well, you're really asking if methane were
[22] to be released from these soils, would it be
[23] released?
[24] Q: No, I'm asking, if those soils were warm,

Page 23

[1] is there an increased risk that methane would be
[2] released?
[3] A: I'm not familiar with how the methane is
[4] held in the soil, so I can't really answer the
[5] question from any personal knowledge.
[6] Q: Are you telling me that you have no
[7] knowledge about how methane is held in soils?
[8] MR. BLUTE: Objection.
[9] MR. LANCASTER: Could we please read
[10] back Dr. Singer's response to my previous question?
[11] (Answer read.)
[12] BY MR. LANCASTER:
[13] Q: Are you saying that you are not familiar
[14] with how methane is held in soils?
[15] A: I'm not familiar with the literature on
[16] this particular subject.
[17] Q: Have you not, sir, held yourself out as an
[18] expert in the sources of methane —
[19] A: Yes.
[20] Q: — into the atmosphere?
[21] A: Yes.
[22] Q: And you're telling me now you're not
[23] familiar with the literature on how methane is held
[24] in soils?

Page 24

[1] **MR. BLUTE:** Objection. There's a
[2] question pending, unless you want to withdraw the
[3] question.
[4] **MR. LANCASTER:** What's the grounds
[5] for the objection?
[6] **MR. BLUTE:** I think it's not a
[7] question at all. I think it's an argument.
[8] **A:** Soil is not considered to be a current
[9] source of methane.
[10] **MR. BLUTE:** And let me just say for
[11] the record, I don't want to interfere with your
[12] examination. And I'm doing my best not to. And I
[13] don't intend to. But if we're going to spend the day
[14] debating scientific points, I don't think it's
[15] relevant to the issues in the suit, either on our
[16] claim or your counterclaim. And there is at some
[17] point —
[18] **MR. LANCASTER:** I'd like to move on.
[19] **MR. BLUTE:** Let me just finish.
[20] There is at some point an issue of how much time is
[21] being spent on matters which are wholly unrelated to
[22] the suit. It's expensive to do that. And at some
[23] point I would ask you to stop and move on to issues
[24] in the suit. And I would say it's being unreasonable

Page 25

[1] to put us to this expense on those issues. So I
[2] just — let's move on.
[3] **MR. LANCASTER:** Let me respond to
[4] that. I understand that concern. The issues in this
[5] suit concern Dr. Singer's expertise in global warming
[6] science; would you agree?
[7] **MR. BLUTE:** I think the issues in the
[8] suit concern claims of libel and counterclaims for
[9] abuse of process and matters relating to those
[10] claims.
[11] And I don't see how methane gas
[12] leaking from the tundra, if it's heated, has anything
[13] to do with the issues in this case.
[14] **MR. LANCASTER:** I believe you. I
[15] believe you don't see that.
[16] **MR. BLUTE:** I don't see that. And I
[17] don't —
[18] **MR. LANCASTER:** I do. But I will try
[19] and move on.
[20] **MR. BLUTE:** Continue on.
[21] **MR. LANCASTER:** I will try and move
[22] on, because I don't want to get deeply into this.
[23] There are many other topics to reach.
[24] **BY MR. LANCASTER:**

Page 26

[1] **Q:** Would you say that the problem of global
[2] warming is a fairly complex problem?
[3] **A:** Yes.
[4] **Q:** Would you agree that greenhouse gas
[5] concentrations are imperceptible to the public?
[6] **A:** What does that mean?
[7] **Q:** Would you agree that the general public is
[8] not able to perceive in the atmosphere around them
[9] the changing levels of carbon dioxide, or methane, or
[10] ozone, or nitrous oxide?
[11] **A:** Do you mean by direct sense?
[12] **Q:** Yes.
[13] **A:** Correct.
[14] **Q:** Would you agree that climate change, to
[15] the extent that it occurs, or potential climate
[16] change, would not be directly sensed by the public?
[17] **A:** You'd have to specify to me over what time
[18] interval you're referring. Certainly they would
[19] probably sense the climate change from summer to
[20] winter.
[21] **Q:** Right. If I specify, then, climate change
[22] over a decade, in your scientific estimate, is that a
[23] change that can be perceived or sensed?
[24] **A:** You have to distinguish — your question

Page 27

[1] is unclear to me. First you asked me about whether
[2] the public could detect such a climate change. And
[3] now you seem to be asking me a different question.
[4] **Q:** I'm sorry. The same second question,
[5] whether that climate change over a decade could be
[6] sensed by the general public.
[7] **A:** This is not a question that can be
[8] addressed to me, as a scientist. I must answer it by
[9] saying that the public seems to think that the
[10] climate is changing, in the sense that they say the
[11] climate used to be better or worse 10 years ago.
[12] Whether they have any foundation for this, I don't
[13] know.
[14] **Q:** Is it fair to say that the chemical
[15] changes in the atmosphere are too slow and too
[16] invisible for the public to be conscious of them
[17] without communication from attentive scientists?
[18] **A:** Yes.
[19] **Q:** Would you agree that the science is fairly
[20] complex in the sense that many disciplines of science
[21] must be comprehended to grasp the relationships
[22] between biology, chemistry, oceanography,
[23] meteorology, and climatology?
[24] **A:** Again, it depends on the time frame. And

Page 28

[1] unless you specify the time frame, I cannot answer
[2] this question.
[3] **Q:** For example, to detect climate change or
[4] to have the ability to make a scientific judgment
[5] about the likelihood that there will be a significant
[6] climate change over 50 years, is it fair to
[7] characterize this science as very complex, because it
[8] involves biology, atmospheric chemistry,
[9] oceanography, meteorology, and sciences of
[10] climatology?
[11] **MR. BLUTE:** I object to the form.
[12] But you can answer, if you can.
[13] **A:** Yes.
[14] **Q:** It's fair to say that it's very complex?
[15] **A:** Yes.
[16] **Q:** As a scientific question?
[17] **A:** (Nodding)
[18] **Q:** Is it fair —
[19] **A:** Over 50 years, yes.
[20] **Q:** Is it fair to say that there are not many
[21] scientists practicing who have sufficient expertise
[22] in all of the related disciplines that bear on this
[23] problem to be able to make valid scientific judgments
[24] about the entire problem alone as single scientists?

Page 29

[1] **MR. BLUTE:** I object to the form. Go
[2] ahead.
[3] **A:** Yes.
[4] **Q:** Is it not true that you are a scientist
[5] with unusual expertise in multiple disciplines?
[6] **A:** I have worked in several scientific areas.
[7] **Q:** Can you list these?
[8] **A:** Yes, principally atmospheric physics,
[9] space physics, planetary physics.
[10] **Q:** When you list planetary physics, what
[11] branches of planetary physics do you have expertise?
[12] **A:** My publications involve such subjects as
[13] meteorites, planetary satellites, the moon, and
[14] interplanetary dust, among others.
[15] **Q:** Can you list others?
[16] **A:** Zodiacal light.
[17] **Q:** In atmospheric physics, what branches do
[18] you consider yourself expert?
[19] **A:** I've published on such topics as the
[20] growth of atmospheric methane, stratosphere ozone,
[21] ionospheric currents, exosphere, magnetosphere.
[22] **Q:** Of all of these disciplines that you've
[23] mentioned, is it fair to say —
[24] **A:** This is not exhaustive.

Page 30

[1] **Q:** Can we keep going, then? Could you list
[2] other branches of science where you've worked?
[3] **A:** If you were to ask me a direct question, I
[4] could say yes or no.
[5] **Q:** Have you conducted research and published
[6] in oceanography?
[7] **A:** Yes.
[8] **Q:** And what was that research?
[9] **A:** I published a paper on composition of
[10] deep-sea sediments.
[11] **Q:** Was that sole author, or jointly authored?
[12] **A:** Sole, sole author.
[13] **Q:** In ecology?
[14] **A:** Ecology is a broad subject. I would
[15] prefer if you were to ask me a specific question.
[16] **Q:** In —
[17] **A:** In a sense, everything is ecology.
[18] **Q:** In biology?
[19] **A:** No.
[20] **Q:** Forestry?
[21] **A:** Yes, I've written a paper on forestry.
[22] **Q:** And that topic?
[23] **A:** On forest fires.
[24] **Q:** Agricultural ecology?

Page 31

[1] **A:** Indirectly, yes. I've written about the
[2] ecology of fisheries.
[3] **Q:** Anything about land plants?
[4] **A:** Not that I recall.
[5] **Q:** Have you studied the chemistry of carbon
[6] dioxide, the transport of carbon dioxide between
[7] oceans, atmosphere, and land plants?
[8] **A:** I have not published any original papers
[9] on the subjects.
[10] **Q:** In topics relating to the chemistry
[11] involved, greenhouse gases and potential global
[12] warming, would you say that yourself or Dr. Roger
[13] Revelle had more expertise?
[14] **A:** Please repeat the question.
[15] **Q:** In scientific topics, chemistry
[16] particularly, transport of chemicals between the
[17] ocean, atmosphere, and land plants, would you say
[18] that yourself or Dr. Roger Revelle had more
[19] scientific expertise?
[20] **MR. BLUTE:** Object to the form. You
[21] can answer.
[22] **A:** It depends on the specific topic. I'm not
[23] familiar with all of his publications, of course.
[24] But I would judge that I have more expertise on the

Page 32

- [1] issue of methane coming from natural sources.
[2] **Q:** Okay. Would you agree that the general
[3] public, including — the nonscientist, including
[4] legislators, politicians, lawyers, and economists,
[5] are unable to develop and carry out their own
[6] analysis of the scientific evidence related to global
[7] warming?
[8] **A:** I would agree with that.
[9] **MR. BLUTE:** Object to the form. Go
[10] ahead. That's fine. You've got it.
[11] **A:** I would agree to that.
[12] **Q:** This is because of the complexity of the
[13] science?
[14] **A:** Partly.
[15] **Q:** And because of the lack of training in
[16] science?
[17] **A:** Yes, yes.
[18] **Q:** Would you agree that the public relies,
[19] then, on the responsible transfer of scientific
[20] information about environmental change from the realm
[21] of the scientist to the realm of the policy maker?
[22] **A:** Is this question a normative question or a
[23] factual question?
[24] **Q:** Both.

Page 33

- [1] **A:** I would agree that the public should rely
[2] on the scientists for the scientific — for forming a
[3] scientific base for policy making.
[4] **Q:** Would you agree that the public does rely
[5] on the responsible transfer of scientific information
[6] from scientists to policy makers?
[7] **MR. BLUTE:** Object to the form. Go
[8] ahead.
[9] **A:** It depends on the specific case. I think
[10] you'd have to ask me. And I will tell you yes or no.
[11] Your question is too broad.
[12] **Q:** Well, let's talk, then, about the global
[13] warming case. In the case of global warming,
[14] potential global warming, because of the scientific
[15] complexity we discussed, would you agree that the
[16] public relies on the responsible transfer of
[17] scientific results, scientific assessments to the
[18] legislative process, that they rely upon scientists
[19] and those who assess the scientific information to
[20] make that transfer responsibly?
[21] **MR. BLUTE:** Object to form.
[22] **A:** This is a complicated question. And I
[23] think I'd like you to rephrase it in a simple way.
[24] **Q:** How does the public —

Page 34

- [1] **A:** Who —
[2] **Q:** How does the general public — and let me
[3] say here the legislative body in Congress —
[4] **A:** Well, that's not the general public.
[5] **Q:** — I'm going to list, the legislative body
[6] in Congress, the man on the street, the teachers in
[7] elementary schools — how do these people, who are
[8] not practicing scientists in the global warming
[9] topic — how do they learn about whether or not
[10] global warming is a risk?
[11] **A:** I think I can answer that question. They
[12] learn about it from television and newspapers.
[13] **Q:** How do televisions and newspapers gather
[14] this information?
[15] **A:** I'm not in the television and newspaper
[16] business. But my impression is that they interview
[17] or listen to the people who want to get a message to
[18] them.
[19] **Q:** Is it customary for practicing scientists
[20] to try and pass their conclusions to the general
[21] public, as I described the general public in the
[22] previous question, through newspaper articles? Is
[23] this the general custom of practicing scientists?
[24] **A:** I would say many practicing scientists

Page 35

- [1] these days do write newspaper articles —
[2] **Q:** Can you —
[3] **A:** — in addition to scientific articles.
[4] **Q:** As director of the Science and
[5] Environmental Policy Project and an expert in the
[6] passage of science to the policy making process, what
[7] is your estimate of the percentage of practicing
[8] scientists that regularly write newspaper articles to
[9] convey their scientific results?
[10] **MR. BLUTE:** Objection.
[11] **MR. LANCASTER:** On what grounds?
[12] **MR. BLUTE:** Several. I think, first
[13] of all, your question includes a statement as to an
[14] area of expertise which is an assumption on your
[15] part. And there's no foundation for it.
[16] **MR. LANCASTER:** Okay. Let's lay that
[17] foundation.
[18] **MR. BLUTE:** And secondly, you asked
[19] for an estimate about a percentage. I just don't
[20] think there's any — I think it calls for — let me
[21] just state my objection.
[22] I think the question calls for just
[23] speculation, a guess.
[24] I also think, again — and I'm not

Page 36

[1] going to — I'll let you go on with it, but I think
[2] at this point — I do think this area of questioning
[3] is just beyond the scope of what's at issue in this
[4] case.

[5] Global warming is not a dispute in
[6] this case. It's not an issue to be decided by the
[7] court. The issue is the authorship or not of Roger
[8] Revelle, and what you said, and your abuse of process
[9] counterclaim. Having said that, go ahead. And you
[10] may answer, if you can.

[11] **BY MR. LANCASTER:**

[12] **Q:** Would you care to answer?

[13] **A:** Would you read the question?

[14] **Q:** Let's lay the foundation. As one who has
[15] been a professor of environmental sciences, as one
[16] who is a director, and has been for at least three
[17] years, of the Science and Environmental Policy
[18] Project, do you have expertise in how scientific
[19] information is conveyed to the governmental process?

[20] **A:** It is conveyed in a number of different
[21] ways.

[22] **Q:** We're just laying the foundation here.
[23] Yes or no; do you see yourself as someone who has
[24] expertise in this topic?

Page 37

[1] **A:** I don't think I have any unusual expertise
[2] that is different from the expertise of any other
[3] scientist.

[4] **Q:** You answered previously that, in your
[5] estimation, the only scientist you could think of was
[6] Dr. Carl Sagan who has written more newspaper
[7] articles about science and his scientific work as a
[8] practicing scientist than you.

[9] **A:** I think you're putting words in my mouth.
[10] I didn't say that.

[11] **MR. LANCASTER:** Can we read back the
[12] answer to the second question, please? I think it
[13] was the second question I asked.

[14] **MR. BLUTE:** In the deposition? Let
[15] me just state this is — I'm not trying to fight with
[16] you about this.

[17] **MR. LANCASTER:** It's quicker to ask
[18] the question again, isn't it?

[19] **MR. BLUTE:** Yes.

[20] **A:** I did not say that Carl Sagan was the only
[21] other scientist.

[22] **Q:** I asked you if you could think of any
[23] other scientist, the name of any other scientist,
[24] publishing as many or more newspaper articles than

Page 38

[1] yourself. And your response was? Could you think of
[2] any other name?

[3] **A:** Not at this time. But I cannot say that
[4] Sagan is the only other scientist.

[5] **Q:** I understand that. Is it fair to say that
[6] you have a knowledge about the transmission of
[7] science to the policy process that is at a higher
[8] level of expertise about that knowledge, about that
[9] process, the transfer of information, than most
[10] practicing scientists?

[11] **MR. BLUTE:** Objection.

[12] **A:** I have no basis for judgment.

[13] **Q:** Okay. For a scientist writing about
[14] scientific conclusions of their own work and the work
[15] of other scientists, would you agree that there is
[16] any ethical burden upon those publishing this work to
[17] the public?

[18] **A:** Yes.

[19] **Q:** Would you agree that for those scientists
[20] who regularly make this their role in science, to
[21] assess the science of the many practitioners around
[22] them, publish newspaper articles about it, in the way
[23] that reaches the public more effectively than through
[24] the scientific journals, is there any unique or

Page 39

[1] greater ethical burden upon this group of scientists
[2] than other practicing scientists?

[3] **MR. BLUTE:** Objection. You can
[4] answer.

[5] **A:** No, I think the burden is the same, which
[6] is to tell the truth. You tell the truth in
[7] scientific articles and you tell the truth when you
[8] speak to the public.

[9] **Q:** Okay. Would you agree, if one assumed —
[10] we can make this a hypothetical, if you'd like — if
[11] we assume that global warming is an issue of public
[12] concern, and if we assume the public relies on those
[13] persons communicating results and assessments of
[14] science to the public, that the question of whether
[15] this communication of science and assessment of
[16] science, the question of whether that communication
[17] is accurate and balanced and truthful, that this
[18] question itself is an issue of public concern?

[19] **MR. BLUTE:** Objection.

[20] **MR. LANCASTER:** On what grounds?

[21] **MR. BLUTE:** Well, first of all, it's
[22] about three or four different questions. It's a
[23] compound question.

[24] **MR. LANCASTER:** It's a question based

Page 40

[1] on two assumptions.
[2] **MR. BLUTE:** Right. He can answer it,
[3] if he can.
[4] **MR. LANCASTER:** Is it too complicated
[5] for him to answer?
[6] **MR. BLUTE:** No, I'm stating an
[7] objection for the record. I'm preserving my
[8] objection at the time of trial. You can choose to
[9] either rephrase it, or Dr. Singer can attempt to
[10] answer it as best he can. But I'm entitled to state
[11] my objection on the record to preserve it; otherwise,
[12] I lose it.
[13] **MR. LANCASTER:** And the objection is
[14] it's too complicated a question?
[15] **MR. BLUTE:** I think it's a compound
[16] question, so that it incorporates more than one
[17] question. And therefore, to the extent you want a
[18] yes or no answer, it would be unclear on the record
[19] as to what he's answering, first of all.
[20] **MR. LANCASTER:** Okay.
[21] **MR. BLUTE:** Secondly, I think it just
[22] calls for an argument, an opinion. It's completely
[23] irrelevant to anything in this case. I'm not going
[24] to tell him not to answer on that ground. I don't

Page 41

[1] think that's appropriate. But again, I hope at some
[2] point we move on to the issues in this case and not
[3] the science —
[4] **MR. LANCASTER:** Me too. I'm on page
[5] one of 40 pages. But I'm having a hard time getting
[6] through one page. The answers are very slow and the
[7] objections are many.
[8] **MR. BLUTE:** Well, let me state this:
[9] I don't want to interfere with you. I want you to
[10] move forward. I do feel I have an obligation to my
[11] client to preserve objections for the record.
[12] **MR. LANCASTER:** I understand.
[13] **MR. BLUTE:** And it's not to interfere
[14] with you. I'll stop making these little speeches. I
[15] do think, though, that some of the areas of
[16] questioning are beyond what's in dispute. That's all
[17] I'm saying. If you want to ask it again or rephrase
[18] it...
[19] **BY MR. LANCASTER:**
[20] **Q:** Do you, Dr. Singer, feel an ethical
[21] obligation to convey truthful information in your
[22] newspaper articles?
[23] **A:** Yes.
[24] **Q:** Do you feel an obligation to convey

Page 42

[1] information that is accurate and balanced? Let me
[2] define "balanced."
[3] **MR. BLUTE:** Objection, as compound.
[4] There's two questions there.
[5] **Q:** Okay. Do you feel an obligation to
[6] publish information that is accurate?
[7] **A:** Yes.
[8] **Q:** Do you feel an obligation to publish
[9] information that is as scientifically precise as
[10] possible?
[11] **A:** To the extent that it will not confuse the
[12] average reader.
[13] **Q:** So in your communications through
[14] newspapers, you anticipate the perceptions of an
[15] average reader?
[16] **A:** I have to make the subject understandable.
[17] **Q:** In making the subject understandable, do
[18] you feel that gives you latitude to stray away from
[19] the truth?
[20] **A:** No.
[21] **Q:** Or to stray away from accuracy?
[22] **A:** No.
[23] **Q:** Does it give you the latitude to stray
[24] away from objectivity?

Page 43

[1] **A:** Is that a different question than the one
[2] you just asked me?
[3] **Q:** Is scientific objectivity different, in
[4] your mind, from expressing scientific truth?
[5] **A:** I see them as closely related.
[6] **Q:** Do you see any differences in the two
[7] concepts?
[8] **A:** Could you suggest a difference?
[9] **Q:** One could imagine a scientist publishing a
[10] newspaper article that was accurate about six
[11] relevant facts out of 10 on global warming, but
[12] omitted four other facts, that would lead the public
[13] to draw a different conclusion about the risks of the
[14] environmental change, or the risks of the toxin,
[15] et cetera. One could be accurate in reporting the
[16] six facts, but one might not be objective by omitting
[17] the other four facts. Do you agree that there's a
[18] distinction?
[19] **A:** Yes, I do. You've explained it very well.
[20] **Q:** As a practicing scientist, communicating
[21] to the general public through newspapers, do you feel
[22] a burden to be objective?
[23] **A:** I do in all of my publications.
[24] **Q:** Are you objective in all of your

Page 44

[1] publications?
[2] **A:** I believe that I am.
[3] **Q:** As a practitioner in the area of science
[4] policy, the transmission of how science is used in
[5] the policy making process — I'll make this a
[6] normative question — do you believe that the public
[7] has a justifiable concern, or that this is an issue
[8] of public concern, whether or not these
[9] communications are truthful, objective, and accurate?
[10] **A:** I think you've asked me this question
[11] before in a number of ways. Is this a different
[12] question?
[13] **Q:** Well, I'd like to have your answer again,
[14] if I did ask it before.
[15] **MR. BLUTE:** Answer, if you can. I
[16] object to the extent it's been asked and answered.
[17] But go ahead.
[18] **A:** Please repeat it.
[19] **Q:** Well, I'll make it very simple.
[20] **A:** Yes.
[21] **Q:** Is it an issue of public concern that the
[22] communications from practicing scientists be
[23] objective, accurate, and truthful?
[24] **A:** Yes.

Page 45

[1] **Q:** If the public were intentionally misled or
[2] even accidentally misled — well, I don't want to ask
[3] multiple questions.
[4] If the public is intentionally misled by
[5] inaccurate and unobjective reporting of the science,
[6] would this be an issue of public concern? And let's
[7] make it more specific; in the global warming issue.
[8] **A:** It should be.
[9] **Q:** If the public were accidentally
[10] misled — that's even without intent on the part of
[11] the scientist — by inaccurate and unbalanced
[12] reporting of the science, would this also be an issue
[13] of public concern in the global warming issue?
[14] **A:** Much less so.
[15] **Q:** Why much less so?
[16] **A:** Because there was no intent.
[17] **Q:** Isn't part of the concern on the part of
[18] the public that they get accurate information and
[19] truthful information, whether they receive — let's
[20] just leave it that way.
[21] **A:** Yes, but there's a difference in opinion
[22] as to what is accuracy and what is truthful. In
[23] other words, there's a scientific controversy. And
[24] in a controversy, both sides believe to have the

Page 46

[1] truth.
[2] So I don't know what truth you're
[3] referring to, unless you're referring to absolute
[4] truth. And if you refer to absolute truth, I wish
[5] you could define it for me.
[6] **Q:** Okay. I'll move on. What is the stated
[7] mission of the Science and Environmental Policy
[8] Project?
[9] **A:** The mission of the SEPP was to write books
[10] on science and environmental policy. That is the
[11] reason it was formed.
[12] **Q:** Was it formed to influence the direction
[13] of federal environmental policy?
[14] **A:** Not specifically. It was hoped, of
[15] course, that the book or any other publications would
[16] have a beneficial influence on the policy making
[17] process.
[18] **Q:** Now, when you say "a beneficial
[19] influence," what do you mean?
[20] **A:** By this, I mean that the policy making
[21] process would pay more attention, greater attention,
[22] than it does now to the underlying science.
[23] **Q:** Would it be fair to say, then, that the
[24] mission of your organization is to increase the

Page 47

[1] conveyance of objective scientific information to the
[2] policy making process?
[3] **A:** That is certainly one of the objectives.
[4] **Q:** Included in — have you not stated that
[5] the mission of your organization — have you not
[6] stated previously in writing that the mission of your
[7] organization is merely to study how government uses
[8] science?
[9] **MR. BLUTE:** I object. I think it's
[10] an unfair question. If there's a specific writing
[11] you want to direct his attention to, ask him if he
[12] remembers writing that.
[13] **Q:** Okay. Do you remember writing such a
[14] description of the mission of your organization?
[15] **A:** I think this is an incomplete statement.
[16] Obviously studying by itself does little good. I
[17] think the mission statement was to study and
[18] document.
[19] **Q:** So you do remember the phrase and you
[20] remember that it was "and document"?
[21] **A:** I don't know if I used that specific
[22] phrase, but that's what I would say now.
[23] **Q:** Okay. And would you include, then, in the
[24] mission to study and document how science is used by

Page 48

[1] government, or the policy making process, to convey
[2] specific scientific information to government in an
[3] effort to influence environmental policy?
[4] **A:** No, the intention was to use specific
[5] information, where available, as examples.
[6] **Q:** Okay. Isn't it true that the Science and
[7] Environmental Policy Project regularly communicates a
[8] specific viewpoint about global warming?
[9] **A:** I don't understand that question.
[10] **Q:** Is it fair to say that the Science and
[11] Environmental Policy Project publishes documents that
[12] espouse a specific viewpoint about global warming,
[13] about the risks of global warming? Let me back up.
[14] I'll withdraw that.
[15] **MR. BLUTE:** Okay.
[16] **Q:** Is it fair to say that the Science and
[17] Environmental Policy Project publishes documents
[18] often that contend there is not a risk of global
[19] warming?
[20] **A:** No.
[21] **Q:** Is it fair to say that the Science and
[22] Environmental Policy Project publishes information
[23] criticizing the use of the Intergovernmental Panel on
[24] Climate Change assessment of science?

Page 49

[1] **A:** You've used lawyer language in your
[2] question by referring to risk of global warming.
[3] **Q:** That was the previous question. I'm
[4] talking about this question.
[5] **A:** We have done an analysis of the IPCC
[6] report and of the summary and published that, yes.
[7] **Q:** Do your communications from the Science
[8] and Environmental Policy Project go at all beyond
[9] publishing the results of this single study you've
[10] mentioned concerning the risks of global warming?
[11] **A:** Yes, we write op-ed articles. We write
[12] updates on the scientific information underlying
[13] potential global warming.
[14] **Q:** Is this communication objective?
[15] **A:** To the best of my knowledge and to the
[16] best of my ability, it is objective, truthful,
[17] accurate, and complete.
[18] **Q:** Can a scientist responsibly advocate
[19] policy action or inaction and maintain scientific
[20] objectivity?
[21] **A:** Yes.
[22] **MR. LANCASTER:** I'd like to start
[23] with the first exhibit as the document you produced
[24] to me. I don't believe you put a document number on

Page 50

[1] it. But I'll call it the galley proof. We've
[2] referred to it many times. And I'd ask that to be
[3] marked as Exhibit 1, it being the —
[4] **MR. BLUTE:** Why don't we call it the
[5] galley proof.
[6] **MR. LANCASTER:** Should we call it the
[7] galley proof? I think we'll be all set with that.
[8] **MR. BLUTE:** Let me just state for
[9] the record it is a document with both typed and
[10] handwritten notations. And it bears the statement at
[11] the top, "This file has been output on a laser
[12] proofer. The type quality, including kerning and
[13] character outline, may be slightly distorted."
[14] **MR. LANCASTER:** And it bears a date,
[15] I think, 31 January '91.
[16] **MR. BLUTE:** Why don't we mark that.
[17] (Exhibit 1 marked
[18] for identification.)
[19] (Recess taken.)
[20] **BY MR. LANCASTER:**
[21] **Q:** Back on. Just for this document, do you
[22] recognize this document, Dr. Singer?
[23] **A:** Yes.
[24] **Q:** Can you tell me what that document is?

Page 51

[1] **A:** This is a laser proof of the Cosmos
[2] Journal article by Revelle, Starr, and myself.
[3] **Q:** Dr. Singer, I'd like to give you — I have
[4] to do something else first, sorry — strike that.
[5] Looking at this galley proof, at the top
[6] of the second page, you speak of global warming,
[7] fourth line down, is that correct?
[8] **A:** Yes.
[9] **Q:** And then under — at the bottom of the
[10] page, the caption, "The Climate Record," you speak of
[11] a temperature increase — we're actually onto the top
[12] of the third page now — the temperature increase of
[13] about 1.6 degrees Celsius.
[14] **A:** Yes.
[15] **Q:** Is that correct?
[16] **A:** Yes.
[17] **MR. BLUTE:** Hold on. Let me just
[18] state for the record, I object, because it's both in
[19] type — "1.5" in type and there's a "6" delineated in
[20] there in pencil.
[21] **Q:** Good. 1.5, in the original, degrees
[22] Celsius, with a marking, and a 6 marked above the 5
[23] in handwritten script, is that correct?
[24] **A:** Yes.

Page 52

[1] Q: What temperature would this be, an
[2] increase in what?
[3] A: You're referring to the 1.6 now?
[4] Q: Yes, and to the — well, let's just stick
[5] with the 1.6. Would this be global — I'll leave the
[6] first question.
[7] A: This would be the increase calculated by
[8] the prevailing theory for global average temperature.
[9] Q: And for what time period would this
[10] average be made?
[11] A: You have to be more precise. Do you mean
[12] time interval, or time period?
[13] Q: Time interval.
[14] A: From about 1880 to the present.
[15] Q: Now, when you talk about a temperature
[16] increase, how does the scientific community generally
[17] measure that temperature increase?
[18] A: Up until about 15 years ago, this was done
[19] by thermometers located at various surface locations.
[20] Q: And how would they publish those results?
[21] How would they assemble those measurements into a
[22] published result?
[23] And what I'm after here is, are these
[24] numbers — do they publish a temperature for every

Page 53

[1] five-minute interval of the day? Do they typically
[2] publish a temperature for every hour of the day?
[3] Generally, how are those averages created in the
[4] published work?
[5] A: This is a very specialized job for people
[6] who assemble such data from various stations.
[7] Stations have different procedures. Some stations
[8] will record temperature every four hours, some twice
[9] a day, some continuously.
[10] Q: In 1988, Dr. James Hansen presented his
[11] scientific results concerning temperature increase to
[12] Congress. Are you familiar with that proceeding?
[13] A: Yes, I am.
[14] Q: And I trust you're familiar with the
[15] temperature record that he presented?
[16] A: Yes, I am.
[17] Q: The results that he presented were
[18] displayed how?
[19] A: They were displayed as a northern
[20] hemisphere temperature averaged over — a rolling
[21] average over a several-year period — and I don't
[22] recall the details — starting around 1880 up to
[23] 1988.
[24] Q: And are you familiar with the temperature

Page 54

[1] record of Jones and Wigley?
[2] A: I recall it, but I'm less familiar with
[3] it.
[4] Q: Is that temperature of Jones and Wigley
[5] typically considered global average temperature?
[6] A: Yes, I believe so.
[7] Q: And that's conveyed as global annually
[8] averaged temperature, is it not?
[9] A: I don't recall whether that's annual —
[10] whether it's a rolling average that is averaged over
[11] a number of years.
[12] Q: Okay. Below this last point we were in
[13] your document —
[14] A: Which page?
[15] Q: On the third page. Actually, it's marked
[16] at the top "Galley: 002." In the first full
[17] paragraph, there's the —
[18] MR. BLUTE: Read the first three
[19] words of the paragraph so we know.
[20] Q: "But has there been a climate effect..."
[21] MR. BLUTE: Thank you.
[22] Q: And the second sentence, "The data are
[23] ambiguous to say the least. Advocates for immediate
[24] action profess to see a global warming of about 0.5

Page 55

[1] degrees C since 1880, and point to record global
[2] temperatures in the 1980s and the warmest year on
[3] record in 1990."
[4] A: Yes.
[5] Q: Now, how would one characterize the
[6] warmest year on record?
[7] MR. BLUTE: Objection.
[8] Q: How would one determine if 1990 were a
[9] warmer year than any other year?
[10] A: The one way to do this is to take the
[11] average over the year and compare it with other
[12] averages over preceding years.
[13] Q: And that's typically done, is it not, in
[14] the publication of —
[15] A: I have not seen that publication. I think
[16] this was a claim made in newspapers.
[17] Q: Is it common practice to report global
[18] temperature change as annually averaged data?
[19] A: That — it would be the most common
[20] practice, yes.
[21] Q: Okay. Thank you. In the sentence just
[22] above where we are, "Advocates for immediate action
[23] profess to see a global warming of about 0.5
[24] degrees C...", again, this is global average

Page 56

[1] temperature, is that correct?
[2] **A:** Yes.
[3] **Q:** And it would be reasonable, if a reader
[4] interpreted that as global annually averaged
[5] temperature, a nonscientific reader?
[6] **A:** I assume.
[7] **Q:** At the end of the paragraph, speaking
[8] about — the same paragraph, "...global atmospheric
[9] (rather than surface) temperatures measured by Tiros
[10] weather satellites...", would it be a reasonable
[11] assumption for a reader that you're talking about
[12] global annually averaged temperatures?
[13] **MR. BLUTE:** I object. You can
[14] answer, if you can.
[15] **A:** Yes.
[16] **MR. LANCASTER:** Objection on what
[17] ground?
[18] **MR. BLUTE:** I think your asking
[19] Dr. Singer to put himself in the mind of a reader is
[20] an inappropriate question. But if he can answer it,
[21] let him answer it. I think it's an inappropriate
[22] question. You're asking him what someone reading
[23] this —
[24] **BY MR. LANCASTER:**

Page 57

[1] **Q:** Did we not discuss before that when you
[2] write an article you anticipate what a reader — how
[3] a reader will interpret it?
[4] **A:** Yes.
[5] **Q:** When you wrote this article, did you
[6] anticipate how a reader would interpret your words?
[7] **A:** The specific question as you raised it
[8] did not occur to me. Since we're talking about
[9] temperature change over long periods, the question
[10] about whether you average over one year or two years
[11] is not particularly relevant.
[12] **Q:** When you wrote this sentence, you were
[13] referring to global average temperature, correct?
[14] **A:** I think throughout we refer to global
[15] average temperatures.
[16] **Q:** So two paragraphs down, where you say,
[17] "Fair to say," let's find that paragraph — "It is
[18] therefore fair to say" — small paragraph, fourth
[19] paragraph down —
[20] **A:** Yes.
[21] **Q:** — "It is therefore fair to say that we
[22] haven't seen the huge greenhouse warming, of between
[23] 0.7 and 2.5 degrees C..." Again, a reader would
[24] understand this to mean global average temperature?

Page 58

[1] **MR. BLUTE:** Objection.
[2] **Q:** Again, you meant, as you wrote this —
[3] you're referring to global average temperature,
[4] correct?
[5] **A:** Let's be precise. I referred to
[6] temperatures averaged over the globe.
[7] **Q:** Yes.
[8] **A:** And averaged over the season — over the
[9] seasons. Is that what you're referring to?
[10] **Q:** I'm talking about —
[11] **A:** What average are you speaking about? Are
[12] you speaking about a geographic average? Are you
[13] speaking about a temporal average?
[14] **Q:** Well, I'm talking about a global
[15] geographic average, is that correct?
[16] **A:** Yes.
[17] **Q:** Okay. And if you were to try and
[18] demonstrate this warming between 0.7 and 2.5 degrees
[19] C, would you normally do so using annually averaged
[20] data?
[21] **A:** Yes.
[22] **Q:** Under the section "Mathematical Models,"
[23] you referred to the calculated average global
[24] increase. Let's find this. Halfway down the

Page 59

[1] paragraph, "There is general agreement..." begins the
[2] sentence.
[3] **A:** Yep.
[4] **Q:** And you refer to global increase ranges
[5] from 1.5 and 4.5 degrees C.
[6] **A:** Yes.
[7] **Q:** Again, this is global average temperature?
[8] **A:** Average global increase, which is a change
[9] in temperature.
[10] **Q:** Yes. Would it be fair for a reader to
[11] assume that you mean global annually averaged
[12] temperature?
[13] **A:** As opposed to what?
[14] **Q:** As opposed to any other way of producing
[15] these results or assessing or measuring these
[16] results.
[17] **A:** Well, you would normally eliminate the sea
[18] stone variation. So in that sense you would at least
[19] average over the year.
[20] **Q:** Okay. Thank you. Okay, moving down to
[21] "Impacts of Climate Change," you refer to a modest
[22] average warming —
[23] **A:** Yes.
[24] **Q:** — in the next century of less than one

Page 60

[1] degree Celsius.
[2] **A:** Yes.
[3] **Q:** Again, this would refer to global average
[4] temperature, wouldn't it?
[5] **A:** Yes.
[6] **Q:** So it's true that throughout this article,
[7] up through and including this paragraph, that every
[8] time you speak about global temperature rise you're
[9] speaking about global average temperature?
[10] **A:** Averaging, again, over what? Over —
[11] geographically?
[12] **Q:** Geographically, yes.
[13] **A:** Yes.
[14] **Q:** The second half of this sentence,
[15] "...normal year-to-year variation," is there any
[16] reason for a reader to expect that phrase to mean
[17] anything other than the variation in global annually
[18] averaged temperature from one year to the next?
[19] **A:** Correct.
[20] **MR. BLUTE:** Objection.
[21] **MR. LANCASTER:** Objection on what
[22] ground?
[23] **MR. BLUTE:** Again, I just don't
[24] think — when you say is there any reason why a

Page 61

[1] reader would expect it to mean something else, do you
[2] mean in this article? Or do you mean if someone is
[3] reading this may take whatever — I think you're
[4] asking him to put himself in the mind of a reader. I
[5] don't think that's an appropriate question.
[6] **Q:** Okay. When you wrote that particular
[7] sentence, —
[8] **MR. BLUTE:** He can tell you what he
[9] meant.
[10] **Q:** — what did you mean? Did you mean
[11] year-to-year variation global annually averaged
[12] temperature?
[13] **A:** In the first place, I don't recall now
[14] whether I wrote this sentence or not. There were, as
[15] you know, two other co-authors. But this is the
[16] final or next to final version. So you may ask me
[17] about this without suggesting that I actually wrote
[18] the sentence.
[19] **Q:** As you read that sentence, —
[20] **A:** Yes.
[21] **Q:** — of which you are an author, —
[22] **A:** Yes.
[23] **Q:** — is it fair to take that sentence to
[24] mean normal year-to-year variation in the context of

Page 62

[1] global annually averaged temperature?
[2] **A:** Yes.
[3] **Q:** Thank you. Can you think of any reason up
[4] to this point in the article why a reader would be
[5] led to believe that the meaning in this sentence
[6] would refer to any different way of averaging the
[7] temperature, any different?
[8] **A:** I'm puzzled by your question. What other
[9] interpretation do you have in mind?
[10] **Q:** A variation in some — something other
[11] than global average temperature.
[12] **A:** Such as?
[13] **Q:** A variation in temperature at one
[14] location.
[15] **A:** Oh. Let me think about this. We don't
[16] refer to specific locations. I think I refer to
[17] global temperatures.
[18] **Q:** Thank you.
[19] **A:** Except where I specifically refer to
[20] elevation, such as in the end of that sentence, it
[21] refers to "high latitudes."
[22] **Q:** Yes.
[23] **A:** That is not global.
[24] **Q:** Understood.

Page 63

[1] **A:** And it refers to winter. That is not
[2] averaged over the year, over the annual cycle.
[3] **Q:** So just to get this clear, the warming in
[4] the next century will be well below the normal
[5] difference in global average temperature from one
[6] year to the next; is that the meaning of that?
[7] **A:** That is what we regarded as the most
[8] likely outcome.
[9] **Q:** Okay. So you allow a reader here to take
[10] your meaning to be that year-to-year variations in
[11] global average temperature are greater than the
[12] modest increase in global annually averaged
[13] temperature that you expect as the most likely
[14] outcome?
[15] **MR. BLUTE:** Objection. You can
[16] answer, if you can.
[17] **A:** I think you can read the sentence. It's
[18] perfectly clear.
[19] **MR. LANCASTER:** Grounds for the
[20] objection?
[21] **MR. BLUTE:** Again, I think the words
[22] say what they say. It speaks for itself. I don't
[23] know how an individual reader takes it. It seems to
[24] me Dr. Singer can't talk about that. Also, I think

Page 64

[1] the question is just an argument.
[2] **MR. LANCASTER:** I'm just trying to
[3] get very clear what is meant here.
[4] **MR. BLUTE:** I'm just making an
[5] objection for the record. There's no need to argue
[6] about this. I'm just preserving it for later on. We
[7] can argue later on if they're raised.
[8] **BY MR. LANCASTER:**
[9] **Q:** How should a reader interpret your use of
[10] the word "normal"? What do you mean by the use of
[11] the word "normal"?
[12] **A:** Where does it occur?
[13] **Q:** "Normal year-to-year variation."
[14] **A:** This means to us, or meant to us, since
[15] one of the co-authors is now deceased, that there
[16] could be year-to-year variations caused by unusual
[17] events, such as volcanoes. And that would be
[18] abnormal.
[19] **Q:** Given that this is an article written by
[20] three scientists, would it be a reasonable
[21] interpretation to take it as the range defined by the
[22] normal statistical distribution?
[23] **A:** The word "normal" is not used here in a
[24] technical sense.

Page 65

[1] **Q:** This is a technical article, is it not?
[2] **A:** Yeah, this is an article in a popular
[3] journal to be read by nonscientists. "Normal,"
[4] therefore, means usual.
[5] **Q:** Usual, okay. Would it be fair to say that
[6] you are familiar with the historical global
[7] temperature record?
[8] **A:** I've done no original work in this, so I'm
[9] generally familiar with what I've seen in the
[10] literature.
[11] **Q:** Would it be fair to say that you're
[12] familiar with the temperature record, or are you not
[13] familiar with it?
[14] **A:** I don't understand what you mean by
[15] "familiar."
[16] **Q:** Have you looked at year-to-year variation
[17] in the global average temperature record?
[18] **A:** I have seen a paper dealing with the
[19] subject.
[20] **Q:** What paper is that?
[21] **A:** A paper by Andrew Solow, S-o-l-o-w, of the
[22] Woods Hole Oceanographic Institution.
[23] **Q:** Had you seen that paper before authoring
[24] this paragraph?

Page 66

[1] **A:** I don't recall.
[2] **Q:** Would you think that you would have
[3] authored a sentence talking about normal year-to-year
[4] variation in global average temperature without
[5] having made yourself familiar with what the normal
[6] variation in global average temperature was?
[7] **MR. BLUTE:** Objection.
[8] **MR. LANCASTER:** On what ground?
[9] **MR. BLUTE:** Again, I think, first of
[10] all, there are three authors. Your question
[11] assumes — I don't know who wrote this, but your
[12] question assumes that Dr. Singer did. He's told you
[13] that there are three authors to this article. So I
[14] think you have to be precise in that question. I
[15] think your question assumes something which may or
[16] may not be true.
[17] Secondly, I think it's — again, if
[18] you want to ask him did you or didn't you, he can
[19] give you his best memory. But I think the way you
[20] phrased it is really just an argument.
[21] **A:** Are you familiar with the work of Solow on
[22] this particular issue?
[23] **MR. BLUTE:** Let him ask the
[24] questions, Dr. Singer.

Page 67

[1] **BY MR. LANCASTER:**
[2] **Q:** Do you maintain that you do not remember
[3] writing — drafting that sentence?
[4] **A:** I did the initial draft. There were many
[5] changes made based on inputs I received. So I cannot
[6] be sure that I wrote this particular sentence or this
[7] particular word.
[8] **Q:** Did either of the other authors, Starr or
[9] Revelle, do the actual editing of the manuscript?
[10] **A:** Yes.
[11] **Q:** Which of those authors did the actual
[12] editing of the manuscript?
[13] **A:** Certainly Starr, possibly Revelle, I don't
[14] recall, plus a number of other people to whom I sent
[15] the manuscript for comment.
[16] **Q:** Who are those persons?
[17] **A:** Hugh Ellsaesser, as I recall, possibly,
[18] although I'm not absolutely sure, possibly Richard
[19] Lindzen, L-i-n-d-z-e-n.
[20] **Q:** Is it possible you sent it to Dr.
[21] Michaels?
[22] **A:** It is possible.
[23] **Q:** Is it possible you sent it to Dr. Balling?
[24] **A:** Yes, it is possible.

Page 68

[1] Q: Would you have any way of determining
[2] whether or not you did?
[3] A: Not at this stage.
[4] Q: Is it possible that one of those four
[5] scientists wrote that sentence, specifically the
[6] sentence — the phrase "well below the normal
[7] year-to-year variation"?
[8] A: It is possible they suggested it.
[9] Q: Do you know which of them might have
[10] suggested it?
[11] A: No, I do not recall.
[12] Q: But you don't remember writing that
[13] phrase?
[14] A: Not specifically.
[15] Q: Do you remember at what draft it appeared,
[16] what version?
[17] A: No, I do not.
[18] Q: Was this manuscript created in a computer,
[19] word processor?
[20] A: Yes.
[21] Q: Whose computer?
[22] A: The computer was — belonged to an
[23] institute that I was using on a courtesy basis. I
[24] did not have a computer of my own.

Page 69

[1] Q: Whose computer?
[2] A: It belonged to The Washington Institute.
[3] Q: Did you store this document on their hard
[4] disk?
[5] A: I don't recall.
[6] Q: Do you recall saving a copy on a floppy
[7] disk?
[8] A: I must have saved a copy, but I don't
[9] recall how I saved it. In any case, my practice was
[10] to incorporate changes as they were suggested. So
[11] the copy I saved would be identical with this copy.
[12] If I saved a copy, it would be identical with this
[13] copy, except for changes made by the editor.
[14] Q: The editor being?
[15] A: The editor of the journal.
[16] Q: Being Mr. Tanzer?
[17] A: Mr. Tanzer, yes.
[18] Q: Would your backup copy, if it existed on
[19] the floppy disk — would that floppy disk have saved
[20] any other drafts?
[21] A: No.
[22] Q: Previous drafts?
[23] A: No, I would simply write over it.
[24] Q: Was this your general practice in creating

Page 70

[1] a manuscript to each version write over the previous
[2] version so that the old language was not saved?
[3] A: Yes.
[4] Q: Was this your general practice with other
[5] articles you were working on?
[6] A: Except when there was some special reason
[7] to save an earlier draft because of some paragraphs
[8] that I wanted to keep but might use later in some
[9] other connection.
[10] Q: Would that have applied to any of the
[11] paragraphs in the Cosmos article?
[12] A: I don't believe so.
[13] Q: You didn't use these paragraphs in other
[14] publications?
[15] A: Yes, I did, and I had the final version on
[16] a disk. I don't recall whether it was a floppy disk
[17] or a hard disk.
[18] Q: Is there a reason why that computer disk
[19] wasn't provided in the answer to the request for
[20] documents that specifically asked for computer disks?
[21] A: I have to consult my attorney here.
[22] MR. BLUTE: Well, we'll go back and
[23] check and see what's there. There was no conscious
[24] decision not to produce something if it was

Page 71

[1] requested.
[2] I'll have to go back and look at the
[3] request. And if it falls under the scope of the
[4] request, we'll certainly turn it over.
[5] MR. LANCASTER: Okay. Thank you.
[6] MR. BLUTE: But my understanding is
[7] you have the final — the final. It's my
[8] understanding it won't show anything different.
[9] MR. LANCASTER: We're interested in
[10] every nuance of drafting.
[11] MR. BLUTE: Okay. Let's deal with
[12] that off the record. We'll check.
[13] BY MR. LANCASTER:
[14] Q: Okay. To get back on —
[15] MR. BLUTE: Excuse me one second.
[16] Let me just —
[17] (Witness conferring with counsel.)
[18] BY MR. LANCASTER:
[19] Q: I'd like to come back to the meaning of
[20] "normal year-to-year variation." What, in your mind,
[21] would be the normal year-to-year variation in global
[22] average temperature?
[23] A: You want a quantitative answer?
[24] Q: Yes.

Page 72

[1] A: I would have to consult Solow's paper.
[2] Q: I'd like to show you exhibit —
[3] MR. LANCASTER: We have three pages.
[4] Can we staple them and mark them as one exhibit?
[5] MR. BLUTE: Yes. Are they related?
[6] MR. LANCASTER: All three are
[7] related.
[8] MR. BLUTE: Yeah.
[9] (Exhibit 2 marked
[10] for identification.)
[11] Q: To describe Exhibit 2, there's the words,
[12] in bold, "Global and Hemispheric" on the first page;
[13] "glob temp, J&W" on the second page, which is marked
[14] at the bottom "page 1"; the third page, "Jones abs
[15] difs," also marked "page 1" at the bottom.
[16] Dr. Singer, the first page, does this
[17] appear to be a record of temperatures?
[18] A: I'm trying to find my way around this.
[19] These are annual temperature anomalies, mm-hmm.
[20] MR. BLUTE: Let me just object.
[21] Dr. Singer — I don't know whether he's seen this
[22] document before.
[23] MR. LANCASTER: I don't know either.
[24] MR. BLUTE: If he hasn't, perhaps you

Page 73

[1] should state what it is and then go on from there.
[2] MR. LANCASTER: Oh, okay. I didn't
[3] know if I was allowed to do that.
[4] MR. BLUTE: Yeah.
[5] BY MR. LANCASTER:
[6] Q: This is a record of temperatures from a
[7] document called Trends '90, published by the CDIC,
[8] the Carbon Dioxide Information Center of the
[9] Department of Energy. Are you familiar with that
[10] organization, CDIC?
[11] A: Not by that name.
[12] Q: Have you heard of the Trends '90
[13] publication?
[14] A: (No response)
[15] Q: Have you ever seen this publication,
[16] Trends '90?
[17] A: Published by whom?
[18] Q: Published by the Department of Energy,
[19] CDIC.
[20] A: Oh, I think I may have seen such a book.
[21] I don't recall, though.
[22] Q: This page is the Jones and Wigley
[23] temperature record from that publication. Does this
[24] record look to you to be what you remember to be the

Page 74

[1] temperature record from 1861 to 1988 from your
[2] looking at it in other publications?
[3] A: It's presented in quite a different way;
[4] and therefore, not easily recognizable. I have a
[5] graph in mind, a picture, of annual temperatures
[6] showing a rather wide black band of considerable
[7] width.
[8] Q: Mm-hmm. If we look at the second page of
[9] this exhibit —
[10] A: Yes.
[11] Q: — there are plotted the third column of
[12] data, global temperature data.
[13] A: Mm-hmm.
[14] Q: Does that curve look familiar to you?
[15] A: Yes, although it looks quite different
[16] from what Solow presented.
[17] Q: I see. Does this — do you doubt that the
[18] data plotted on this curve conformed to the third
[19] column listed in the Trends '90 page, or the Jones
[20] and Wigley record?
[21] MR. BLUTE: I object to that.
[22] Q: Do you have any reason, as you look at it,
[23] to dispute or doubt that it is?
[24] MR. BLUTE: I object.

Page 75

[1] Q: Well, should we go point by point, then?
[2] A: I assume —
[3] Q: I mean, we can construct it, if you want.
[4] MR. BLUTE: No, why don't we just
[5] state, if you want, that it's your understanding that
[6] this chart matches up with the information on the
[7] first page.
[8] MR. LANCASTER: Okay.
[9] MR. BLUTE: I'm not fighting you on
[10] it. I don't know it to be true. If you want to
[11] state that that's your understanding, then we can go
[12] from there, without acknowledging it, that's all.
[13] BY MR. LANCASTER:
[14] Q: Okay. It's my understanding that these
[15] points plotted on the second page are the third
[16] column.
[17] A: I would prefer to consult with an expert
[18] that I know personally regarding this analysis,
[19] because it is well known that data can be used
[20] selectively. I'm not accusing of these people of
[21] doing so.
[22] Q: Sure. I'm willing to go through these
[23] points and check them. We could check the first
[24] point. And I would be patient to let you do so to

Page 76

[1] give you some measure of confidence that these are
[2] related.

[3] **MR. BLUTE:** Let me say this: Is it
[4] your — are you representing to us that you've
[5] reviewed the documents —

[6] **MR. LANCASTER:** Yes.

[7] **MR. BLUTE:** — and that the graph on
[8] the second page depicts in graphic form the
[9] information that's on the first page?

[10] **MR. LANCASTER:** Yes.

[11] **MR. BLUTE:** All right. Subject to
[12] our reviewing it and disagreeing with you, we'll
[13] accept that representation for the purposes of your
[14] questioning.

[15] **MR. LANCASTER:** Okay. Thank you.

[16] **BY MR. LANCASTER:**

[17] **Q:** Then let's move on to the third page —
[18] thank you, Joe — to the third page, where are
[19] plotted the differences.

[20] And the first tall black line on this
[21] chart would refer to the year 1862 temperature
[22] anomaly minus the 1861 temperature anomaly; in other
[23] words, the absolute difference between those two
[24] average annual temperatures.

Page 78

[1] representation on the record as to what you
[2] understand this graph to be and then we will accept
[3] that representation and answer your questions,
[4] subject to our disagreeing, should we upon further
[5] review misrepresent it.

[6] **BY MR. LANCASTER:**

[7] **Q:** Let me represent to you that this third
[8] plot on the third page is a plot of the absolute
[9] differences between neighboring years, with the
[10] previous year value being subtracted from the
[11] subsequent year value.

[12] **A:** May I ask who prepared this plot?

[13] **Q:** Sure. I did, okay?

[14] **MR. BLUTE:** All right. So in other
[15] words — let me just — this plot of Jones absolute
[16] differences is a document that you prepared?

[17] **MR. LANCASTER:** Yes.

[18] **MR. BLUTE:** Based on the data in the
[19] previous two pages?

[20] **MR. LANCASTER:** Based on the cover
[21] sheet.

[22] **MR. BLUTE:** Based on the cover sheet.

[23] **MR. LANCASTER:** The second page is a
[24] representation of the third column, global

Page 77

[1] **MR. BLUTE:** All right. Now, that I
[2] don't see.

[3] **Q:** All right. Let's look at it carefully.
[4] We've got essentially 0.53 less 0.38 equaling 0.15,
[5] which is the first column.

[6] **MR. BLUTE:** Yeah, I guess what I
[7] don't understand, without any — if you want to make
[8] a representation as to what this is, why don't you do
[9] that. But there's nothing on this document which
[10] tells me what it depicts.

[11] **MR. LANCASTER:** Well, it's the Jones
[12] absolute differences.

[13] **MR. BLUTE:** I see at the top, okay.

[14] **MR. LANCASTER:** That's cryptic. And
[15] I'm sorry I didn't have time to lay out a detailed
[16] description on the page.

[17] **MR. BLUTE:** I take it that this
[18] document is part of a larger document which has some
[19] text that describes that; is that fair to say?

[20] **MR. LANCASTER:** No, it isn't. These
[21] two documents are a rendering of this global
[22] temperature and a showing of the interannual
[23] variation.

[24] **MR. BLUTE:** Why don't you make a

Page 79

[1] temperatures.

[2] **MR. BLUTE:** Is that also a document
[3] that you prepared?

[4] **MR. LANCASTER:** Yes.

[5] **MR. BLUTE:** All right. What I would
[6] like to do, that being the case, is separate out the
[7] Jones — the Trends '90 graph as a separate exhibit
[8] so it is clear on the record that they are not
[9] related in the sense that — I thought this all came
[10] as one document. I just want to make that clear on
[11] the record.

[12] **MR. LANCASTER:** We can do that, break
[13] them into two exhibits?

[14] **MR. BLUTE:** Yeah. For the record,
[15] Singer Exhibit 2 is a document entitled "Global and
[16] Hemispheric Temperature Anomalies" from Trends '90.

[17] Then we'll make Exhibit 3 and Exhibit
[18] 4 two — Exhibits 3 and 4 are charts prepared by
[19] Dr. Lancaster, which he represents to us were drawn
[20] from Exhibit 1. Is that fair?

[21] **MR. LANCASTER:** From Exhibit 2.

[22] **MR. BLUTE:** I apologize, Exhibit 2.

[23] (Exhibits 3 and 4 marked
[24] for identification.)

Page 80

[1] **MR. BLUTE:** Again, for the record, in
[2] order to move forward in the deposition, we will
[3] accept Dr. Lancaster's representation that these
[4] graphs accurately reflect the information on Singer
[5] Exhibit 2, —
[6] **MR. LANCASTER:** Understood.
[7] **MR. BLUTE:** — subject to our
[8] reviewing them, and also subject to the statement
[9] that we do not — we're not stipulating that the
[10] numbers in Exhibit 2 are accurate or correct.
[11] **MR. LANCASTER:** Understood.
[12] **A:** From which publication were these numbers
[13] taken? There are a number of publications listed
[14] here.
[15] **Q:** These are the CDIC version of the Jones
[16] and Wigley record. I don't know —
[17] **A:** There's no reference given.
[18] **Q:** No, I agree. I don't know from which
[19] publication they derived those numbers or whether
[20] they are assembled from a number of publications.
[21] I just would like to go to Exhibit 4,
[22] then.
[23] **MR. BLUTE:** Let me — can I just take
[24] a short break and discuss something with him outside?

Page 81

[1] **MR. LANCASTER:** Sure.
[2] (Witness conferring with counsel.)
[3] **MR. BLUTE:** Okay. Just for the
[4] record, it's unclear on Exhibit 2 where these numbers
[5] came from; in other words, which of the references we
[6] can go to to see whether these numbers are reported.
[7] And that's the reason for Dr. Singer's discomfort in
[8] accepting them.
[9] **MR. LANCASTER:** I understand.
[10] **MR. BLUTE:** That being said, let's go
[11] on with the questioning. We are not conceding that
[12] these are or are not accurate numbers. We're not
[13] disputing them with you now. And we'll accept your
[14] representation for the purposes of questioning —
[15] **MR. LANCASTER:** Okay.
[16] **MR. BLUTE:** — that you've accurately
[17] portrayed graphically the information that appears on
[18] Singer Exhibit 2.
[19] **MR. LANCASTER:** Understood.
[20] **MR. BLUTE:** Okay.
[21] **BY MR. LANCASTER:**
[22] **Q:** Looking at Exhibit 4, what would you take
[23] to be the usual value?
[24] **A:** Of?

Page 82

[1] **Q:** Of these numbers. Let me put it this
[2] way: If you were looking at these data from a
[3] scientific point of view, trying to characterize the
[4] normal value, how would you determine that value?
[5] **MR. BLUTE:** Object to that question.
[6] Go ahead, if you understand it.
[7] **A:** Well, this is a misleading question.
[8] Based on misleading knowledge of what this
[9] represents, it is well known that there's something
[10] called persistence in climate.
[11] And what we're seeing here is the effect
[12] of year-to-year persistence which would, in the view
[13] of statisticians — I'm not expert on this — reduce
[14] the year-to-year variability, but not the variability
[15] over a number of years.
[16] In other words, this is a question that
[17] you should address to someone who's properly
[18] qualified in climate statistics, which you're not, as
[19] an attorney, and I'm not as an atmospheric physicist.
[20] **Q:** If you write a sentence where you refer
[21] to the normal year-to-year variation, would it be
[22] reasonable for a reader to investigate normal
[23] year-to-year variation?
[24] **A:** (Nodding)

Page 83

[1] **Q:** Can you answer verbally?
[2] **MR. BLUTE:** You have to answer
[3] verbally if you have an answer to that.
[4] **A:** Is your question finished?
[5] **Q:** The first one, would it be reasonable for
[6] a reader to investigate year-to-year variation in
[7] global average temperature?
[8] **MR. BLUTE:** I object to the question,
[9] but you can answer.
[10] **A:** No.
[11] **Q:** It wouldn't be reasonable for a reader to
[12] try and investigate year-to-year variation?
[13] **A:** I don't think so. I don't think they
[14] would make an effort to do so.
[15] **Q:** Normally a reader would not make an effort
[16] to do so?
[17] **A:** Correct.
[18] **Q:** Okay. If I, as a scientist, not as an
[19] attorney, read the Cosmos article, normal
[20] year-to-year variation, and take the word "normal" to
[21] mean the mean variation plus or minus the standard
[22] deviation, would I be acting unreasonably?
[23] **A:** Well, as we discussed earlier, the word
[24] "normal" here is not used in the scientific sense.

Page 84

[1] It's not — we don't have what's called a normal
[2] distribution, a Gaussian distribution, nor is there
[3] any reason to expect one.
[4] **Q:** Understood. Looking at this record of
[5] year-to-year variations, —
[6] **A:** Which one?
[7] **Q:** — on the third page, Exhibit 4, —
[8] **MR. BLUTE:** Exhibit 4.
[9] **A:** Exhibit 4, okay.
[10] **Q:** — would it be fair to say that the
[11] normal, meaning usual in the sense that you applied,
[12] variation in global annually averaged temperature is
[13] less than 0.2 degrees Celsius?
[14] **A:** No, it would be misleading.
[15] **Q:** Would it be fair to say that the normal
[16] year-to-year variation is less than 0.3 degrees
[17] Celsius?
[18] **A:** That would also be misleading.
[19] **Q:** Would it be fair to say that the normal
[20] year-to-year variation in global annually averaged
[21] temperature is less than 0.4 degrees Celsius?
[22] **A:** In my view, one should not look at
[23] Exhibit 4. One should look at Exhibit 3 in order to
[24] answer your question.

Page 85

[1] **Q:** Then let's look at Exhibit 3. And I'll
[2] ask the same question.
[3] As you look at Exhibit 3, what do you
[4] determine to be the normal year-to-year variation in
[5] global annually averaged temperature?
[6] **A:** I would guess that the average reader
[7] presented with this curve would estimate the
[8] year-to-year variation by the spread of the points
[9] that you have drawn there.
[10] **Q:** Can you give me an estimate of what that
[11] number would be or the range that it would be or a
[12] number that with some confidence you can estimate
[13] that number would be less than?
[14] **A:** I'm trying to put myself in the place of
[15] an average reader.
[16] **Q:** Let me — let me ask you, as a scientist,
[17] who published that sentence. Can you turn the words
[18] "normal year-to-year variation" for me into a number
[19] in degrees Celsius or into a range less than a
[20] certain number degrees Celsius?
[21] **A:** Well, as you're well aware, this is an
[22] issue that Roger Revelle and I discussed in the
[23] editing of the article. And we jointly decided to
[24] take out any reference to a number. And therefore,

Page 86

[1] we deleted the words on the laser proof which said
[2] "less than one degree Celsius."
[3] **Q:** Could you please answer my question?
[4] **MR. BLUTE:** I'm a little confused
[5] now. Is your question directed to this graph?
[6] **MR. LANCASTER:** Yes.
[7] **MR. BLUTE:** Or is your question
[8] directed to the article? What is it directed to?
[9] Why don't you rephrase it, please.
[10] **MR. LANCASTER:** It's directed to the
[11] graph. Could you read it back for me, please?
[12] (Question read.)
[13] **A:** Looking at the graph, Exhibit 3, that
[14] you've presented us with, which was drawn by you,
[15] based on data that you have not yet completely
[16] identified to us, the approximate number will be half
[17] a degree centigrade.
[18] **Q:** Thank you. Looking at Exhibit 2, as
[19] graphically depicted in Exhibit 3 and Exhibit 4, what
[20] is shown to be the largest difference in global
[21] average temperature from one year to the next?
[22] **A:** Using Exhibit 4, which depicts only
[23] successive years, the largest is .4 degrees.
[24] **Q:** Now, using Exhibit 4, where the successive

Page 87

[1] year differences are shown in global average
[2] temperature, can you estimate how many times from one
[3] year to the next global average temperature changed
[4] by more than 0.25 degrees?
[5] **A:** I can't estimate it, but I can count it.
[6] **Q:** Can you count it?
[7] **A:** Eight.
[8] **Q:** Out of 127 years, temperature differences
[9] between each year, with eight of those differences
[10] exceeding 0.25 degrees Celsius, and the greatest
[11] difference being 0.4, you are comfortable in saying
[12] that the normal year-to-year variation in global
[13] average temperature is about 0.5 degrees Celsius, is
[14] that correct?
[15] **A:** Looking at your Exhibit 3, yes.
[16] **Q:** Now looking at Exhibit 3 and 4 together,
[17] would you still stand by that assessment?
[18] **A:** Exhibit 3 and 4 should not be looked at
[19] together. They're not comparable.
[20] **Q:** Looking only at Exhibit 4, if a reader of
[21] your Cosmos Journal article obtained the temperature
[22] record that is before us as Exhibit 2, and looked at
[23] the year-to-year variations in the way they have been
[24] displayed in Exhibit 4, what normal year-to-year

Page 88

[1] variation from Exhibit 4 would a reader reasonably
[2] conclude?
[3] **MR. BLUTE:** I object for the same
[4] reasons we discussed earlier.
[5] **MR. LANCASTER:** Understood.
[6] **A:** As I explained earlier, Exhibit 4 is a
[7] misrepresentation of the data and therefore should
[8] not be presented to an unsophisticated nonscientific
[9] reader.
[10] **Q:** Okay. So you stand by 0.5 degrees Celsius
[11] as being the usual qua normal year-to-year variation?
[12] **MR. BLUTE:** I object.
[13] **Q:** You stand by your meaning in the Cosmos
[14] article in the phrase "the normal year-to-year
[15] variation" as being about 0.5 degrees centigrade,
[16] assuming that Exhibit 3 before you is an accurate and
[17] objective display of the global temperature record?
[18] **MR. BLUTE:** I object to that
[19] question.
[20] **A:** I think you've misrepresented.
[21] **MR. LANCASTER:** Grounds?
[22] **MR. BLUTE:** Let me state my grounds
[23] for the reasons Dr. Singer just said. I think you're
[24] misrepresenting both what's stated in the article and

Page 89

[1] what he's stated in his testimony today. You're
[2] mixing his article with Exhibit 2 and Exhibit 3. So
[3] I object.
[4] I also object generally, Dr.
[5] Lancaster, on the whole issue of the accuracy or not
[6] of anything in this article. This case is not about
[7] whether this is a good article, a bad article, an
[8] accurate article, or any of those items that you
[9] might wish to discuss.
[10] This case is about who authored it,
[11] who signed their name to it, and the statements that
[12] you made about it. And I'm not going to litigate and
[13] have Dr. Singer litigate the issues of global
[14] warming.
[15] **MR. LANCASTER:** No, this issue goes
[16] directly to whether or not Roger Revelle authored
[17] this article and whether this article represents his
[18] views.
[19] **MR. BLUTE:** I don't see how it does.
[20] I don't believe it does. I ask you to move on.
[21] **MR. LANCASTER:** We will move on.
[22] That's fine, because we've covered this ground.
[23] There's one final question. I don't think so. I
[24] think that — well, this last question I think I'm

Page 90

[1] entitled to ask.
[2] **BY MR. LANCASTER:**
[3] **Q:** Your meaning, in the phrase "the normal
[4] year-to-year variation," could reasonably be taken to
[5] mean about 0.5 degrees Celsius, is that correct?
[6] **A:** No, it says here "less than one degree
[7] Celsius."
[8] **Q:** I am talking about what you mean by — you
[9] say "below the normal year-to-year variation." That
[10] sets up the normal year-to-year variation as a number
[11] or as a range. What is that number? What is that
[12] range in your mind?
[13] **MR. BLUTE:** When you say "in your
[14] mind," are you referring to Dr. Singer's mind, Dr.
[15] Revelle's mind, Dr. Starr's mind?
[16] **MR. LANCASTER:** Yes, Dr. Singer's
[17] mind.
[18] **MR. BLUTE:** They all authored it.
[19] **MR. LANCASTER:** Dr. Singer's mind.
[20] **MR. BLUTE:** You may answer, if you
[21] can.
[22] **A:** Less than one degree Celsius.
[23] **Q:** Well, I'll take that for now.
[24] I would like now to ask you to mark the

Page 91

[1] galley proof with a highlighter for anything that can
[2] indicate to me and to you those sentences that Roger
[3] Revelle co-authored, starting right at the beginning
[4] of the article, please, and going all the way
[5] through.
[6] We can talk about it sentence by sentence,
[7] but I think it would be faster if you would look at
[8] sentences and paragraphs and determine from your
[9] memory whether or not Dr. Revelle had any
[10] participation in the actual writing of those
[11] sentences.
[12] **MR. BLUTE:** I object. Dr. Revelle
[13] was a co-author of the article. So to — maybe I'm
[14] misunderstanding you.
[15] **MR. LANCASTER:** I want to know where
[16] each of these sentences and paragraphs came from, who
[17] wrote them.
[18] **BY MR. LANCASTER:**
[19] **Q:** We were just at the previous page where
[20] you said you weren't sure that you wrote "well below
[21] normal year-to-year variation."
[22] And you say that it may have been, in
[23] fact, Dr. Ellsaesser, Dr. Lindzen, Dr. Michaels, or
[24] Dr. Balling, possibly. I would like to know, from

Page 92

[1] your memory, sentences in this document that you
[2] remember clearly were written or suggested, specific
[3] language, by Dr. Roger Revelle.
[4] **MR. BLUTE:** I object to the question.
[5] You can answer.
[6] **MR. LANCASTER:** Object on what
[7] grounds?
[8] **MR. BLUTE:** Again, I think it's a
[9] trick question. This was a collaborative effort.
[10] And if the question is who is the drafter of the
[11] sentences, then, fine. If that's the question, then
[12] Dr. Singer can do his best to tell you who was the
[13] initial drafter, since one person, by definition, has
[14] to be the drafter.
[15] But if the question is who wrote them
[16] and who authored them, I think it's a trick question,
[17] because Dr. Revelle is a co-author of the entire
[18] article. If you want to discuss the process by which
[19] the article came out, that's fine.
[20] **MR. LANCASTER:** That's what I'm
[21] getting at.
[22] **MR. BLUTE:** I think the question as
[23] you phrased it is a trick question. I think it's
[24] meant to be a trick question. It's misleading.

Page 93

[1] If the question is who does Dr.
[2] Singer remember who was the drafter of each sentence
[3] in the article, then you can ask him that question,
[4] and I'd ask him to answer as best he can. But to ask
[5] him who was the author of sentences or who wrote the
[6] sentences is a misleading, trick question.
[7] **MR. LANCASTER:** I don't think it's a
[8] trick question. I think it goes to the core of the
[9] issue here.
[10] **MR. BLUTE:** Let's not argue it.
[11] There's no judge here to resolve it. I stated my
[12] objection.
[13] Dr. Singer, as best you can, try and
[14] answer that question.
[15] **BY MR. LANCASTER:**
[16] **Q:** Well, let's go paragraph by paragraph.
[17] The first paragraph.
[18] **A:** I think the —
[19] **Q:** Did those words come from Dr. Revelle?
[20] **A:** In the initial draft, I incorporated
[21] Revelle's New Orleans paper in this article.
[22] **Q:** In the first paragraph, did that sentence
[23] that comprises the first paragraph exist in Dr.
[24] Revelle's AAAS talk, his paper?

Page 94

[1] **A:** I'd have to check that.
[2] (Pause.)
[3] (Exhibit 5 marked
[4] for identification.)
[5] **Q:** Dr. Singer, Exhibit 5 has been marked.
[6] **A:** Yes.
[7] **Q:** And I present it to you as the text of the
[8] AAAS talk presented in New Orleans. Do you recognize
[9] this document?
[10] **A:** Yes.
[11] **Q:** Where did you first see this document?
[12] **A:** It was given to me by Roger Revelle.
[13] **Q:** When?
[14] **A:** In February 1990 in New Orleans.
[15] **Q:** In New Orleans. Having this document to
[16] refer to, the first paragraph in the Cosmos Club
[17] galley proof, Exhibit 2 —
[18] **A:** One.
[19] **Q:** — Exhibit 1, I'm sorry, did Roger Revelle
[20] author that first paragraph with you?
[21] **A:** Not that I recall.
[22] **MR. BLUTE:** Objection.
[23] **Q:** I'm sorry, did you draft that paragraph?
[24] **A:** I think so.

Page 95

[1] **Q:** Does that paragraph exist in the AAAS
[2] talk?
[3] **A:** No.
[4] **Q:** Do you remember specific input from Dr.
[5] Roger Revelle as to the wording of that paragraph?
[6] **A:** In general discussion with him, it was
[7] agreed that it was a complex and controversial issue.
[8] So I think it accurately reflects his view.
[9] **Q:** The question is whether he's an author of
[10] that by way of participation in the drafting, not by
[11] way of endorsement in February of 1991, but by way of
[12] participation in the creation of the language.
[13] **A:** The answer is I did the initial draft at
[14] his request.
[15] **Q:** These words, "complex and controversial
[16] environmental and foreign policy issues," then, were
[17] his words to you that you wrote down, mixed with your
[18] own views? So he's truly a — let's just leave that
[19] question.
[20] **A:** Yes.
[21] **Q:** Yes?
[22] **A:** Yes, we had a long discussion. And many
[23] of the ideas that emerged in the first part of it,
[24] which do not occur in this paper, are reflected in

Page 96

[1] the first part of the draft.
[2] **Q:** Could we please mark that first paragraph
[3] yellow, then, with the highlighter, to show that
[4] Dr. Revelle did co-author with you that paragraph?
[5] That's what you're saying now? Is that true?
[6] **A:** Would you define the word "co-author"?
[7] **MR. BLUTE:** I object.
[8] **Q:** He actively participated in the drafting
[9] of that paragraph?
[10] **A:** No, that is not correct.
[11] **MR. BLUTE:** Let me just state — I'm
[12] not going to argue about it. But you know, let's not
[13] play games. Be precise what you mean.
[14] **MR. LANCASTER:** I want to be precise.
[15] **MR. BLUTE:** Only one person can put a
[16] pen to paper initially.
[17] **MR. LANCASTER:** Yes.
[18] **MR. BLUTE:** Okay. So there's that
[19] person. Dr. Singer has talked about discussions that
[20] he's had. He's talked about initial drafting. And
[21] the words you're throwing around, "co-authorship" —
[22] I don't think the question is clear what you want
[23] from him.
[24] **BY MR. LANCASTER:**

Page 97

[1] **Q:** I want from you testimony as to whether or
[2] not Roger Revelle contributed, when this statement
[3] was written, to the language of that statement.
[4] **A:** The word "contributed" is vague. We
[5] didn't sit around a table and write it together. But
[6] the words are the ones that he expressed in
[7] conversation with me.
[8] **Q:** By virtue of that, then, —
[9] **A:** I felt comfortable —
[10] **Q:** — you grant him authorship of that
[11] paragraph?
[12] **A:** I would grant him — yes, because he
[13] believed that this was a complex and controversial
[14] issue.
[15] **Q:** I don't mean to ask whether you grant him
[16] authorship because you recognize that this statement
[17] that you drafted reflects his view derived after the
[18] fact.
[19] I mean, when you wrote this statement,
[20] when you drafted this statement, had Dr. Revelle
[21] participated in the creation of this language,
[22] through contribution, conversation, notes, whatever,
[23] so that the writing of this sentence Dr. Revelle was
[24] an author, shared rights of authorship in this

Page 98

[1] sentence? Did he or did he not?
[2] **MR. BLUTE:** Objection. Go ahead.
[3] **MR. LANCASTER:** On what ground?
[4] **MR. BLUTE:** I just think — he's a
[5] co-author of the article. He signed the article.
[6] It's ridiculous to go back and separate — if you're
[7] going to separate it out, do that, but don't mix the
[8] words. I mean —
[9] **MR. LANCASTER:** That's what I'm
[10] trying to do with these two issues. I'm trying to
[11] separate it out.
[12] **MR. BLUTE:** Dr. Singer has explained
[13] already his answer twice, that he had conversations
[14] with Dr. Revelle, but that Dr. Singer was the person
[15] who put the pen to paper. All right? He's already
[16] explained that.
[17] **MR. LANCASTER:** Mm-hmm. I'm trying
[18] to find out paragraph by paragraph here to what
[19] extent Dr. Revelle participated in the drafting of
[20] the language.
[21] **MR. BLUTE:** All right. And what I'm
[22] saying is by definition he participated — strike
[23] that.
[24] Go ahead. Ask the question. Answer

Page 99

[1] the question as best you can.
[2] **A:** I don't know what you mean by
[3] "participation." If "participation" you mean that he
[4] sat around a table with me and we jointly drafted
[5] these words, the answer is no.
[6] **Q:** Okay.
[7] **A:** If that's your meaning of "participation."
[8] **Q:** So in this first paragraph —
[9] **A:** But his instructions to me were to prepare
[10] a first draft.
[11] **Q:** He instructed you?
[12] **A:** He instructed me to do it.
[13] **Q:** You were doing this at his bidding, —
[14] **A:** Yes.
[15] **Q:** — preparing these words. So these words
[16] were all created subsequent to your meeting with Dr.
[17] Revelle February 16, 1990?
[18] **A:** We had a discussion. And when he agreed
[19] to be a co-author, he instructed me to prepare a
[20] first draft.
[21] **Q:** Did you write this first paragraph at Dr.
[22] Revelle's bidding subsequent to your meeting?
[23] **A:** In the sense in which I just explained it,
[24] yes, I wrote it after the meeting, and I wrote this

Page 100

[1] first draft at his bidding.
[2] **Q:** This first paragraph, then, —
[3] **A:** Not just the first paragraph. The first
[4] draft.
[5] **Q:** I'm talking about the first paragraph.
[6] We're going to go paragraph by paragraph.
[7] **A:** Okay.
[8] **Q:** This first paragraph represented your
[9] assessment of conversation previous to the writing of
[10] this paragraph with Dr. Revelle?
[11] **A:** Yes.
[12] **Q:** So that this first paragraph contains some
[13] of Dr. Revelle's ideas in formulating the draft?
[14] **A:** When you use the word "ideas," the fact
[15] that greenhouse warming is a complex and
[16] controversial issue is hardly original. I think
[17] everyone agrees.
[18] So I incorporated not only his ideas but
[19] everyone else's in the whole world. There's no one
[20] who disagrees.
[21] **Q:** So everyone else in the whole world is an
[22] author of this?
[23] **MR. BLUTE:** Objection.
[24] **A:** In this first paragraph, yes.

Page 101

[1] **Q:** Every other person in the whole world
[2] thinks that greenhouse warming is complex and
[3] controversial?
[4] **A:** Yes.
[5] **MR. BLUTE:** You're arguing with the
[6] witness.
[7] **MR. LANCASTER:** No, I am not. I'm
[8] asking who is an author of this paragraph. Am I
[9] allowed to ask that?
[10] **MR. BLUTE:** That's not the question
[11] to ask, first of all.
[12] **MR. LANCASTER:** Okay.
[13] **MR. BLUTE:** Secondly, you're arguing
[14] with the witness. You're badgering the witness.
[15] **MR. LANCASTER:** I am not.
[16] **MR. BLUTE:** You are. And you're
[17] asking him to restate things that he's already said.
[18] All right?
[19] Now, just for the record, you ask the
[20] question, you wait, Dr. Singer, let me object, and
[21] then you answer. Let's proceed that way. Go ahead.
[22] **MR. LANCASTER:** Well, I think we have
[23] the answer on record there with your objection.
[24] (Discussion off the record.)

Page 102

[1] **BY MR. LANCASTER:**
[2] **Q:** Is it fair to say that any person who
[3] believes that greenhouse warming is complex and
[4] controversial is an author of that statement?
[5] **MR. BLUTE:** Objection.
[6] **A:** I think we're playing with words.
[7] **MR. BLUTE:** Right.
[8] **Q:** Well, we will be playing — we could go
[9] off the record here.
[10] **MR. BLUTE:** Let's go off the record
[11] for a second.
[12] (Discussion off the record.)
[13] **BY MR. LANCASTER:**
[14] **Q:** Let's try it this way. Dr. Singer, do you
[15] maintain that Dr. Revelle is a co-author of this
[16] first paragraph?
[17] **MR. BLUTE:** Go ahead.
[18] **A:** It depends on how you — what you mean by
[19] this question. We didn't sit around the table and do
[20] it line by line. He asked me to draft the article.
[21] And he had several chances to review it. And he
[22] evidently agreed with it. Besides, this first
[23] paragraph is a preamble. There's nothing
[24] controversial in it. This paragraph could have been

Page 103

[1] written by anyone and contains no original
[2] information.
[3] **Q:** So it does not contain any specific ideas
[4] that you would attribute to Roger Revelle uniquely?
[5] **A:** Or to me.
[6] **Q:** Or to yourself uniquely.
[7] **A:** It's a general preamble.
[8] **Q:** Can you say anything different for any of
[9] the other paragraphs in this paper, or is your
[10] response the same for every paragraph in the paper?
[11] **MR. BLUTE:** I object.
[12] **Q:** Okay. Let's go paragraph —
[13] **MR. BLUTE:** Same as what? I don't
[14] understand.
[15] **Q:** Do you maintain that Dr. Revelle, because
[16] he asked you to write — because he asked you to
[17] draft a paper, and because you had a sense of his
[18] ideas, co-authored each and every paragraph through
[19] the Cosmos Club article — galley proof?
[20] **A:** In that sense, yes. In the sense that I
[21] think I represented here what I thought were ideas
[22] that he had and would agree to.
[23] In other words, I did not think that
[24] this — any of this material would strike him as

Page 104

[1] strange, odd, or in conflict with his own views.
[2] **Q:** Any of the material in this galley proof,
[3] or in the first draft?
[4] **A:** Well, certainly the galley proof.
[5] **Q:** On this first page, in the text that
[6] existed 31 January 1991, ignoring, then, the
[7] annotations, did Roger Revelle specifically, to your
[8] memory, contribute any specific words and text
[9] occurring on this page?
[10] **A:** Well, yes, I have here a number of marked
[11] changes which came out of our conversation in his
[12] office in February 1991.
[13] **Q:** I'm asking you prior to 31 January 1991.
[14] I'm asking you to ignore all of the annotations. I'm
[15] talking about what went into the galley proof.
[16] **A:** Oh. I don't recall now what changes had
[17] taken place between the initial draft and this galley
[18] proof, except I know many changes were made as a
[19] result of inputs from co-authors and others.
[20] **Q:** And do you maintain that some of those
[21] inputs were from Roger Revelle?
[22] **A:** I don't recall specific inputs from him.
[23] **Q:** Do you remember that there were not any
[24] specific inputs, or do you remember — or do you just

Page 105

[1] not remember whether there were?
[2] **A:** It's the second. I got so many inputs, so
[3] many comments, that I don't recall whether —
[4] specifically whether he made any changes on the
[5] drafts — several drafts that I sent him.
[6] **Q:** So as far as you remember, Dr. Revelle may
[7] have sent you, but you don't remember that he did?
[8] **A:** Correct.
[9] **Q:** Now, if you testified previously that Dr.
[10] Revelle did send you annotations on drafts —
[11] **A:** I don't recall that testimony.
[12] **MR. BLUTE:** Let him ask the question
[13] first. Go ahead.
[14] **Q:** Then would you correct that testimony now?
[15] **MR. BLUTE:** I object.
[16] (Pause.)
[17] **MR. LANCASTER:** The next exhibit
[18] would be Plaintiff's Answers to Defendant's First Set
[19] of Interrogatories. I don't know if these need to be
[20] entered as an exhibit. I suppose they do.
[21] **MR. BLUTE:** Just refer to them as
[22] they are. It's the Plaintiff's Answers to
[23] Defendant's Interrogatories. Is there a particular
[24] one that you want to address his attention to?

Page 105

BY MR. LANCASTER:
[1] **Q:** Yeah. I'm reading page two, top of page
[2] two, in response to Interrogatory 1. And you affirm,
[3] under penalty of perjury: "Between February 1990 and
[4] February 1991, I prepared a first draft, much of
[5] which derived from Revelle's presentation at the AAAS
[6] meeting in New Orleans, and sent it to Revelle and
[7] Starr for their review and comments. Revelle and
[8] Starr reviewed the draft and returned copies to me
[9] with suggested changes and/or comments."
[10] Do you stand by that statement, or do you
[11] correct it now?
[12] **MR. BLUTE:** I object.
[13] **MR. LANCASTER:** What ground?
[14] **MR. BLUTE:** It's just an argument.
[15] Are you asking him does he want to change an
[16] interrogatory answer?
[17] **BY MR. LANCASTER:**
[18] **Q:** What I want to know is, your answer, right
[19] five minutes ago, was that you don't remember whether
[20] or not Roger Revelle sent you any comments back on
[21] any drafts, is that correct?
[22] **A:** That is correct.
[23] **Q:** Is that statement consistent with the

[1] statement in response to interrogatories that Revelle
[2] reviewed the draft, returned copies to me with
[3] suggested changes?
[4] **A:** All I can say is that I didn't recall
[5] Starr's reviewing drafts until he sent me copies
[6] recently. There were so many copies going back and
[7] forth from so many different people who commented
[8] that I didn't keep track of it. I simply
[9] incorporated whatever changes were appropriate.
[10] **Q:** There were many comments coming to you,
[11] then?
[12] **A:** Yes.
[13] **Q:** And so until — strike that.
[14] When did you receive the copies from Dr.
[15] Starr of your drafts and his comments?
[16] **A:** In the spring of 1990.
[17] **Q:** They were in your possession —
[18] **A:** No.
[19] **Q:** — I mean the copies we have here.
[20] **A:** Oh, those. Those arrived only after your
[21] deposition.
[22] **Q:** In the last 10 days?
[23] **A:** Well, no, after your first deposition.
[24] **Q:** After the first deposition.

Page 108

Page 110

[1] A: Yes.
[2] Q: So this summer of 1993?
[3] A: Yes.
[4] Q: Until those arrived, you didn't recall
[5] Dr. Starr's comments?
[6] A: No, not in detail. I knew that he sent me
[7] comments back.
[8] Q: You knew that he sent you comments back?
[9] A: That's right.
[10] Q: I want to reask the question, because I
[11] didn't get an answer.
[12] Is your statement that you don't remember
[13] Revelle sending you comments consistent with your
[14] statement in the answer to the interrogatories that
[15] Revelle returned copies to me with suggested changes?
[16] MR. BLUTE: It says Revelle and
[17] Starr, first of all. So — the records speak for
[18] themselves. As to whether they're consistent or
[19] inconsistent, you can argue that to whoever you want.
[20] Q: I want to give you a chance to make them
[21] consistent.
[22] MR. BLUTE: If we feel they're
[23] inconsistent, we can supplement the answer to
[24] interrogatories.

[1] Q: Thank you.
[2] MR. BLUTE: For the record, it's
[3] Plaintiff's Answers to Interrogatories and was the
[4] answer to Interrogatory No. 1.
[5] Q: Coming back to Exhibit 1, the galley
[6] proof, you have said here that you don't remember
[7] specific wording contributed by Revelle's comments to
[8] this document before it was produced in January of
[9] '91.
[10] Can you find anywhere in these paragraphs
[11] on page one language from the AAAS talk upon which
[12] you claim this is based?
[13] (Witness reviewing document.)
[14] A: Yes, Revelle's second paragraph in his New
[15] Orleans paper is reflected, I think, in — on page
[16] one.
[17] Q: Can you show me where on page one it's
[18] reflected?
[19] A: Yes.
[20] Q: The specific language.
[21] A: The second paragraph says that we shall
[22] have a better idea over the next 10, 20 years of the
[23] likely magnitude of warming.
[24] And then says in the meantime — and this

Page 109

Page 111

[1] MR. LANCASTER: I'd like you to do
[2] that, considering your present testimony.
[3] MR. BLUTE: Dr. Singer has testified
[4] that his present memory is that he can't remember
[5] specific changes from Revelle.
[6] MR. LANCASTER: No, he's testified
[7] right now that he doesn't remember ever getting
[8] comments from Revelle, isn't that correct?
[9] A: That is correct, I don't remember whether
[10] Revelle sent comments back to me or not.
[11] MR. BLUTE: To the extent the
[12] interrogatory answer is inconsistent with that
[13] testimony, then he has corrected it.
[14] BY MR. LANCASTER:
[15] Q: That interrogatory answer also reads,
[16] "This process was repeated until we arrived at a
[17] final draft."
[18] I take that to mean that Revelle and Starr
[19] reviewed the draft and returned copies, not just to
[20] the first draft, but to subsequent drafts as well?
[21] A: That's what it says, yes.
[22] Q: But your testimony today is that you don't
[23] remember that Revelle ever sent you comments back?
[24] A: Correct.

[1] means that — means to me and means to him — that we
[2] should not take drastic action, but learn to
[3] mitigate, adapt to, and better understand.
[4] Q: Can you show me the specific language on
[5] the first page of the galley proof that derives from
[6] this second paragraph?
[7] Are you telling me that the word "The
[8] scientific" — the words "The scientific base for a
[9] greenhouse warming is too uncertain to justify
[10] drastic action at this time," that you wrote those
[11] words based upon your reading of Revelle's AAAS talk?
[12] A: Yes, the second paragraph would be in
[13] consonance with this.
[14] Q: I'm not asking whether it's in consonance.
[15] I'm asking whether, when you drafted the words in the
[16] Cosmos article, in the galley proof, were they
[17] drafted based on the AAAS talk? Were they drafted
[18] after the AAAS talk?
[19] A: After the AAAS talk.
[20] Q: So clearly, this sentence here was drafted
[21] after the AAAS talk.
[22] A: (No response)
[23] MR. BLUTE: You have to give a verbal
[24] response, if you have one.

Page 112

[1] A: That wasn't a question, was it?
[2] Q: Well, I'm asking, you are telling me that
[3] the fifth paragraph of the Cosmos article, "We can
[4] sum up our conclusion in a simple message: The
[5] scientific base for a greenhouse warming is too
[6] uncertain to justify drastic action at this time,"
[7] was written — drafted by you based upon the second
[8] paragraph of the AAAS talk? Is that what you're
[9] telling me?
[10] A: Well, no. First of all, this is a message
[11] that I have had for some time and may have used, I
[12] don't recall now, in other publications prior to my
[13] meeting with Roger Revelle I thought —
[14] Q: So these words may have been written —
[15] MR. BLUTE: Let him answer the
[16] question.
[17] A: That's it.
[18] MR. BLUTE: Thank you.
[19] Q: Are you saying you don't remember if those
[20] words were written prior to February 16, 1990?
[21] A: What I'm saying is I may have used such
[22] words before and decided that they would be
[23] appropriate in this co-authored article.
[24] Q: If you had used that phrase before, "The

Page 113

[1] scientific base for a greenhouse warming is too
[2] uncertain to justify drastic action at this time,"
[3] and you had authored those words before, then you
[4] feel justified in saying that their existence here —
[5] they were drafted based on Roger Revelle's AAAS talk?
[6] A: I said they were in consonance with the
[7] second paragraph of his AAAS talk.
[8] Q: I asked you earlier if anything on this
[9] first page was specific wording based upon Roger
[10] Revelle's language in the AAAS talk.
[11] A: Well, this is a tendentious question,
[12] because this information can be obtained by a word
[13] processor in a document comparison. And I don't
[14] think you need to ask this question in order to gain
[15] information, which is the purpose of today's
[16] exercise.
[17] MR. BLUTE: If — if the question is,
[18] do the words in Roger Revelle's paragraph get carried
[19] over into these, that can be looked at by a
[20] comparison of the records. If your question is, does
[21] the —
[22] MR. LANCASTER: I think that will be
[23] good.
[24] BY MR. LANCASTER:

Page 114

[1] Q: You admit that these words may have been
[2] written by you prior to your meeting with Revelle in
[3] February 1990?
[4] A: They may have. I don't recall. Or they
[5] may have been written after the meeting.
[6] Q: So you're not swearing here under oath
[7] that those words were written after Revelle's AAAS
[8] talk based on his talk?
[9] MR. BLUTE: I object.
[10] MR. LANCASTER: I just want this
[11] clear. This is very important.
[12] MR. BLUTE: He's answered it three
[13] times. And it's leading. He told you that he may
[14] have written the words and used them before, but that
[15] he published them here in consonance with the AAAS
[16] paper. That's the answer that he gave.
[17] MR. LANCASTER: We started talking
[18] about these words, because the answer was — do we
[19] need to read it back what the answer was? —
[20] MR. BLUTE: No.
[21] MR. LANCASTER: — that this specific
[22] wording derived from the AAAS talk. That's what I'm
[23] trying to track down. I'm looking for these
[24] connections, Joe.

Page 115

[1] MR. BLUTE: Fine. You can ask the
[2] question. But I think you're playing a game with the
[3] witness.
[4] MR. LANCASTER: No, you know clearly
[5] what I'm trying to do. I think that clearly I am
[6] trying to nail down where and when these sentences
[7] were drafted and to what extent Dr. Revelle
[8] contributed to their drafting.
[9] And if they all existed prior to the
[10] meeting with Dr. Revelle, then this is very relevant
[11] information for somebody trying to determine to what
[12] extent Revelle was an author of these words, simply
[13] that. Let's move to the second page, please.
[14] MR. BLUTE: Fine. Ask your
[15] questions.
[16] BY MR. LANCASTER:
[17] Q: The second page of the galley proof, at
[18] the top, it's marked "001," Dr. Singer, looking down
[19] through these paragraphs, can you find any sentences
[20] on this page that exist in the AAAS talk?
[21] MR. BLUTE: I object to that. If
[22] you're asking —
[23] MR. LANCASTER: That's a simple
[24] factual question.

Page 116

- [1] **MR. BLUTE:** No, but come on. Do you
[2] want to sit here and spend an hour reading both?
[3] **MR. LANCASTER:** Yeah, I will spend
[4] all day getting these answers.
[5] **MR. BLUTE:** And I will tell you I
[6] will not permit you to force us to have him read
[7] through documents to tell you something that the
[8] documents say for themselves. You can read — you
[9] can look at this document, a jury can look at this
[10] document, and compare them.
[11] **MR. LANCASTER:** Okay.
[12] **MR. BLUTE:** It costs money to sit
[13] here, both for the stenographer's time and my
[14] time, —
[15] **MR. LANCASTER:** I understand.
[16] **MR. BLUTE:** — to to go through a
[17] useless exercise.
[18] **MR. LANCASTER:** I'm paying the
[19] stenographer, Joe.
[20] **MR. BLUTE:** If you have a question.
[21] **BY MR. LANCASTER:**
[22] **Q:** The question, then, is, did Roger Revelle
[23] contribute specific words to you or advice to you or
[24] comments to you regarding any of the language in the

Page 117

- [1] galley proof prior to January 31, 1991?
[2] **A:** Most of what is on page two, the chapter
[3] called "Greenhouse Gases," is an expansion and is
[4] unacceptable — is an expansion of material that's in
[5] Roger Revelle's first paragraph of his New Orleans
[6] paper.
[7] **Q:** So there's no specific language in there
[8] that you remember came from a conversation or a
[9] comment of Dr. Revelle other than an expansion of the
[10] sentence in the first paragraph?
[11] **A:** Yes. Nor is it necessary, because there's
[12] nothing controversial about this. But we owe it to
[13] the reader to tell him what methane is.
[14] **Q:** Understood. Now, you drafted this, as the
[15] first drafter, then?
[16] **A:** Yes.
[17] **Q:** Let's move to the third page marked "002"
[18] at the top, "Galley: 002." Same question for this
[19] page: Is there any specific language given to you by
[20] Dr. Revelle that went into your drafting of this page
[21] prior to February 1, 1991?
[22] **A:** I believe that the material relating to
[23] the Munk experiment may have come from Revelle's
[24] paper.

Page 118

- [1] **Q:** Now, you say that —
[2] **A:** But I don't see it now.
[3] **Q:** Do you believe you could have obtained the
[4] information about Walter Munk's experiment otherwise?
[5] **A:** Yes.
[6] **Q:** Okay. Only three pages to go. Moving to
[7] the next page, "Galley: 003," is there any material
[8] on this page, any language, specific language, in
[9] sentences, in words and sentences, that you recall
[10] was specifically given to you in conversation or
[11] comments from Dr. Roger Revelle?
[12] **A:** Revelle expressed to me his skepticism
[13] about the validity of mathematical models. And that
[14] skepticism is reflected partly in the chapter titled
[15] "Mathematical Models."
[16] **Q:** Did you draft this chapter subsequent to
[17] February 16, 1990?
[18] **A:** That, I don't recall.
[19] **Q:** Is it possible that you wrote this chapter
[20] on mathematical models prior to February 16, 1991?
[21] **A:** It is possible, yes.
[22] **Q:** Is it possible that this language was
[23] contributed by some of the other commentators to whom
[24] you sent the article while it was being drafted? Is

Page 119

- [1] that possible?
[2] **A:** Yes, it is possible.
[3] **Q:** Do you have any idea now which of those
[4] commentators may have contributed some of these
[5] specific ideas?
[6] **A:** I can identify one.
[7] **Q:** Please do.
[8] **A:** The business in the second paragraph,
[9] about the models being tuned, the word "tuned" in
[10] quotes, was conveyed to me, perhaps in a publication
[11] that he sent me, by Professor Lindzen, L-i-n-d-z-e-n.
[12] And the material in the third paragraph was conveyed
[13] to me by Dr. Ellsaesser, as stated here.
[14] **Q:** Yeah. Now, in the second paragraph, "The
[15] 'models' are tuned..." you remember that Dr. Lindzen
[16] contributed that, but it's not stated here?
[17] **A:** That's correct.
[18] **Q:** Any other memory regarding the statements
[19] on this page, specific attribution to commentators?
[20] **A:** Not that I can recall.
[21] **Q:** One last question on this, on this section
[22] on mathematical models: If it is possible that this
[23] was drafted prior to February 16, 1990, is it
[24] possible that comments from Drs. Lindzen and

Page 120

[1] Ellsaesser reached you on this topic before February
[2] 16, 1991?
[3] A: Yes, because they had been writing about
[4] these topics, and they may have sent me preprints or
[5] reprints from which I gained the information.
[6] Q: You testified today that you believe you
[7] sent copies of your drafts of the Cosmos article to
[8] Drs. Lindzen and Ellsaesser to receive their comments
[9] back.
[10] A: (Nodding)
[11] Q: Is it possible that this section was
[12] written prior to February 16, 1991?
[13] A: 1990.
[14] Q: 1990. Thank you for correcting me. And
[15] you received comments back prior to that date as
[16] well?
[17] A: I don't believe so. I believe I sent out
[18] drafts, successive drafts, not only to my co-authors,
[19] but to other people whose scientific judgment I
[20] valued.
[21] Q: Okay. Thank you.
[22] (Discussion off the record.)
[23] (Lunch recess taken at 1:00 p.m.)
[24] (Deposition resumed at 1:38 p.m.)

Page 121

[1] A_F_T_E_R_N_O_O_N__S_E_S_S_I_O_N
[2]
[3] MR. LANCASTER: Okay. Show we're
[4] resuming the deposition of Dr. Fred Singer.
[5] BY MR. LANCASTER:
[6] Q: And understanding that you're still under
[7] oath. Okay?
[8] A: Okay.
[9] Q: Picking up where we left off, we were
[10] going through the galley proof.
[11] And my question was asking for specific
[12] contribution in the form of ideas and language given
[13] to you in conversations or comments or annotations on
[14] drafts that you can remember coming from Dr. Roger
[15] Revelle or from other commentators. And I think we
[16] finished page Galley: 003.
[17] And turning now to Galley: 004. On this
[18] page, Dr. Singer, can you remember clearly any of
[19] these sentences being attributed to language given to
[20] you by Dr. Revelle prior to February 1, 1991?
[21] A: Okay, the second paragraph on the bottom,
[22] starting with the words "In view...", then turning to
[23] Galley: 005, under the chapter heading "Energy
[24] Policies," all of that.

Page 122

[1] Q: Let's stop on four with this paragraph,
[2] "In view of the uncertainties..."
[3] A: Yes.
[4] Q: Can you explain to me in detail how
[5] Dr. Revelle's views and comments helped you draft
[6] that language?
[7] A: Yes. You understand that I was the
[8] drafter of this first draft and incorporated comments
[9] and ideas from many sources, and specifically from
[10] Revelle's New Orleans paper, and other places or
[11] other conversations that I had had with him in the
[12] past, and drafted a draft that I felt would be in
[13] consonance with his views, that he would be happy
[14] with as a co-author. Obviously, we cannot be —
[15] we're not completely substitutive.
[16] So this paragraph you're referring to
[17] reflects his views that we should try to better
[18] understand future global change, his feeling that
[19] more research was needed to not only understand the
[20] science, but also its effects on our society and on
[21] our environment.
[22] Q: This "In view of the uncertainties..."
[23] paragraph, the last paragraph before the section on
[24] "Energy Policies," —

Page 123

[1] A: There's "an expanded research program."
[2] Q: — there's "an expanded research program"
[3] that derives from the AAAS talk.
[4] A: Yes, but also from my own views and from
[5] Chauncey Starr's views.
[6] Q: Would it be fair to say that the language
[7] in that paragraph is similar to the language in the
[8] first paragraph, that expanding the research program
[9] is something that very many people believe?
[10] A: Can you refer me to the paragraph?
[11] Q: Well, what I'm asking is, as you're
[12] telling me that other commentators also —
[13] A: Yes.
[14] Q: — believe in an expanded research
[15] program, are you telling me that this specific
[16] paragraph derived from something specific that Dr.
[17] Revelle gave you, such as the AAAS talk? Is it
[18] specifically relating to that, or is it a general
[19] statement that could have come from many places?
[20] A: Well, it's not unique to Revelle.
[21] Q: Okay, but consistent with the AAAS talk?
[22] A: Yes. I would say there's nothing in the
[23] draft that is in conflict with Revelle's AAAS talk.
[24] Q: Okay, let's move, then, to the fifth page,

Page 124

[1] or the page marked "Galley: 005."
[2] **A:** Yes.
[3] **Q:** And you had comments there?
[4] **A:** Yes, yes. Energy policy and direct
[5] interventions are largely modeled on the triple — on
[6] Revelle's AAAS paper, with inputs, of course, from
[7] Chauncy Starr and others.
[8] **Q:** Can you show me any specific language?
[9] **A:** Yes, the specific language would be the
[10] new idea by John Martin to fertilize the Antarctic.
[11] **Q:** At the bottom of the page, first paragraph
[12] under "Direct Interventions"?
[13] **A:** Yes.
[14] **Q:** Okay. The reference to John Martin, then,
[15] is traceable to the AAAS talk?
[16] **A:** Uniquely so, because I had not heard of it
[17] before.
[18] **Q:** Okay. I apologize. If I could back up to
[19] Galley: 004, can you remember any of the material
[20] that went into your draft of this text attributable
[21] to other commentators, either Dr. Starr, or Dr.
[22] Lindzen, or Ellsaesser, or Michaels, or Balling, or
[23] others?
[24] **A:** Starr made many detailed comments.

Page 125

[1] **Q:** Can you remember any of them?
[2] **A:** No, I don't remember them. The first
[3] matter there, the matter of soil adjustment, is
[4] something that I had published in the past. I
[5] received from Sherwood Idso's book and other
[6] publications and Reifsnnyder's publication the
[7] material there.
[8] Patrick Michaels suggested to me the
[9] feature of the warmer nighttime temperatures which he
[10] discovered in the data of Thomas Karl and I had not
[11] been aware of until he drew my attention to it.
[12] **Q:** Can you tell me when he drew your
[13] attention to it? Was it after February 16, '91? Was
[14] it after you wrote the first draft?
[15] **A:** No, I don't know when he drew my attention
[16] to it.
[17] **Q:** Okay.
[18] **A:** Balling communicated to me the material
[19] about property cycles which appears in the second
[20] paragraph on Galley: 004.
[21] **Q:** Again, do you remember when he
[22] communicated that to you? Was it, perhaps, in
[23] response to a review of this draft article?
[24] **A:** It might have been.

Page 126

[1] **Q:** Okay.
[2] **A:** Or I might have just picked it up in
[3] something that he sent me.
[4] **Q:** Is there anything else specific on this
[5] page you remember?
[6] **A:** No.
[7] **Q:** Acknowledging that the specific reference
[8] is to Revelle's contribution of expanded research
[9] program.
[10] Okay, then, turning to Galley: 005, other
[11] than the unique contribution by Revelle referring to
[12] John Martin in the AAAS talk, do you recognize or
[13] remember any of the text drafted here being
[14] attributable to comments from Chauncy Starr or
[15] others?
[16] **A:** In his AAAS paper, Revelle lists six
[17] different kinds of action. And what I've done is to
[18] take these, use them, and expand on them to make them
[19] more intelligible to the average reader in the
[20] process of working in ideas I received from Chauncey
[21] Starr and also some of my own ideas.
[22] **Q:** Okay. Let's move on to the short last
[23] piece, the "Conclusion," on Galley: 006 and the
[24] partial paragraph above.

Page 127

[1] **A:** Yes, this came from a paper communicated
[2] to me by Yale economist William Nordhaus, who
[3] actually gave this paper at the AAAS meeting in New
[4] Orleans. And I was very impressed with that. And so
[5] was Roger Revelle.
[6] **Q:** Did Dr. Revelle contribute to the drafting
[7] of this paragraph to the extent that when it was
[8] written you would say he was a co-author?
[9] **A:** Well, we're back again at this impasse.
[10] **Q:** Let me rephrase that. To the extent that
[11] your choice of language in drafting these — this
[12] last paragraph, is any of that choice of language
[13] directly attributable to Dr. Revelle, specific
[14] comments from him, prior to February 1st, 1991?
[15] **A:** Yes. Again, the words "It would be
[16] prudent to complete the ongoing and recently expanded
[17] research so that we will know what we are doing
[18] before we act" is a rephrasing of the second
[19] paragraph of Revelle's AAAS paper.
[20] **Q:** Okay. So that sentence was written after
[21] February 16th?
[22] **A:** To the best of my recollection, yes.
[23] **Q:** Just the best of your recollection. Are
[24] you certain of that?

Page 128

- [1] A: No; to the best of my recollection.
[2] Q: Okay. Other language in the conclusion,
[3] to the best of your recollection, was written after
[4] February 16th, 1991?
[5] A: To the best of my recollection, yes.
[6] Q: Is it possible that this text was written
[7] by you before February 16th, 1990?
[8] A: It's possible, if I managed to get a
[9] preprint of Nordhaus's paper. And, of course, I
[10] don't know right now whether I saw that before
[11] February or not. Since I quote Nordhaus,
[12] N-o-r-d-h-a-u-s, directly, I had access to his paper
[13] and I was quoting directly from it.
[14] Q: Thank you. Referring to the AAAS talk,
[15] which we've marked, I believe, as Exhibit —
[16] A: 5.
[17] Q: — Exhibit 5, the very first sentence of
[18] that, "There is a good but by no means certain chance
[19] that the world's average climate will become
[20] significantly warmer during the next century...",
[21] et cetera, is that sentence or any of that language
[22] that I just read — can it be found in the galley
[23] proof?
[24] A: The answer is I don't know. I have to

Page 129

- [1] look for it.
[2] Q: Well, let me ask you a more specifically
[3] related question. As a scientist, is that first
[4] sentence that I just read the first half of,
[5] "There is a good chance the climate will become
[6] significantly" — "There is a good but by no means
[7] certain chance that the world's average climate will
[8] become significantly warmer during the next
[9] century...", is that consistent, in your view, with
[10] the statement under the heading "Impacts of Climate
[11] Change"; "Assume what we regard as the most likely
[12] outcome: A modest average warming in the next
[13] century of less than one degree Celsius; well below
[14] the normal year-to-year variation — and mostly at
[15] high latitudes and in the winter"? Are those two
[16] statements consistent?
[17] (Witness reviewing documents.)
[18] A: Yes, after rereading both statements, I
[19] think that they are consistent.
[20] Q: It is your view, then, that the statement,
[21] "A modest average warming in the next century of less
[22] than one degree Celsius; well below the normal
[23] year-to-year variation," refers to a change in
[24] climate that would be significantly warmer during the

Page 130

- [1] next century?
[2] A: You left off —
[3] MR. BLUTE: Let me state my
[4] objection. I think there are two separate questions
[5] here. Your first question was, are they consistent?
[6] His answer to that was yes. Now you've asked
[7] something entirely different.
[8] MR. LANCASTER: I'm trying to explore
[9] the consistency. Is that allowed? Well, let me try
[10] to approach it in more detail.
[11] BY MR. LANCASTER:
[12] Q: In your view, would a warming of less
[13] than one degree Celsius, well below the normal
[14] year-to-year variation — that would be a warming in
[15] what range?
[16] A: Well, below one degree centigrade.
[17] Q: Did you not say today that, in your view,
[18] the normal year-to-year variation would be a
[19] threshold of less than one degree centigrade?
[20] A: (Nodding)
[21] Q: So what would be a range well below that?
[22] A: It's hard to quantify this, since the
[23] empirical evidence that we have could even be
[24] interpreted as zero. Therefore, Roger and I agreed

Page 131

- [1] in the discussion to eliminate any reference to
[2] numbers.
[3] Q: I am not talking about the discussion in
[4] February of 1991. I'm talking about the drafting of
[5] the galley proof and the consistency with the AAAS
[6] talk upon which you've claimed this galley proof is
[7] based.
[8] A: Well, I —
[9] Q: Is it your contention that a warming well
[10] below one degree centigrade is significantly warmer?
[11] Is that what you believe Roger Revelle meant by
[12] "significantly warmer"?
[13] MR. BLUTE: Objection.
[14] Q: Two different questions.
[15] A: I'd like to answer that. You have misread
[16] the material in a very significant way. They are
[17] consistent, as I've testified.
[18] I'm testifying here that this statement is
[19] the most likely outcome. That means if you take a
[20] distribution of views of people that I've talked to,
[21] we believe, we as co-authors, believe that this is
[22] the most likely outcome. Roger, what he says here,
[23] there's a certain chance, —
[24] Q: A good chance.

Page 132

[1] **A:** — a probability. No, he doesn't say a
[2] good chance.
[3] **Q:** It says "good but by no means certain
[4] chance."
[5] **A:** Yes, chance. This could be 10 percent, 20
[6] percent. He doesn't specify what the chance is. I
[7] think you're sophisticated. You understand that
[8] we're dealing with probabilities.
[9] He only says that there's a chance it will
[10] be significantly warmer. He doesn't define what the
[11] chance is. He doesn't define what he means by
[12] significantly. In the final version, we agreed on
[13] the wording.
[14] **Q:** Isn't it true in 1990, when you drafted
[15] the first draft of this article, that you knew what
[16] Roger Revelle believed when he said there's a good
[17] chance significantly warmer? Isn't it true that you
[18] knew what he believed to be the most likely outcome
[19] in the next century?
[20] **MR. BLUTE:** Objection. Go ahead.
[21] **A:** Well —
[22] **Q:** Okay. Let me lay the foundation for that.
[23] You knew Dr. Revelle for many years previous to 1990,
[24] is this true?

Page 133

[1] **A:** Yes.
[2] **Q:** Do you maintain that a collaboration on a
[3] joint paper between you and Dr. Revelle would not be
[4] unusual?
[5] **A:** I do.
[6] **Q:** You're an expert in the field of global
[7] warming, are you not?
[8] **A:** I know something about the subject.
[9] **Q:** You had communicated with Dr. Revelle at
[10] various meetings over years previous to 1990?
[11] **A:** That is correct.
[12] **Q:** Would you say you were well acquainted
[13] with Dr. Revelle's views?
[14] **A:** Yes.
[15] **MR. LANCASTER:** If we could mark a
[16] document produced by plaintiff, No. 14, I believe,
[17] which I think bears Attorney Blute's control number
[18] S00034, being two pages, a letter from Dr. Singer to
[19] the Washington Post dated September 15, 1992 as the
[20] next exhibit.
[21] (Exhibit 6 marked
[22] for identification.)
[23] **Q:** Dr. Singer, do you recognize this letter?
[24] **A:** Yes.

Page 134

[1] **Q:** Referring to page two, you write, "Revelle
[2] had a balanced view of the consequences of increased
[3] carbon dioxide...", et cetera.
[4] **Second sentence:** "In an article published
[5] in The Resourceful Earth in 1984, he indicated (on
[6] page 198) that average temperatures near the earth's
[7] surface might rise between two and three degrees with
[8] a doubling of atmospheric CO2 (after another
[9] century)..."
[10] **A:** That is correct.
[11] **Q:** Is that correct?
[12] **A:** Yes.
[13] **Q:** Do you draw any understanding of Dr.
[14] Revelle's view from that statement of his?
[15] **A:** Not particularly.
[16] **Q:** Okay. Thank you.
[17] **A:** He —
[18] **Q:** Go ahead and answer.
[19] **MR. BLUTE:** Go ahead and answer the
[20] question.
[21] **A:** He was simply echoing a view prevalent
[22] among mathematical models. I don't think he believed
[23] in this number.
[24] **Q:** And what basis do you have for concluding

Page 135

[1] that he didn't believe in that number?
[2] **A:** Our discussion.
[3] **Q:** Your discussions when, sir?
[4] **A:** With him.
[5] **Q:** With him on what date?
[6] **A:** February 1991.
[7] **Q:** How about previous to February 1991, in
[8] the spring of 1990, when you drafted this language?
[9] **A:** We didn't get into numbers.
[10] **Q:** At that point in the spring of 1990, did
[11] you have any reason to believe that Roger Revelle
[12] believed that global warming in the next century —
[13] the most likely outcome would be less than one degree
[14] centigrade?
[15] **A:** We didn't discuss any numbers. This was
[16] in February 1990, not in the spring. Our
[17] conversation at breakfast revolved around some of the
[18] recommendations he made in his paper and his
[19] agreement to become a co-author.
[20] **MR. LANCASTER:** I'd like to mark the
[21] next exhibit, a document that defendant produced,
[22] document No. 1, titled "Is the Climate Changing?"
[23] marked in the upper right and in handwriting, "Roger
[24] Revelle abstract for 'Is the Climate Changing?'"

Page 136

[1] Irvine - 2-28-9."
[2] (Exhibit 7 marked
[3] for identification.)
[4] Q: Let me represent to you that this is a
[5] text of a talk that Roger Revelle had planned to
[6] deliver in Irvine February 28th, 1990. The "90"
[7] appears on this copy and I guess got Xeroxed off the
[8] edge of that one.
[9] The language I'd like to draw your
[10] attention to, "During the next hundred years there is
[11] likely to be an equal change in the opposite
[12] direction, i.e., the climate in the United States is
[13] likely to be about five degrees warmer than now."
[14] Would you draw any understanding of
[15] Dr. Revelle's view about the likelihood of global
[16] warming based on that statement?
[17] A: Well, he told me that he was careless with
[18] numbers.
[19] Q: Okay. Thank you.
[20] MR. BLUTE: And — no, go ahead.
[21] Q: Now, sir, I'd like to draw your attention
[22] to the next exhibit which I would offer, being your
[23] first draft sent to Dr. Revelle with cover letter
[24] March 2nd, 1990. If we could mark that as the next

Page 137

[1] exhibit.
[2] (Exhibit 8 marked
[3] for identification.)
[4] Q: Do you recognize this document?
[5] A: Let me look at it.
[6] Q: It's marked Exhibit — what are we on now,
[7] 8?
[8] (Witness reviewing document.)
[9] A: Yes, I recognize it.
[10] Q: Do you recognize the draft article
[11] attached marked at the top of the second page of this
[12] exhibit "3-1-2-27-90" —
[13] A: Yes. Mm-hmm.
[14] Q: — "SFS-A: Greenhouse"?
[15] A: Mm-hmm.
[16] Q: Would the "2-27-90" indicate that this was
[17] a draft written February 27th, 1990, or at least this
[18] version existed or was printed that day?
[19] A: Yes.
[20] Q: "SF," do I take that to mean your
[21] initials?
[22] A: Yes.
[23] Q: And the "A: Greenhouse" indicating a file
[24] no doubt located on an A drive?

Page 138

[1] A: Yes, that's what it seems to be.
[2] Q: Maybe in a file named "Greenhouse," or
[3] subdirectory, a directory, "Greenhouse"?
[4] A: No, I think it's a file.
[5] Q: Actually a file, okay. Dr. Singer, is
[6] this the draft — the first draft that you wrote of
[7] the Cosmos article?
[8] A: I believe so.
[9] Q: Referring to page seven of the text, there
[10] exists there a heading, "Impacts of Climate Change."
[11] A: Yes. Mm-hmm.
[12] Q: Reading the first sentence, "But assume
[13] the most likely outcome - a modest general warming of
[14] perhaps one to two Celsius in the next century," do
[15] you see that language?
[16] A: Yes. Mm-hmm.
[17] Q: You wrote that language?
[18] A: Yes.
[19] Q: Would you argue you wrote that language
[20] based on your understanding of the AAAS talk and
[21] Roger Revelle's views?
[22] A: No, I think this was — may have been my
[23] own understanding at the times.
[24] Q: Haven't you told us that the first draft

Page 139

[1] you wrote was based on Roger Revelle's direction to
[2] you to write a draft? And haven't you told us — let
[3] me just leave that.
[4] Wasn't this first draft created following
[5] Roger Revelle's direction to you to write a draft
[6] based on what you and he and Dr. Starr believed?
[7] A: Yes.
[8] Q: And haven't you told us that in the
[9] writing of the draft, the first draft you wrote, you
[10] were attentive to put down words that you believe
[11] encompassed what Dr. Revelle believed?
[12] MR. BLUTE: Objection. Go ahead.
[13] A: In general, yes.
[14] Q: In March of 1990, when you sent this draft
[15] that you created at the direction of Roger Revelle
[16] you claim to Dr. Revelle and Dr. Starr, did you
[17] believe then that this first sentence under "Impacts
[18] of Climate Change," would be inconsistent with Dr.
[19] Revelle's view?
[20] A: I thought it would be consistent with his
[21] view.
[22] Q: Would you say that a modest general
[23] warming of perhaps one to two degrees Celsius in the
[24] next century would be a significant warming?

Page 140

[1] A: Significant, yes, in the sense that one
[2] could discern it, but not significant in the sense
[3] that it would cause serious problems.
[4] Q: If there were a warming in the next
[5] century of .5 degrees Celsius, would that be
[6] significant in the sense that it could be discerned?
[7] A: It might not be. It might get lost in the
[8] noise.
[9] Q: Yet, you maintain that Dr. Revelle's
[10] statement that there would be a significant
[11] warming — let me get it exactly right.
[12] Let me refer to Exhibit 7, Dr. Revelle's
[13] statement that, "...the climate in the United States
[14] is likely to be about five degrees warmer than now,"
[15] you maintain that this was merely his being careless
[16] with numbers?
[17] MR. BLUTE: Let me say one thing. I
[18] think what you're reading is from Exhibit No. 7,
[19] which, as I understand it, —
[20] MR. LANCASTER: I've just referred to
[21] it, yes.
[22] MR. BLUTE: — which I understand was
[23] not something that was ever published by Roger
[24] Revelle or indeed has Roger Revelle's name on it. So

Page 141

[1] I just want to make that clear. We don't concede
[2] that Roger Revelle ever wrote that statement.
[3] MR. LANCASTER: Fine.
[4] MR. BLUTE: It's not published
[5] anywhere. I don't know where that document came from
[6] or who prepared it.
[7] A: It is — this number is inconsistent with
[8] what Roger Revelle published in The Resourceful
[9] Earth. And it is quite inconsistent with his actual
[10] handwritten notes on the galley, on the Cosmos — the
[11] galley. So this is why I said that this five degree
[12] number — this doesn't make sense to me.
[13] Q: Okay.
[14] A: And since it's just been discussed, we
[15] don't know who wrote this. Maybe if he did write it,
[16] he may have been very careless.
[17] Q: Do you still maintain that Dr. Revelle's
[18] statement, leading off the AAAS talk, there is a —
[19] quote, "There is a good but by no means certain
[20] chance that the world's average climate will become
[21] significantly warmer during the next century," was
[22] not captured by you in your drafting the language in
[23] the draft of Exhibit 8 under "Impacts of Climate
[24] Change"?

Page 142

[1] A: I think these two are entirely consistent.
[2] I see no conflict at all between them.
[3] Q: Okay. And you would agree, then, —
[4] strike that.
[5] Yet, you also maintain that Dr. Revelle's
[6] first sentence in the AAAS talk is consistent with
[7] the language that appears in the galley proof January
[8] 31st, 1991, is that correct?
[9] A: Yes, it depends on how you quantify the
[10] word "chance" and the word "significant."
[11] Q: In your view, is the statement in your
[12] March 2nd draft, "...a modest general warming of
[13] perhaps one to two Celsius in the next century,"
[14] consistent with the statement January 31st, "A modest
[15] average warming in the next century of less than one
[16] degree Celsius; well below the normal year-to-year
[17] variation"? Are they saying the same thing?
[18] A: The answer to that question is that
[19] they're not consistent. And the reason for it is
[20] that I have received during this intervening year
[21] sufficient inputs, either from publications that I
[22] saw or from comments that I received, to bring about
[23] this change. In other words, the draft evolved
[24] over — during the year based on comments received.

Page 143

[1] Q: By people other than Dr. Revelle and Dr.
[2] Starr?
[3] A: Possibly, yes. Mm-hmm.
[4] MR. LANCASTER: Taking as the next
[5] exhibit the draft conveyed by letter from Dr. Singer
[6] to Dr. Revelle dated March 6th, 1990, I'd like to
[7] mark that as the next exhibit.
[8] (Exhibit 9 marked
[9] for identification.)
[10] Q: Dr. Singer, do you recognize Exhibit 9?
[11] A: Yes.
[12] Q: Is this the letter you sent to Dr. Revelle
[13] March 6th, 1990 with attached draft?
[14] A: Yes.
[15] Q: This — on the second page of this
[16] exhibit, the first page of the draft is marked
[17] "Doc 2 GRNH2 3/5/90/SFS." May I take "3/5/90" to
[18] refer to March 5th, 1990?
[19] A: Yes.
[20] Q: You created this draft as well?
[21] A: Yes, I printed it.
[22] Q: And the second draft came — strike that.
[23] The second draft was mailed to Dr. Revelle
[24] four days after the first draft?

Page 144

[1] A: I don't recall. But one can check the
[2] dates.
[3] Q: Does it appear that from the date, if one
[4] is March 6th, 1990, the other is March 2, 1990?
[5] A: Yes, it does.
[6] Q: Dr. Singer, do you know where Dr. Revelle
[7] was during this first week of March 1990?
[8] A: Yes, I believe he was recovering from an
[9] operation.
[10] Q: Do you know his condition during that
[11] week?
[12] A: No, I do not.
[13] Q: Would you be surprised to learn that he
[14] was in the hospital or in a hospital bed at his home?
[15] A: No, not surprised. I've since learned
[16] that he was quite ill. I did not know this at this
[17] time.
[18] Q: In all likelihood, Dr. Singer, did you
[19] receive comments from Dr. Revelle between the sending
[20] of your first draft and the sending of your second
[21] draft?
[22] A: Very likely not.
[23] Q: Yet, you remember — in your
[24] interrogatories you said that you received comments

Page 145

[1] from Dr. Revelle after your first draft was sent to
[2] him.
[3] MR. BLUTE: He said on the record
[4] today he does not have memory of Revelle, so —
[5] Q: Now we're at a different point. Now we're
[6] at a point where you're realizing that it's very
[7] unlikely that you did?
[8] MR. BLUTE: No, he told you in
[9] response to a direct question that he didn't remember
[10] one way or the other. It's correct in all the
[11] respects. But I don't see the point in arguing that.
[12] A: If you say and you're correct that he was
[13] in the hospital, then I would say it's very unlikely
[14] that I received anything from him.
[15] Q: Just based on the four-day interval, your
[16] comment, "Please ignore the first draft," —
[17] A: Yes.
[18] Q: — it's likely that there weren't comments
[19] coming back, is that true?
[20] A: No. My purpose here was to tell him that
[21] I had made changes and I didn't want him to waste his
[22] time looking at the first draft.
[23] Q: Okay. I understand. Looking at the text,
[24] I think we can use the fax number in the corner,

Page 146

[1] number 28 in the top right corner, to identify the
[2] page bearing the subsection "Impacts of Climate
[3] Change.
[4] In this draft the language is, "But assume
[5] the most likely outcome - a modest general warming of
[6] perhaps one degree Celsius in the next century."
[7] Do you have any memory, Dr. Singer, of why
[8] you made the change between Draft 1 and Draft 2 on
[9] this point?
[10] A: Not in detail. Likely because of inputs
[11] that I received or information that I received
[12] bearing on this issue.
[13] Q: It's likely that you received information
[14] from Dr. Starr, then, or other commentators on that
[15] issue?
[16] A: I know that Starr sent information. I
[17] don't have the information at hand. And I'm not sure
[18] whether he commented on this point. But I may have
[19] received information from other sources. We can
[20] easily check that.
[21] MR. LANCASTER: Well, I guess we
[22] should mark this as Exhibit 10, unless there's a more
[23] efficient way to check it. Is there a way to refresh
[24] memory without marking as exhibits, or would you

Page 147

[1] prefer to mark it?
[2] MR. BLUTE: We ought to mark it as an
[3] exhibit. The reason for marking it is just so that
[4] when you read the transcript you know exactly what
[5] you were referring to. That's the only purpose it
[6] serves at this point.
[7] MR. LANCASTER: Well, maybe we don't
[8] need to mark this as an exhibit if I show you the
[9] documents you gave me when I walked in the room
[10] today, which include —
[11] MR. BLUTE: You better mark it just
[12] so it's clear on the record what you're showing him.
[13] That's the only purpose this serves.
[14] MR. LANCASTER: Okay. Well then,
[15] we'll mark this as the next exhibit, what appears to
[16] be Dr. Starr's comments on Draft 1.
[17] (Exhibit 10 marked
[18] for identification.)
[19] BY MR. LANCASTER:
[20] Q: Dr. Singer, Exhibit 10, do these appear to
[21] be Dr. Starr's comments returned to you on Draft 1
[22] sent to him on March 2, 1990?
[23] (Witness reviewing document.)
[24] A: Yes, I see comments by him in this draft.

Page 148

[1] Q: On page seven, I believe, is the text
[2] we're talking about, under "Impacts of Climate
[3] Change."
[4] A: Yes.
[5] Q: Do you see any comment registered at the
[6] line "...a modest general warming of perhaps one to
[7] two degrees Celsius in the next century"?
[8] A: No, I do not.
[9] Q: Is it unlikely, then, that your change
[10] between Draft 2 — I mean Draft 1 and Draft 2 of this
[11] article was based on Dr. Starr's comments to you?
[12] A: That is correct.
[13] Q: Does that make it even more likely that
[14] that change was based on someone else's comments to
[15] you?
[16] A: It does.
[17] MR. LANCASTER: Let's mark up Draft
[18] 3. I'd like to mark as an exhibit a letter from
[19] Dr. Singer to Dr. Revelle dated March 20th with
[20] attached text. I guess that's Exhibit 11.
[21] (Exhibit 11 marked
[22] for identification.)
[23] Q: Dr. Singer, does this appear to be
[24] Draft 3?

Page 149

[1] A: It does.
[2] Q: That you sent to Dr. Revelle apparently
[3] March 20th, 1990?
[4] A: Yes.
[5] Q: And at the top of the first page of the
[6] text, it says, "Doc 3 GRNH2 3/19/90"?
[7] A: Yes.
[8] Q: Apparently written two weeks after
[9] Draft 2?
[10] A: Yes.
[11] Q: Turning to the heading "Impacts of Climate
[12] Change," I guess it's the fifth page of the draft
[13] text —
[14] MR. BLUTE: I'm sorry, say it again.
[15] Fifth page of the text?
[16] MR. LANCASTER: The fifth page of the
[17] draft text.
[18] MR. BLUTE: Mm-hmm.
[19] Q: I read, quoting, "But assume the most
[20] likely outcome - a modest general warming of perhaps
[21] one degree Celsius in the next century, mostly at
[22] high latitudes and in the winter."
[23] Would you agree that this sentence has
[24] changed again from Draft 2 to Draft 3?

Page 150

[1] A: I'd have to compare it.
[2] Q: Please do. I think Exhibit 9 would be
[3] Draft 2.
[4] (Witness reviewing document.)
[5] A: Yes. Mm-hmm.
[6] Q: Would you agree that the language that has
[7] now been added is "mostly at high latitudes and in
[8] the winter"?
[9] A: Yes. Mm-hmm.
[10] Q: And do you remember the reason why you
[11] added those words?
[12] A: Yes, because the climate models, insofar
[13] as one can believe them, predict warming — when you
[14] decompose the average warming — predict the warming
[15] will be primarily at high latitudes.
[16] Q: Does that mean that the warming in the
[17] United States would be greater than the global
[18] average warming?
[19] A: No, I don't know that.
[20] Q: Does the United States sit at a higher
[21] latitude than the equatorial region?
[22] A: Yes, but at a lower latitude than the
[23] polar regions.
[24] Q: Is it possible that Dr. Revelle — he

Page 151

[1] earlier stated that he thought that — strike that.
[2] If Dr. Revelle in 1990 stated that he
[3] believed the warming in the United States would be
[4] five degrees in the next century — strike that.
[5] Do you know when Dr. Revelle said that the
[6] warming in the next century — if indeed that is his
[7] statement — the warming in the next century in the
[8] United States would be five degrees, do you know that
[9] he was referring to Celsius or Fahrenheit?
[10] A: I don't know that.
[11] Q: Would it be not unusual if he were
[12] speaking to a nonscientific argument — I mean
[13] nonscientific audience to put his prediction of
[14] likely warming in Fahrenheit for a United States
[15] audience?
[16] A: That's pure speculation. I have no way of
[17] telling. And I don't know what the audience was. It
[18] might have been scientific.
[19] Q: Okay. That's not impossible, though?
[20] It's possible that he was talking Fahrenheit?
[21] A: Yes, since he didn't specify.
[22] Q: If he were talking Fahrenheit, what would
[23] be the converted value in Celsius?
[24] MR. BLUTE: Just so it's clear on the

Page 152

[1] record, are we talking about the exhibit that you
[2] marked that was the so-called abstract?
[3] **MR. LANCASTER:** Yes.
[4] **MR. BLUTE:** Okay. And again, that's
[5] assuming that Roger Revelle wrote this.
[6] **MR. LANCASTER:** Right.
[7] **A:** And that it was to be given at the
[8] University of California, Irvine?
[9] **Q:** Yes.
[10] **MR. BLUTE:** How's he going to know?
[11] I object.
[12] **MR. LANCASTER:** How is Dr. Singer
[13] going to know what the conversion between Fahrenheit
[14] and Celsius would be? I think he knows.
[15] **MR. BLUTE:** No, I just think — well,
[16] you can answer that. Go ahead.
[17] **A:** Okay. It would be five-eighth of that
[18] number; about three degrees, about three degrees
[19] centigrade.
[20] **Q:** Now, your addition of the words "mostly at
[21] high latitudes and in the winter," did those words —
[22] were those suggested by Dr. Starr?
[23] **A:** No.
[24] **Q:** You added those from your own information

Page 153

[1] gathered elsewhere?
[2] **A:** It may have been suggested by one of my
[3] other commentators.
[4] **Q:** Do you believe that this Draft 3 was the
[5] last draft that you sent to Dr. Revelle and Dr.
[6] Starr?
[7] **A:** I don't know that.
[8] **Q:** Would it surprise you that Dr. Revelle
[9] kept practically every piece of paper ever sent to
[10] him for archives?
[11] **A:** It does surprise me.
[12] **Q:** Would it surprise you that the archives
[13] show communications between Dr. Starr and Dr. Revelle
[14] and between you and Dr. Revelle in 1990 and 1991?
[15] **A:** No, it wouldn't surprise me. We were
[16] co-authors of a paper.
[17] **Q:** Would you — let me —
[18] **A:** I don't recollect what those
[19] communications might have been.
[20] **Q:** If these three drafts sent in March of
[21] 1990 appear in the archives, and no other drafts sent
[22] to Dr. Revelle appear in the archives, does that —
[23] is that any evidence to you about whether or not
[24] another draft was sent to Dr. Revelle?

Page 154

[1] **MR. BLUTE:** I object to that. It's
[2] an unanswerable question. That would assume
[3] knowledge about Revelle's habits of keeping records.
[4] **MR. LANCASTER:** Fine.
[5] **MR. BLUTE:** It would assume how many
[6] records go to the archives. It would assume the
[7] voracity of your understanding of what's in the
[8] archives.
[9] **MR. LANCASTER:** I'll withdraw it.
[10] Withdrawn.
[11] **BY MR. LANCASTER:**
[12] **Q:** You have no record of any other draft
[13] being sent?
[14] **A:** No, I do not.
[15] **Q:** Dr. Starr hasn't —
[16] **A:** My letters, as you can see, were
[17] handwritten. And I have kept no copies.
[18] **Q:** Dr. Starr shows the same three drafts sent
[19] to him?
[20] **A:** At first glance, they appear to be the
[21] same. I have not had a chance to check them, since I
[22] just saw the Revelle drafts here for the first time
[23] today.
[24] **Q:** You've had Dr. Starr's documents for many

Page 155

[1] weeks now?
[2] **A:** I'd say about three or four weeks.
[3] **Q:** Do those documents contain any other
[4] drafts — do those documents contain more than three
[5] drafts?
[6] **A:** No, they do not. I believe I've given you
[7] everything that I've received from Dr. Starr.
[8] **Q:** When did you discard or misplace your
[9] copies of the drafts? Why do you have no records?
[10] I'm sorry, just the first question.
[11] **A:** Well, I'm not good at collecting and
[12] archiving. I didn't attach any great importance to
[13] preserving the successive improvements in this draft.
[14] **Q:** Dr. Starr has all three drafts, Dr.
[15] Revelle kept all three drafts, you were the primary
[16] author, and Dr. Starr's drafts came to you, and yet
[17] you have none of that record?
[18] **A:** I don't have an office like Starr or
[19] Revelle. I don't have a secretary. I do my own
[20] writing and my own filing. And I'm not organized the
[21] way they are.
[22] **Q:** So you might have them, but you couldn't
[23] find them?
[24] **A:** I don't think I would have kept them.

Page 156

[1] Q: Okay.
[2] A: And I have not conducted a major search.
[3] Q: Okay.
[4] MR. BLUTE: Beyond gathering whatever
[5] documents were available to respond to your document
[6] request, obviously.
[7] MR. LANCASTER: I understand.
[8] BY MR. LANCASTER:
[9] Q: Given that all three drafts were written
[10] in March — strike that.
[11] Did you send draft copies of draft — of
[12] each of the drafts to Drs. Ellsaesser and Lindzen?
[13] A: I would say probably not. I would have
[14] sent them either number one, number two, and number
[15] three. And I don't recall which. Possibly number
[16] one.
[17] Q: Did Richard Geyer see a draft of this
[18] article before it was published?
[19] A: Certainly not from me.
[20] Q: I'd like to return to Exhibit 1, if we
[21] could, and have you circle in green comments written
[22] in your hand, all annotations and comments.
[23] MR. BLUTE: Green would be all —
[24] just so I understand, the green is all Dr. Singer's

Page 157

[1] comments?
[2] MR. LANCASTER: Yes. And maybe we
[3] could use the highlighter, if that works, whichever
[4] you two prefer.
[5] MR. BLUTE: Anything in your
[6] handwriting.
[7] A: (Indicating)
[8] Q: And to be complete, can we mark in orange
[9] what you recognize to be Dr. Revelle's handwriting?
[10] A: (Indicating)
[11] Q: Thank you.
[12] (Recess taken.)
[13] BY MR. LANCASTER:
[14] Q: Turning back to this marked up manuscript,
[15] now the galley proof, moving to the impact — the
[16] climate change section again, Galley: 003, can you
[17] explain to me the discussion in February of 1991
[18] concerning the first sentence under this section?
[19] And explain the notations.
[20] A: The printed text represents, of course, my
[21] final draft submitted to the Cosmos Journal sometime
[22] in 1990. The handwritten note on the side is Roger
[23] Revelle's.
[24] And it reads either "one or three" or

Page 158

[1] "one to three." I can't make it out. The discussion
[2] revolved around whether warming would be below the
[3] year-to-year variation.
[4] And I explained to Roger that my wording
[5] was much more certain, that if the average warming
[6] was below one degree, it would be below the normal
[7] year-to-year variation, whereas his numbers would
[8] certainly not be below the normal year-to-year
[9] variation.
[10] He didn't argue about the normal
[11] year-to-year variation, but he argued about the
[12] number. I was able to convince him.
[13] But we compromised finally by leaving out
[14] all references to any number. And note that his
[15] position was much more conservative than mine. He
[16] was willing to allow that a much larger temperature
[17] increase would still be below the normal year-to-year
[18] variation. And I told him that that is not so.
[19] Q: Let me see if I have this right. The "one
[20] to three" indicates what?
[21] A: The "one to three" indicates degrees
[22] Celsius.
[23] MR. BLUTE: Just for the record, or
[24] "one or three." It's not clear at this point what it

Page 159

[1] was.
[2] MR. LANCASTER: It's clear to me that
[3] it's "to." I can read it as a "t" written by Dr.
[4] Singer.
[5] BY MR. LANCASTER:
[6] Q: The "one to three" is in Dr. Singer's
[7] handwriting, is it not, Dr. Singer?
[8] MR. BLUTE: He's got that listed as
[9] Dr. Revelle's handwriting.
[10] Q: That's a mistake. Isn't it true that if
[11] you look closely at the word "one," "one to three" —
[12] A: Oh, you mean that whole thing is my
[13] handwriting?
[14] Q: I believe the "one to three" is written in
[15] the lighter pen. The "o's" and the "t's" are the
[16] same as yours. The "t" —
[17] A: No.
[18] Q: The "t-o" clearly shows under the
[19] cross-out.
[20] A: No, I disagree with you.
[21] Q: I won't argue. Okay.
[22] MR. BLUTE: The testimony is that
[23] that was Dr. Revelle's handwriting. He so testified.
[24] He was there. You're not a handwriting expert.

Page 160

[1] Let's move on.
[2] (Discussion off the record.)
[3] **BY MR. LANCASTER:**
[4] **Q:** Taking what you've told us to be the "one
[5] or three" or the "one to three" written by Roger, may
[6] I take the "RR" with the circle around it to indicate
[7] your expression that this was one of Roger's
[8] comments?
[9] **A:** Yes.
[10] **Q:** Fine.
[11] **A:** The "RR" is in my handwriting.
[12] **Q:** Clearly. Would you agree that it doesn't
[13] matter whether Roger wrote "one or three" or "one to
[14] three," or whether you wrote "one to three" or "one
[15] or three," that in either case we're talking about
[16] Revelle's comment?
[17] **A:** Well, I would never have written this.
[18] **Q:** Okay.
[19] **A:** You know, this is my final draft. And so
[20] these comments were written on here by Revelle to
[21] discuss with me before we turned the draft — the
[22] final draft, the laser proofs back to the publisher.
[23] **Q:** Okay. Let let me back up and ask
[24] generally. The comments on this draft in your

Page 161

[1] handwriting, —
[2] **A:** Yes.
[3] **Q:** — were these made prior to your meeting
[4] with Dr. Revelle?
[5] **A:** No.
[6] **Q:** Were they made subsequent to your meeting
[7] with Dr. Revelle?
[8] **A:** All the substantive comments were made at
[9] the meeting with Dr. Revelle. The comment that it
[10] was reviewed by Revelle was made after the meeting,
[11] just after the meeting.
[12] **Q:** Did you have this galley proof, this
[13] document, in your possession when you traveled to
[14] La Jolla?
[15] **A:** Yes.
[16] **Q:** Did you send a draft copy to Dr. Starr
[17] prior to leaving for La Jolla?
[18] **A:** I took it with me. He was at La Jolla.
[19] **Q:** So you carried this document expecting to
[20] have contact with Dr. Starr and Dr. Revelle?
[21] **A:** That is correct.
[22] **Q:** Did you and Dr. Starr review this draft
[23] together at La Jolla?
[24] **A:** Yes, he had a copy of the draft. And he

Page 162

[1] gave me no additional comments.
[2] **Q:** So none of your handwriting on this draft
[3] reflects Dr. Starr's comments?
[4] **A:** I believe that's correct.
[5] **Q:** Would it be fair to say that this draft
[6] during your meeting with Dr. Revelle changed hands,
[7] that at times he held it and marked on it, and that
[8] other times you held it and marked on it?
[9] **A:** I don't think we held it. I think it was
[10] on a table and we were sitting on either side of the
[11] manuscript.
[12] **Q:** I see. So at any point that you are
[13] talking about either you or Dr. Revelle could have
[14] made a notation?
[15] **A:** Yes.
[16] **Q:** Would you have ever made a notation based
[17] on something he said?
[18] **A:** Yes.
[19] **Q:** So he might have spoken a word and you
[20] could have written it down?
[21] **A:** Yes. That, in fact, is how it happened.
[22] **MR. BLUTE:** Let's go off the record
[23] for a second.
[24] (Discussion off the record.)

Page 163

[1] (Witness conferring with counsel.)
[2] **BY MR. LANCASTER:**
[3] **Q:** Well, just again on this point, under the
[4] "Impacts of Climate Change" in the first sentence, is
[5] it reasonable to understand the "one or three" or the
[6] "one to three" comment to indicate Dr. Revelle's
[7] belief that a modest average warming, a likely
[8] outcome, would be one to three degrees — in the
[9] range of one or three degrees Celsius, in that range?
[10] **A:** That is one interpretation.
[11] **Q:** Is that an incorrect interpretation? And
[12] if so, what is the correct interpretation? Why are
[13] those words written there?
[14] **A:** He was under the impression that this
[15] would still be below the normal year-to-year
[16] variation. And we discussed it and thought the best
[17] way to adjust it is to take out reference to any kind
[18] of number. So we deleted my sentence — my part of
[19] the sentence and we deleted his comment.
[20] **Q:** Doesn't it show that he actually struck
[21] the word "well" in that third line of that paragraph?
[22] **A:** It does show that, yes.
[23] **Q:** Isn't it true in the published version
[24] that the word "well" isn't struck, that it exists in

Page 164

[1] the document?
[2] **A:** I'd have to check that.
[3] **MR. BLUTE:** It speaks for itself.
[4] **Q:** Would you agree, based on what you've just
[5] said, that it was understood between you and Dr.
[6] Revelle that the words "of less than one degree
[7] Celsius: well" would be struck from the document?
[8] **A:** I don't recall that. But I'm quite
[9] willing, as it were, to strike the word "well." So
[10] if it does appear in the final version, it might well
[11] have been a mistake.
[12] **Q:** Might it not have been a mistake if
[13] Dr. Revelle believed that one to three degrees was
[14] the most likely average warming in the next century,
[15] to have the words "below the normal year-to-year
[16] variation"?
[17] **A:** Well, I don't think that's correct.
[18] That's just my point, that if you accept the fact
[19] that the average warming is below the normal
[20] year-to-year variation, which he did, then you cannot
[21] specify a warming of one to three degrees. It has to
[22] be less than one degree.
[23] **Q:** Did you and Dr. Revelle discuss at that
[24] point what the number was for the normal year-to-year

Page 165

[1] variation?
[2] **A:** I think we tried to estimate it.
[3] **Q:** What number did you come up with?
[4] **A:** I told him it would have to be less than
[5] one degree. And he agreed but suggested that we also
[6] take out my wording, which is "of less than one
[7] degree." So we left it kind of open. This is quite
[8] usual when people collaborate and try to achieve a
[9] compromise.
[10] **Q:** Is it possible that you got to this point
[11] and you understood Dr. Revelle's belief was that a
[12] likely warming would be one to three degrees
[13] indicated by this comment written in the margin, and
[14] that then you were able to move on by you striking
[15] the language "of less than one degree Celsius," your
[16] agreeing to strike that language?
[17] **A:** Well, I certainly agreed to it, yes.
[18] **Q:** Is it possible that at that time you
[19] didn't discuss and didn't estimate the normal
[20] year-to-year variation?
[21] **MR. BLUTE:** He just testified that he
[22] did.
[23] **MR. LANCASTER:** Yeah, I just want to
[24] know if it's possible that he didn't.

Page 166

[1] **A:** I think we did.
[2] **Q:** You remember that clearly?
[3] **A:** Yes, I think I said to him that a
[4] three-degree increase would certainly stick out about
[5] the normal year-to-year variation. And he accepted
[6] that.
[7] **Q:** If Dr. Revelle's closest colleagues
[8] believe that Roger Revelle — Roger Revelle's view
[9] was that the most likely warming in the next century
[10] would be one to three degrees, then you're saying
[11] they're mistaken?
[12] **MR. BLUTE:** Objection. You can
[13] answer.
[14] **A:** Either that, either they're mistaken, or
[15] they misinformed you, or I was able to convince him
[16] otherwise. Revelle is not an expert on mathematical
[17] models. And these numbers are derived from
[18] mathematical models.
[19] **Q:** Is it fair to say that it was your belief
[20] in March of 1990 that a modest average warming in the
[21] next century would be one to two degrees Celsius?
[22] **A:** Yes, at that time that was my belief.
[23] **Q:** And what influenced your belief between
[24] that time and the writing of this draft?

Page 167

[1] **A:** I would say a closer look at the data on
[2] temperature changes and a realization that the models
[3] are really much worse than I had thought. This was
[4] based on discussions with a number of experts whose
[5] names I've already mentioned.
[6] **Q:** Okay. Would you agree that the following
[7] eight scientists were cited by Dr. Revelle in his
[8] AAAS talk: Dr. Starr, Dr. Searl, Dr. John Martin,
[9] Dr. Wallace Broecker, Dr. Paul Waggoner, Dr. Walter
[10] Munk, Dr. Taro Takahashi, and Dr. Inez Fung?
[11] **A:** Yes.
[12] **Q:** Do you have that exhibit in front of you?
[13] **A:** Yes.
[14] **MR. BLUTE:** If you represent those
[15] are the people.
[16] **MR. LANCASTER:** That sounds right.
[17] **A:** I couldn't find Munk's name before. But
[18] if it's there, then I'm glad to know that.
[19] **Q:** Of these eight scientists, would you agree
[20] that the Cosmos article you drafted only referred to
[21] two, namely Dr. Munk and Dr. Martin?
[22] **A:** Yes.
[23] **Q:** Yet, you had the AAAS talk before you?
[24] **A:** Yes. Mm-hmm.

Page 168

[1] Q: Is there any reason why the work of Starr
[2] and Searl cited by Dr. Revelle in the AAAS talk
[3] wasn't carried into the Cosmos article?
[4] A: It was, through the co-authorship of
[5] Starr.
[6] Q: But no mention of Dr. Searl?
[7] A: No mention of Dr. Searl, that's correct.
[8] Q: Isn't it true that, in fact, the topic,
[9] the whole discussion in the AAAS talk regarding
[10] Drs. Starr and Searl's work, is not in the Cosmos
[11] article?
[12] A: Starr had, of course, a choice of what he
[13] wanted to put in. And had he wanted to put that in,
[14] he would have. The article, as you know, had become
[15] too long. And one of the first things we did between
[16] Draft 1 and 2 was to cut severely.
[17] Q: Isn't it true that — or do you remember
[18] writing in a letter that you and Dr. Starr
[19] co-authored this article based on Dr. Revelle's AAAS
[20] talk because Revelle cited Starr and Searl's work in
[21] his talk? — I'll withdraw that.
[22] Did you not use as justification in
[23] defense for Revelle's co-authorship Revelle's
[24] citation of Starr and Searl's work in the AAAS talk?

Page 169

[1] MR. BLUTE: Is there a particular
[2] place you want to direct him to?
[3] Q: Do you remember writing that?
[4] A: I object to the use of the word "defense."
[5] Q: I withdraw the word "defense." Predicate.
[6] Let's replace it with predicate. Do you remember
[7] predicating an explanation —
[8] A: Yes, I thought that Revelle's referring to
[9] Starr in his paper, in this very prominent way, would
[10] make our triple collaboration a very natural one.
[11] Q: But it's true that the work of Starr and
[12] Searl isn't referred to in the Cosmos article at all,
[13] isn't that true?
[14] A: Not by name.
[15] Q: Can you show me how it does come through,
[16] with Exhibit 5, the AAAS talk, paragraphs two and
[17] three on page two?
[18] A: Yes.
[19] (Witness reviewing document.)
[20] A: He refers here to a specific scenario that
[21] Starr and Searl have constructed. It's very
[22] detailed. It uses lots of numbers.
[23] When I wrote the draft, I judged that it
[24] would not be wise to include in a general article

Page 170

[1] this kind of detail.
[2] Q: Okay. Did not Dr. Revelle say in his AAAS
[3] talk, "It may be more difficult to help forest trees
[4] and other ecological components to adapt, because the
[5] expected climate change will happen 50 to 100 times
[6] more rapidly than the changes at the end of the last
[7] ice age"?
[8] MR. BLUTE: Just point out where it
[9] is.
[10] Q: I believe it's page four, the end of the
[11] second paragraph.
[12] (Witness reviewing document.)
[13] A: Yes, he said that.
[14] Q: Is this consistent, in your view, with the
[15] Cosmos article saying, "Keep in mind also that
[16] year-to-year changes at any location are far greater
[17] and more rapid than what might be expected from
[18] greenhouse warming; and nature, crops, and people are
[19] already adapted to such changes"? That's — you can
[20] find it under "Impacts," Galley: 004, second
[21] paragraph down.
[22] A: That is — that is partly correct. But I
[23] also say —
[24] Q: I asked if it was consistent or not. Are

Page 171

[1] these statements consistent?
[2] A: It is consistent, yes.
[3] Q: How is it consistent that Dr. Revelle says
[4] in his AAAS talk that it may be more difficult to
[5] help forest trees and other ecological components to
[6] adapt, when the Cosmos draft says, keep in mind that
[7] nature is already adapted?
[8] A: It depends on which biota you're referring
[9] to. If you're referring to biota that had a lifetime
[10] of a few years, then clearly there's no problem.
[11] If you're referring to biota that had a
[12] lifetime, let's say, of 100 years, then there could
[13] be an adaptation problem. And I refer to it in the
[14] Cosmos article, in my first draft, in order to give a
[15] balanced picture, because not all the impact —
[16] there's a variety of impacts over a climate change,
[17] some good, some bad.
[18] Q: Why did that balance picture get taken
[19] out?
[20] A: It didn't.
[21] Q: Where is it in the Cosmos article?
[22] A: I'll refer you to it. I published a
[23] research paper in the late '70s pointing out the fact
[24] that rapid changes in climate that is more rapid than

Page 172

[1] changes of the soil can lead to adaptation problems.
[2] And that's referred to at the end of Galley: 003 and
[3] beginning of Galley: 004. I didn't reference the
[4] fact that this is my work.

[5] Q: Are you referring to the sentence, "Even
[6] though crop varieties are available that can benefit
[7] from higher temperatures with either more or less
[8] moisture, the soils themselves may not be able to
[9] adjust that quickly?"

[10] A: Yes.

[11] Q: Does that refer at all to forest trees?

[12] A: Yes.

[13] Q: Although you talk about crop varieties in
[14] the beginning of the sentence, a reader, to get your
[15] meaning correctly, would understand that the second
[16] half of the sentence, talking about soils adjusting,
[17] would be soils under forest trees?

[18] A: Yes. Mm-hmm.

[19] Q: So you maintain that the statement nature
[20] has already adapted to such changes is consistent
[21] with Revelle's warning it may be difficult to help
[22] forest trees to adapt?

[23] A: Yes, that's right.

[24] Q: Referring again to the AAAS text,

Page 173

[1] Exhibit 7, —

[2] A: 5.

[3] Q: — 5, thank you, Dr. Revelle states,
[4] "Planting trees in the United States would be
[5] worthwhile." Did that point get carried through to
[6] the Cosmos article?

[7] A: That is his point five on page one, which
[8] reads, "Sequestration of carbon in trees and other
[9] long-lived land plants."

[10] Q: Right, which he explains in the text at
[11] page three, last paragraph.

[12] (Witness reviewing document.)

[13] A: Yes, under "Direct Interventions,"

[14] Galley: 005 of Exhibit 1, I say, "Rebuilding forests
[15] is widely talked about, but may not be
[16] cost-effective..."

[17] By this, I mean it is possible to do this.
[18] It will do exactly as Revelle has suggested, of
[19] course, but it may cost a great deal of money.

[20] Q: Isn't it true elsewhere in the Cosmos
[21] article you say, "Tree planting would have to cover
[22] Australia and is uneconomic"?

[23] A: Yes.

[24] Q: So certainly, those statements about tree

Page 174

[1] planting aren't based on Revelle's view expressed in
[2] the AAAS talk?

[3] A: Revelle didn't discuss the economics
[4] anywhere. He was discussing about the theoretical
[5] possibility of sequestering carbon.

[6] Q: Okay.

[7] A: And I agree with him.

[8] MR. LANCASTER: Referring to the
[9] published Cosmos article, I think this may require
[10] another exhibit, if we could mark that as Exhibit
[11] whatever we're on.

[12] (Exhibit 12 marked
[13] for identification.)

[14] Q: Do you recognize this as the final version
[15] published in the Cosmos Journal?

[16] A: I do.

[17] Q: And do you know the date of publication?

[18] A: Approximately April 1991.

[19] Q: Sometime in April. It was not published
[20] in February?

[21] A: No. It could have been as early as March.

[22] Q: To revisit the "Impacts" sentence one more
[23] time on — I guess it's shown here as page 31 of
[24] Cosmos — just to verify what the quotation is,

Page 175

[1] "Assume what we regard as the most likely outcome: A
[2] modest average warming in the next century - well
[3] below the normal year-to-year variation - and mostly
[4] at high latitudes and in the winter."

[5] Now, you're aware, are you not, that the
[6] Intergovernmental Panel on Climate Change has stated
[7] its estimate of the most likely warming would be
[8] between 1.5 degrees Celsius and 4.5 degrees Celsius
[9] in the next century?

[10] A: I'm aware of that. Excuse me, that's
[11] incorrect.

[12] Q: Please correct me.

[13] A: Before doubling of CO2, whenever that
[14] takes place.

[15] Q: Would that be for a doubling of CO2 or for
[16] an equivalent doubling of CO2?

[17] A: Equivalent doubling.

[18] Q: Would that be for an equivalent doubling
[19] of CO2 at equilibrium conditions or transient
[20] conditions?

[21] A: Equilibrium conditions.

[22] Q: Would you accept that it is the contention
[23] of the Intergovernmental Panel on Climate Change that
[24] it's most likely that this condition will exist

Page 176

[1] before the end of the next century?
[2] **A:** Intergovernmental Panel on Climate Change
[3] has produced a variety of scenarios. Its basic
[4] scenario has proved to be unreliable and quite
[5] unacceptable. They've modified it at least once
[6] since then. And I believe it is still very doubtful
[7] whether their scenario will hold up. But be this as
[8] it may, the temperature numbers that you've mentioned
[9] are the ones that they have published.
[10] **Q:** Do you know — strike that.
[11] Do you think that Roger Revelle was aware
[12] of the IPCC report?
[13] **MR. BLUTE:** Objection. If you know.
[14] **MR. LANCASTER:** Do you want me to
[15] rephrase that?
[16] **Q:** Do you have any knowledge —
[17] **MR. BLUTE:** If he has knowledge. I
[18] don't want him guessing as to what Roger Revelle
[19] might have read somewhere sometime.
[20] **MR. LANCASTER:** That's fine.
[21] **BY MR. LANCASTER:**
[22] **Q:** Let's ask it this way: Did you and
[23] Dr. Revelle ever discuss the IPCC report?
[24] **A:** No.

Page 177

[1] **Q:** Do you have any knowledge — is there any
[2] reason for you to believe that Dr. Revelle disputed
[3] the IPCC report?
[4] **A:** I don't think he could have. It wasn't
[5] published.
[6] **Q:** Previous to the publication of the IPCC
[7] report, were copies distributed to numerous
[8] scientists?
[9] **A:** Perhaps they were to those people who
[10] worked on it. Speaking for myself, I did not get a
[11] copy until it was published.
[12] **Q:** Do you think it is possible that Dr.
[13] Revelle saw a copy before it was published?
[14] **A:** I have no basis for speculating on that.
[15] **Q:** Would it surprise you if you learned that
[16] he had reviewed a copy of the IPCC report before it
[17] was published?
[18] **A:** No, it would not surprise me.
[19] **Q:** All right. Would you agree with me that
[20] the modest average warming in the next century that
[21] you and your co-authors considered to be the most
[22] likely outcome in the Cosmos article would have to be
[23] well below 0.5 degrees Celsius in order to be well
[24] below the normal year-to-year variation?

Page 178

[1] **A:** We decided not to put a number on it. But
[2] it certainly would be a lower figure than what the
[3] IPCC had published.
[4] **Q:** It would be a very dramatically different
[5] figure, would it not?
[6] **A:** If — yes.
[7] **Q:** Yet, you believe that that statement would
[8] be accurate and truthful and objective?
[9] **A:** Yes, I do. And I believe my co-authors
[10] would subscribe to it.
[11] **Q:** Referring to the comment in the galley
[12] proof in Dr. Revelle's handwriting, bottom of the
[13] first page, Exhibit 1, under the section "The
[14] Scientific Base," can you say what that comment says?
[15] **A:** Yes.
[16] **Q:** Can you read that?
[17] **A:** Yes, I can.
[18] **Q:** Read it, please.
[19] **A:** The complete sentence says, "The models
[20] used to calculate future climate" — and those are
[21] the ones, I'd interject now, on which the IPCC
[22] estimates of 1.5 to 4.5 are based, which we do not
[23] accept — "are not yet good enough because the
[24] climate-balancing processes are not sufficiently

Page 179

[1] understood," to which Roger added in his own
[2] handwriting, "Nor would they ever be good enough
[3] until we gain more understanding of climate processes
[4] through observations and experiments."
[5] **Q:** Did you leave a word out there that's
[6] difficult to read?
[7] **A:** Yes.
[8] **Q:** Could that word be "careful," "through
[9] careful observations and experiments"?
[10] **A:** Yes, thank you.
[11] **Q:** Referring to the Cosmos article, is that
[12] comment by Revelle written?
[13] **A:** Yes, after we had a discussion on it, and
[14] I had to persuade him, persuade Roger Revelle, to
[15] modify his language and to soften it from his
[16] position that the models would never be good enough
[17] to make valid predictions, to the words "nor are they
[18] likely to be good enough," which is a much softer way
[19] of putting it to explain.
[20] In this discussion with Roger, I
[21] discovered, again, as I knew, of course, from past
[22] discussions, that he had no faith whatsoever in these
[23] mathematical models. And this is why I believe that
[24] he would never have accepted, nor would he accept any

Page 180

[1] of the numbers that the IPCC produced, nor would he
[2] give any weight to any of the numbers that
[3] mathematical models came up with. And he said so in
[4] his own words and his own handwriting, not only here,
[5] but also on other occasions.

[6] Q: Do you know if Dr. Revelle placed any
[7] credence in the forecast of Dr. Arrhenius in the
[8] 1900s?

[9] A: I don't know of anyone who does.

[10] Q: Referring to the "Nitrous Oxide"
[11] subheading under "Greenhouse Gases" on the second
[12] page of the text, Dr. Revelle's comment, "And
[13] denitrifying process in the ocean," —

[14] A: Yes.

[15] Q: — did that comment make it into the
[16] Cosmos article?

[17] A: No, it did not.

[18] Q: Can you say why not?

[19] A: Partly because he didn't feel it was
[20] necessary after we talked about it. And as you can
[21] see, he had added a question mark originally when he
[22] made the comment — when he wrote the comment and
[23] added another question mark afterwards. It doesn't
[24] add — in other words, it doesn't add to the

Page 181

[1] substance of the discussion.

[2] Q: Can you remember if Dr. Revelle made any
[3] subsequent comments to you after this day on that
[4] topic?

[5] A: No, he did not.

[6] Q: Are you certain of that?

[7] A: I think after we finished our discussion
[8] on this draft and he essentially signed off, I don't
[9] think we had any more detailed discussions.

[10] Q: And when you say he signed off, what do
[11] you mean by that? Is his name signed somewhere here?

[12] A: No, when I said he signed off, I mean by
[13] that we got up and said, "Okay, we've gone through
[14] the draft." The reason it doesn't make any
[15] difference is that this bacteria that produced the
[16] N₂O, and while the text here talks about soil, and
[17] there may also be processes in the ocean, it — it's
[18] immaterial to the rest of the discussion.

[19] Q: Isn't this whole section under "Greenhouse
[20] Gases" attempting to inform the reader about sources
[21] of those gases and uncertainty?

[22] A: Yes. There's always a question as to how
[23] complete do you want the discussion to be.

[24] Q: Understood. Is it — following up that,

Page 182

[1] is it fair to say you would always want the
[2] discussion to be as complete as space permitted?

[3] MR. BLUTE: I object. Go ahead.

[4] A: No, I would want the discussion to be as
[5] complete as is necessary for the purpose.

[6] The purpose here is to inform the reader
[7] sufficiently about the science so he can make some
[8] judgments about what to do. It doesn't make any
[9] difference about denitrifying processes in the ocean,
[10] because there's nothing that can be done about it.

[11] So while this is interesting information,
[12] from a scientific point of view, to the average
[13] reader who reads this article it's of useless
[14] baggage.

[15] On the other hand, when we talk about
[16] methane, in the previous paragraph, preceding
[17] paragraph, we do talk about the various sources, like
[18] coal mines, oil field operations, where actions,
[19] policy actions, can have some effect on sources.

[20] Q: By that argumentation, wouldn't you have
[21] left out any discussion about water vapor? — I
[22] withdraw it. It's argumentative.

[23] Let's move on to page Galley: 004, Dr.
[24] Revelle's notation next to the fourth paragraph down,

Page 183

[1] I'll try and read it: "Warming of Antarctic Ocean
[2] will take a long time because of deep convection."

[3] A: Yes.

[4] Q: Does that match the way you read that?

[5] A: Yes.

[6] Q: Isn't it true that you incorporated that
[7] remark in the Cosmos article through the words,
[8] "Modeling results suggest little warming of the
[9] Antarctic Ocean because the heat is convected to
[10] deeper levels"?

[11] A: Yes.

[12] Q: Does that convey the same message to the
[13] reader, do you believe?

[14] A: Yes.

[15] Q: Those are equivalent statements?

[16] A: Yes, I believe so.

[17] Q: In terms of scientific accuracy and
[18] precision, those are equivalent statements?

[19] A: Well, I think it has to be primarily
[20] understandable. It has to be to the average reader
[21] something that he can comprehend.

[22] Q: And an average reader would have trouble
[23] understanding the warming of the Antarctic Ocean
[24] would take a long time because of deep convection?

Page 184

[1] You've made it easier — I'll leave that question.
[2] **A:** Yes.
[3] **Q:** You've made it easier to understand this
[4] concept by saying, "Modeling results suggest little
[5] warming of the Atlantic Ocean because the heat is
[6] convected to deeper levels." I'm sorry, there must
[7] be a typo in what I'm reading. I think "Antarctic."
[8] Let me check that.
[9] (Pause.)
[10] **A:** My copy says "Antarctic."
[11] **Q:** "Modeling results suggest little warming
[12] of the Antarctic Ocean because the heat is convected
[13] to deeper levels."
[14] **A:** I feel they're equivalent.
[15] **Q:** Okay. Do you remember, in your letter to
[16] defendant in 1992, telling defendant that you engaged
[17] in a spirited rewrite of the Cosmos article in
[18] Dr. Revelle's office?
[19] **A:** I remember the word "spirited." I don't
[20] remember the rest.
[21] **MR. BLUTE:** Are you representing that
[22] that's what he said in the letter?
[23] **MR. LANCASTER:** I'm representing
[24] that. I believe the language is "culminating in a

Page 185

[1] spirited exchange."
[2] **MR. BLUTE:** Let's not play a game,
[3] not to suggest that you are. But so everything is
[4] clear, why don't we actually get the letter. I
[5] didn't mean to suggest you were playing a game.
[6] Sorry.
[7] (Discussion off the record.)
[8] (Exhibit 13 marked
[9] for identification.)
[10] **A:** He can change, yes. Yes, absolutely
[11] correct.
[12] **Q:** "Roger and I" — I'm quoting — "had
[13] spirited exchanges about our Cosmos paper culminating
[14] in a detailed rewrite for the final draft in February
[15] 1991 when I was in his office."
[16] **A:** Yes.
[17] **Q:** Were your spirited exchanges previous to
[18] this detailed rewrite, or did they occur on that day?
[19] **A:** On that day.
[20] **Q:** 6 February.
[21] **A:** On that day, yes. They were simultaneous.
[22] **Q:** And is it your position that the
[23] modifications between the galley proof and the Cosmos
[24] Journal article constitute a detailed rewrite?

Page 186

[1] **A:** Yes, that's what I had in mind.
[2] **Q:** Would you say that this rewrite was any
[3] substantial change in the article?
[4] **A:** No, I don't think so. But it did evoke a
[5] spirited discussion.
[6] **Q:** I understand. If I represent to you that
[7] the amount of text altered owing to Dr. Revelle's
[8] review on 6 February comprised less than one
[9] hundredth of the Cosmos text, you would still contend
[10] that this was a rewrite?
[11] **A:** Yes, we rewrote some parts of it.
[12] **Q:** Okay. Moving along rapidly, let me ask
[13] you, coming back to the "Impacts of Climate Change"
[14] and the comment regarding what the authors expected
[15] as global warming in the next century, why, if
[16] Dr. Revelle believed in your conversation with him
[17] that global warming in the next century would be less
[18] than one degree Celsius, well below the normal
[19] year-to-year variation — why would he have objected
[20] to leaving that phrase in, "less than one degree
[21] Celsius"? Why cross that out, if he believes that
[22] the expected warming in the next century would be
[23] below one degree Celsius?
[24] **MR. BLUTE:** I object. Go ahead.

Page 187

[1] **A:** We had no access to data in his office. I
[2] believe that he thought that the year-to-year
[3] variation was larger, much larger, than it really is.
[4] He seemed to be under the impression, as
[5] best I recall now, that the year-to-year variation is
[6] really quite large. I mentioned to him that I didn't
[7] think so, and that it was smaller, but it was less
[8] than one degree. And so we compromised by leaving
[9] out any reference to any number.
[10] **Q:** Why was a compromise necessary if he
[11] believed less than one degree Celsius? Why would any
[12] compromise be necessary?
[13] **A:** Well, he didn't have the time nor
[14] inclination apparently to verify my statements. He
[15] seemed to think that the year-to-year variation was
[16] large, much larger, and we couldn't settle the matter
[17] in sitting next to each other at the table.
[18] **Q:** Do you think he was tired at this point?
[19] **A:** He didn't seem to be tired.
[20] **Q:** How many minutes into your meeting were
[21] you at that point?
[22] **A:** Well, it's hard to say. I can't answer
[23] this question after two and a half years.
[24] **Q:** Do you remember as you approached this

Page 188

[1] article with Dr. Revelle —
[2] **A:** Halfway through, perhaps.
[3] **Q:** Would he have sat down —
[4] **A:** We didn't jump around. We went through
[5] these.
[6] **Q:** You started at the beginning?
[7] **A:** Yeah, we started at the beginning.
[8] **Q:** And do you remember that it was Dr.
[9] Revelle's pattern to work carefully and slowly from
[10] the beginning?
[11] **A:** Yes.
[12] **Q:** Is it likely that to cover this first page
[13] here it could easily have taken half an hour?
[14] **A:** No, I don't think it was that long.
[15] Although, we did spend a good bit of time on his
[16] additions, his last sentence, in which I tried to
[17] persuade him to tone down his skepticism about the
[18] mathematical models and about the predictions of
[19] future warming.
[20] **Q:** Would it surprise you to know that
[21] Dr. Revelle taught seminars in which he discussed the
[22] global temperature record?
[23] **A:** No, it doesn't surprise me.
[24] **Q:** Yet, you represent here that he had an

Page 189

[1] inaccurate knowledge, at least at this time
[2] discussing with you, what the normal year-to-year
[3] variation was.
[4] **A:** That was my impression, yes.
[5] **Q:** Is it possible that you allowed him to
[6] believe that — withdraw that.
[7] Is it possible that your description to
[8] Dr. Revelle of normal year-to-year variation was
[9] significantly higher than the true normal
[10] year-to-year variation?
[11] **MR. BLUTE:** Objection.
[12] **A:** That doesn't make sense. This could not
[13] have happened.
[14] **Q:** Take the hypothetical that the true
[15] year-to-year variation, the normal year-to-year
[16] variation, is less than .2 degrees Celsius.
[17] If that were true, then would a
[18] representation to Dr. Revelle that the normal
[19] year-to-year variation is just less than one degree
[20] Celsius — that would be an inaccurate
[21] representation, wouldn't it?
[22] **A:** The reason I said it doesn't make sense is
[23] that he chose a much higher value for year-to-year
[24] variation. You see —

Page 190

[1] **Q:** What did he choose?
[2] **A:** If you're correct, then he would have
[3] asked that we abolish the statement that the expected
[4] temperature increase is less than the year-to-year
[5] variation. That's what he should have done. He
[6] didn't. He accepted that.
[7] **Q:** Is it fair for me to say that you were
[8] quite happy to let him accept that?
[9] **A:** My feeling was the fewer changes the
[10] better. I was at this point glad to turn the article
[11] back to the editor and let him take care of it.
[12] **Q:** Didn't you realize, Dr. Singer, that
[13] leaving that statement stand the way it was would
[14] essentially send the message to the reader that
[15] Dr. Revelle and Dr. Starr and Dr. Singer believed the
[16] likely warming in the next century would be well
[17] below 0.5 degrees centigrade?
[18] **A:** We believe that the warming will be very
[19] small, much smaller than the IPCC, even the lowest
[20] IPCC number. This belief is firmly based on
[21] observations that we had.
[22] **Q:** Did Dr. Revelle believe that the warming
[23] in the next century, the most likely global average
[24] warming in the next century, would be well below 0.5

Page 191

[1] degrees Celsius; yes or no?
[2] **MR. BLUTE:** I object to that. You
[3] can answer.
[4] **A:** We had a discussion on this matter. I
[5] tried to persuade him that the warming would be less
[6] than one degree. He wasn't sure what it would be.
[7] We then decided to leave out any reference to the
[8] expected warming, any numerical reference.
[9] **Q:** Was it not clear to you that leaving the
[10] sentence the way it was would allow the meaning to be
[11] carried that the expected warming, the most likely
[12] outcome, would be less — would be well below 0.5
[13] degrees centigrade? Wasn't it clear to you then as
[14] it is now that that's what the meaning was?
[15] **MR. BLUTE:** I object to that, because
[16] I think the testimony has been that both Dr. Revelle
[17] and Dr. Singer had a disagreement over what the
[18] year-to-year global warming increase would be.
[19] So when you say "Wasn't that what it
[20] meant?" it was left out. I don't understand. It
[21] wasn't —
[22] **MR. LANCASTER:** I think — let's go
[23] off the record.
[24] (Discussion off the record.)

Page 192

[1] **MR. BLUTE:** I'll withdraw my
[2] objection. Ask another question.
[3] **MR. LANCASTER:** I'd like to go, I
[4] believe, two questions back and reask that question
[5] to get a yes or a no.
[6] (Question read.)
[7] **BY MR. LANCASTER:**
[8] **Q:** Okay. Let's ask that.
[9] **A:** Well, your question is premised on the
[10] supposition that your analysis and your
[11] representation of Jones' data is correct. We argued
[12] about it this morning.
[13] I have no basis of judging whether your
[14] presentation is sound. I would be happy to submit it
[15] to someone whom I consider an expert. So I'm not
[16] willing to commit myself here, nor do I have the
[17] data, on the magnitude of the year-to-year variation.
[18] I simply can't answer your question in the way in
[19] which you've phrased it.
[20] **Q:** Do you think this disagreement about
[21] whether the expected warming in the next century is
[22] less than or greater than one degree Celsius is an
[23] important issue?
[24] **A:** Only if you will spell out by how much.

Page 193

[1] Certainly it is immaterial whether it is .9 degrees
[2] or 1.1 degrees. It is very material whether it is
[3] less than one, that is to say, .8, .9 degrees, even a
[4] little bit less than one, or whether it is between
[5] three and five degrees. Then it would be a very
[6] material difference.
[7] **Q:** Is it an important issue between well
[8] below 0.5 degrees versus one to three degrees?
[9] **A:** In my view, estimating impacts of climate
[10] change on various human activities, as best as I can
[11] estimate those, the difference between .5 degrees and
[12] one degree is not material.
[13] **Q:** What expertise, Dr. Singer, do you have
[14] for estimating impacts on human society from global
[15] warming?
[16] **A:** We have historical data, which I have
[17] read. And we have publications by people who have
[18] devoted time to the subject, which I have also looked
[19] at.
[20] **Q:** Which people?
[21] **A:** To mention a specific person, John Eddy,
[22] an expert on solar influences on climate, has written
[23] about historical climate changes and their effects.
[24] **Q:** Has John Eddy analyzed impacts on human

Page 194

[1] society with potential climate change scenarios? Has
[2] he conducted an impact assessment?
[3] **A:** You mean for the future?
[4] **Q:** For any potential global change scenario.
[5] **A:** Not that I'm aware of.
[6] **Q:** Have you conducted research that leads you
[7] to draw a conclusion about potential impacts? Have
[8] you conducted any impact assessment research
[9] yourself?
[10] **A:** If you mean have I been funded to carry on
[11] such a project, the answer is no.
[12] **Q:** Isn't it true, Dr. Singer, that there has
[13] yet to be carried out impact assessment research for
[14] global warming?
[15] **A:** The answer is yes and no. Let me say that
[16] a lot of money has been spent by people who have
[17] claimed to have carried out such impact research.
[18] **Q:** Which people?
[19] **A:** I cannot give you their names. But —
[20] **Q:** Do you know of these people?
[21] **A:** The reports are available from the
[22] Environmental Protection Agency and from the
[23] Department of Energy. I regard such studies as
[24] rather speculative, because the assumptions that have

Page 195

[1] gone into these studies are immense.
[2] **Q:** So you would agree that there are no
[3] conclusive reliable data for what the impacts of a
[4] global warming in the next century could be?
[5] **A:** No.
[6] **Q:** Then how can you conclude —
[7] **MR. BLUTE:** Let him finish.
[8] **A:** I think you phrased it improperly. I have
[9] concluded that the impacts would be minor, of little
[10] consequence, in our society, in our society, which is
[11] an industrial society.
[12] **Q:** What evidence do you have to form a
[13] conclusion? You've admitted that you haven't done
[14] this research.
[15] **A:** Well, other people have and have published
[16] it.
[17] **Q:** You just told me that you don't believe
[18] any complete or reliable studies have been done.
[19] **A:** I cannot say that they are complete. I
[20] cannot say that they're reliable. I can only say
[21] that they have been published. Many people will
[22] believe them.
[23] **Q:** So you maintain that impact studies have
[24] been published that are not comprehensive or

Page 196

- [1] complete, and you don't believe the impacts that they
[2] portend; is that true?
[3] **A:** Let me start again. Many impact studies
[4] have been published. There is a wide range, wide
[5] spectrum of impacts that have been predicted. These
[6] seem to depend very much on the assumptions that
[7] people make. I, of course, find some impact studies
[8] more believable than others.
[9] **Q:** Do you maintain that you know enough about
[10] these impact studies to conclude the difference
[11] between a warming well below 0.5 degrees Celsius
[12] versus a warming between one and three degrees
[13] Celsius is not a significant issue?
[14] **A:** I think that's a fair statement and
[15] certainly for the United States.
[16] **Q:** How about for the globe?
[17] **A:** That's something that needs to be looked
[18] at more carefully, because in an agricultural society
[19] the impacts are different than they are in the United
[20] States.
[21] **Q:** Would you say that you and Dr. Revelle
[22] have equal concern for global citizens and their
[23] welfare in the face of global warming?
[24] **A:** We have never compared notes on this. But

Page 197

- [1] since we have similar backgrounds and somewhat
[2] similar experiences, perhaps we do have similar
[3] concerns.
[4] **Q:** What is authorship, in your view? What
[5] constitutes an author?
[6] **A:** Well, let me give you an operation
[7] definition. Authorship means that your name appears
[8] on the top of the article.
[9] **Q:** Is that a complete definition of an
[10] author?
[11] **A:** It is an accepted definition. I think if
[12] you see someone's name on an article or a book you
[13] would call him the author, you would refer to him as
[14] an author, and he would be regarded as the author.
[15] **Q:** If two people wrote an article and the
[16] name of only one appeared at the top, is there only
[17] one author?
[18] **A:** Well, by this operation definition, yes.
[19] **Q:** If four people contributed to an article
[20] and only two names appear at the top, are there only
[21] two authors?
[22] **A:** Yes, there are only two authors, and two
[23] collaborators or contributors.
[24] **Q:** So in your view, authorship is not

Page 198

- [1] justified on the basis of — or authorship is not
[2] attributable on the basis of contribution alone?
[3] **A:** That is correct. And there are many
[4] instances among scientific papers where names appear
[5] as authors where the contribution has been minor, and
[6] names do not appear where people have made what I
[7] would call major contributions.
[8] **Q:** What about the case where a person puts
[9] their name on a body of work that is written by
[10] someone else? Are they an author?
[11] **A:** Where a person puts their name? I don't
[12] understand your use of the plural.
[13] **Q:** Say Person B writes a page of text. And
[14] person A publishes it with Person A's name at the
[15] head of it. By your definition, A is the author and
[16] B is not; is that true?
[17] **A:** By my operational definition, if B's name
[18] does not appear as an author, he is not regarded as
[19] an author.
[20] **Q:** So no matter what B's responsibility is
[21] for the ideas and the work of the piece, and no
[22] matter how little A might have contributed, the fact
[23] that A's name appears makes A the author?
[24] **A:** That's correct.

Page 199

- [1] **Q:** Does that make A the legitimate author?
[2] **A:** That's a separate question.
[3] **Q:** Let's talk about legitimate authorship.
[4] **A:** That's a legal question. And I'm not
[5] prepared to answer legal questions.
[6] **Q:** Is it not an ethical question?
[7] **A:** Ethical questions —
[8] **MR. BLUTE:** I just want to interject
[9] one thing. Are you assuming that A knows that his
[10] name is going to be used and has voluntarily agreed
[11] to it, or are you assuming someone's name being used
[12] without their authorization? I think that does —
[13] **Q:** Let's do both. Let's say B has not
[14] authorized A for A to publish with A's name on work
[15] that B authored.
[16] **A:** You've lost me.
[17] **Q:** Let's say B drafts an article and A takes
[18] the article and publishes it with A's name on it. By
[19] your operational definition, A is the author, is that
[20] correct?
[21] **A:** Correct.
[22] **Q:** Now, do you have any ethical concern about
[23] that?
[24] **A:** Yes.

Page 200

[1] Q: Would A's activity — actions be
[2] unethical?
[3] A: The way you've described it?
[4] Q: The way I've described it.
[5] A: Unless there are other circumstances, I
[6] would say yes.
[7] Q: So in your view, the word "legitimate" has
[8] only legal connotation, of which you have no grounds
[9] to speak?
[10] A: I think you put words in my mouth. I
[11] didn't say only legal connotations. You yourself
[12] said legal connotations and I agreed with you.
[13] Q: Okay. Let's go back to A, whether or not
[14] A is a legitimate author. I asked previously if A
[15] was a legitimate author, and you said you couldn't
[16] answer because it's a legal determination.
[17] A: Legitimate derives from the Latin word
[18] "legit," which is law. Legitimate means lawful.
[19] Lawful refers to law. These questions are circulated
[20] by lawyers. This is a question you yourself will
[21] have to answer and not address to me. I can't help
[22] you with it.
[23] Q: Is there any use of the word "legitimate"
[24] in common English language by nonlawyers?

Page 201

[1] A: I suppose there must be, yes.
[2] Q: Can you imagine journalists who are not
[3] lawyers ever using the word?
[4] A: Yes.
[5] Q: Let's imagine the hypothetical where A and
[6] B are co-authors on a paper. A is drafting the
[7] paper. They talked about the paper being a
[8] co-authored paper. And B's understanding is that it
[9] will be a co-authored paper. And B's ideas are
[10] incorporated in the paper. And A publishes the paper
[11] with only A's name on it. Do you have any ethical
[12] concern about that?
[13] A: Yes.
[14] Q: Let us say A and B are writing a paper and
[15] halfway through their writing of a paper A takes the
[16] ideas and the co-authored work and publishes half or
[17] three quarters of it under only A's name.
[18] Do you have any ethical concern about
[19] that, assuming that these paragraphs were considered
[20] by A and B to be co-authored paragraphs?
[21] MR. BLUTE: I'm going to object.
[22] Dr. Singer can answer this question. But it is now
[23] coming on 4:30. It's a long day. Let me just
[24] finish.

Page 202

[1] These hypotheticals, although
[2] interesting, have nothing to do with the issues in
[3] this case. And if you've got a particular issue or
[4] item you want to discuss, fine. We know that Dr.
[5] Revelle —
[6] MR. LANCASTER: Let's just get the
[7] answer to this question. And I won't ask another in
[8] this series.
[9] BY MR. LANCASTER:
[10] Q: Do you need that read back? Or do you
[11] remember it? Is there an ethical concern?
[12] A: My answer is it depends entirely on the
[13] circumstances. I cannot give you an answer.
[14] Q: Is the reason that you are uncomfortable
[15] giving me an answer in this case is because you know
[16] that's exactly what you did with this paper?
[17] MR. BLUTE: With this paper? I
[18] object to that. And I don't think you have to answer
[19] that. That's just an argument. And what we saw —
[20] it's not true.
[21] MR. LANCASTER: Okay. Let's mark up
[22] Exhibit 14.
[23] (Exhibit 14 marked
[24] for identification.)

Page 203

[1] Q: What's the title of the Cosmos Club
[2] article, Dr. Singer?
[3] A: "What To Do About Greenhouse Warming:
[4] Look Before You Leap."
[5] Q: Do you recall this article published in
[6] Environmental Science and Technology, Volume 24,
[7] No. 8, 1990?
[8] A: Yes.
[9] Q: When did you submit your manuscript to
[10] this journal?
[11] A: I don't recall. But we can check to see
[12] when it was published.
[13] Q: They would know, wouldn't they; the
[14] journal would?
[15] A: Yeah. Mm-hmm.
[16] Q: What's the title of this article?
[17] A: "What To Do About Greenhouse Warming."
[18] Q: Let's pick up the galley proof. Picking
[19] up Exhibit 14 and picking up Exhibit 1, —
[20] A: Okay.
[21] Q: — reading the second paragraph of Exhibit
[22] 14, and I quote, "The wide acceptance of the Montreal
[23] Protocol - which limits and rolls back the
[24] manufacture of chlorofluorocarbons (CFCs), considered

Page 204

[1] a threat to the stratospheric ozone layer - has
[2] encouraged environmental activists at conferences in
[3] Toronto and The Hague to call for similar controls on
[4] carbon dioxide. They have expressed disappointment
[5] with the White House for not supporting immediate
[6] action on CO2..." Do you see that language there?
[7] **A:** Yes.
[8] **Q:** I'm now reading from the Cosmos Journal
[9] article, starting in the third paragraph, "Wide
[10] acceptance of the Montreal Protocol, which limits and
[11] rolls back the manufacture of chlorofluorocarbons
[12] (CFCs) to protect the ozone layer, has encouraged
[13] environmental activists at international conferences
[14] the past three years to call for similar controls on
[15] CO2 from fossil-fuel burning. These activists have
[16] expressed disappointment with the White House for not
[17] supporting immediate action."
[18] **MR. BLUTE:** Is there a question at
[19] the end of that?
[20] **Q:** The question to you, sir, is, do these two
[21] statements sound similar to you?
[22] **A:** They do.
[23] **Q:** I'll read the next paragraph: "The
[24] scientific base for greenhouse warming includes some

Page 205

[1] facts, lots of uncertainty, and just plain
[2] ignorance;" — I'm sorry, this is a quote from
[3] Exhibit 14, the Environmental Science and Technology
[4] piece — "it needs more observations, better
[5] theories, and more extensive calculations."
[6] Reading now from the Cosmos article, first
[7] paragraph under "The Scientific Base": "The
[8] scientific base for greenhouse warming includes some
[9] facts, lots of uncertainty and just plain lack of
[10] knowledge - requiring more observations, better
[11] theories and more extensive calculations."
[12] Do these two statements sound similar?
[13] **A:** They do.
[14] **Q:** I don't want to take the time to read all
[15] the way through here.
[16] **MR. BLUTE:** Should we state for the
[17] record S. Fred Singer is the author of both of these?
[18] **Q:** Isn't it true, Dr. Singer, that you are
[19] the sole author of the Environmental Science and
[20] Technology article?
[21] **A:** It is.
[22] **Q:** Isn't it true, Dr. Singer, that the entire
[23] Environmental Science and Technology article, other
[24] than the very first paragraph, is the same text

Page 206

[1] practically verbatim as the Cosmos Club Journal
[2] article?
[3] **A:** No.
[4] **Q:** Okay. Let's go paragraph by paragraph
[5] through the Environmental Science —
[6] **A:** We don't have to. I can tell you what I
[7] have in mind.
[8] **Q:** Okay. Can you give me a more complete
[9] answer?
[10] **A:** Yes.
[11] **MR. BLUTE:** Go ahead.
[12] **A:** This takes certain parts of the draft
[13] which I prepared at a time when it was not known
[14] where this would be published.
[15] **MR. BLUTE:** By "it," you're referring
[16] to Exhibit No. 1?
[17] **A:** Exhibit No. 1. Later it became the Cosmos
[18] article and used some of these same ideas, which you
[19] have accused me do not include Revelle's ideas, in a
[20] short summary paper for Environmental Science and
[21] Technology.
[22] **Q:** Is it not your contention —
[23] **A:** May I finish? These are obviously not the
[24] same. They obviously are different length. The

Page 207

[1] Cosmos paper has graphs, data, and sections that
[2] reflect very directly the material that Roger Revelle
[3] presented at the AAAS meeting in New Orleans.
[4] **Q:** Dr. Singer, earlier today you've contended
[5] that Chauncy Starr and Dr. Revelle were co-authors of
[6] this material in the Cosmos article, did you not?
[7] **MR. BLUTE:** We're not going to play
[8] that game again.
[9] **MR. LANCASTER:** This is not a game,
[10] Joe. This is a simple question.
[11] **MR. BLUTE:** We're not going to go
[12] back and review 40 pages of testimony.
[13] **MR. LANCASTER:** No, we're not.
[14] **BY MR. LANCASTER:**
[15] **Q:** Do you consider Roger Revelle a co-author
[16] of this text?
[17] **A:** You're playing a game.
[18] **Q:** I am not playing a game. I'm deadly
[19] serious.
[20] **MR. BLUTE:** Time out. Time out.
[21] Before you begin the next question, if you want to
[22] ask a question now to Dr. Singer, fine. But don't
[23] rephrase your characterization of what he said
[24] earlier, because I assure you I can show you in the

Page 208

[1] transcript that what you just characterized his
[2] testimony to be is not true.
[3] So if you want to ask him a question
[4] as to — that he can give a direct answer to now,
[5] fine. But don't characterize what he said four hours
[6] ago —
[7] **MR. LANCASTER:** Okay.
[8] **MR. BLUTE:** — mischaracterize.
[9] **BY MR. LANCASTER:**
[10] **Q:** We're not going to go over all of it.
[11] Dr. Singer, is the statement in the Cosmos
[12] Club Journal article, "The scientific base for a
[13] greenhouse warming is too uncertain to justify
[14] drastic action at this time. There is little risk in
[15] delaying policy responses to this century-old problem
[16] since there is every expectation that scientific
[17] understanding will be substantially improved within
[18] the next decade" — those two sentences, were those
[19] co-authored by Roger Revelle?
[20] **A:** Let me explain it to you.
[21] **Q:** Yes or no; were they co-authored by Roger
[22] Revelle?
[23] **MR. BLUTE:** No, no, you asked a
[24] question. He can answer it as he sees fit.

Page 209

[1] **MR. LANCASTER:** Fine.
[2] **MR. BLUTE:** You can't tell him "Yes
[3] or no?" You answer it as you see fit, Dr. Singer.
[4] **A:** And I would not like to be shouted at.
[5] **Q:** I apologize.
[6] **A:** I hope you'll keep your voice down.
[7] **Q:** I don't like being sued.
[8] **MR. BLUTE:** Let's just ask the
[9] question and answer it. And then I think we ought to
[10] break.
[11] **MR. LANCASTER:** I will promise to
[12] keep my voice down.
[13] **A:** The Cosmos paper became co-authored when
[14] Roger Revelle's name appeared on it, when he reviewed
[15] it and agreed to it. I see nothing wrong with
[16] writing short summaries, op-ed articles, giving
[17] talks, or doing anything else that is essentially a
[18] condensation of the paper.
[19] And I'm sure that Chauncy Starr has done
[20] the same. And I'm sure that Roger Revelle would do
[21] the same when he gives a talk, if he can do that,
[22] quoting from this Cosmos paper or using it.
[23] I'm appalled by your behavior, I really
[24] am, because you accused me of being unethical,

Page 210

[1] something that you've been accusing me of for some
[2] time. And I take this very seriously. I don't
[3] appreciate it at all. I'm outraged.
[4] **MR. BLUTE:** Let's stop. I think —
[5] first of all, given the time — it's up to you. It's
[6] 4:30. We've had a long day.
[7] **MR. LANCASTER:** I'd like to ask a
[8] couple more questions. We can do it in a subdued
[9] manner.
[10] **MR. BLUTE:** That's fine. I don't
[11] want to go beyond five, for obvious reasons.
[12] **MR. LANCASTER:** I understand.
[13] **MR. BLUTE:** I have to leave at five.
[14] So let's go on for another half hour.
[15] Try and keep it, both of us, in a
[16] subdued manner. You ask the question. Dr. Singer,
[17] give me a chance to object, and then you can give the
[18] answers. Go ahead.
[19] **BY MR. LANCASTER:**
[20] **Q:** Were Dr. Revelle and Dr. Starr aware of
[21] your submission of this material to Environmental
[22] Science and Technology?
[23] **A:** I cannot say. I don't believe so.
[24] **Q:** Did you notify them, sir, of your

Page 211

[1] submission of this material to Environmental Science
[2] and Technology?
[3] **A:** Not that I recall.
[4] (Pause.)
[5] **A:** To finish my answer, I think you should
[6] address the question to Dr. Starr and ask him if he
[7] sees anything objectionable about publishing a
[8] summary which may well have been submitted early on.
[9] I don't know when it was submitted. I don't even
[10] remember if it was submitted. It may have been
[11] requested. It may have been asked for.
[12] **Q:** Isn't it true that the text of the Cosmos
[13] Club article, you have told me, was written up in
[14] your first draft in March of 1990 at the direction of
[15] Roger Revelle for a collaborative venture to publish
[16] a co-authored paper?
[17] **MR. BLUTE:** I object to the
[18] characterization of his earlier testimony.
[19] **MR. LANCASTER:** On what grounds?
[20] **MR. BLUTE:** I think the testimony
[21] stands for itself.
[22] **MR. LANCASTER:** Okay. I'm sorry.
[23] Withdraw and rephrase.
[24] **BY MR. LANCASTER:**

Page 212

[1] Q: The Cosmos Club article, the text, in
[2] March 1990, was that drafted at the direction of
[3] Roger Revelle as part of a collaboration involving
[4] you and Dr. Starr and Dr. Revelle?
[5] A: At his suggestion.
[6] Q: At his suggestion, meaning he did or did
[7] not anticipate this was co-authored work?
[8] A: He did anticipate that. In other words,
[9] if I fulfilled my part to draft — to prepare a
[10] draft, he would agree to be a co-author.
[11] Q: Do paragraphs two, three, four, five, six
[12] on the first page of the Cosmos Club article go — do
[13] those paragraphs incorporate Dr. Revelle's ideas
[14] drawn out of the AAAS talk?
[15] A: I've answered this —
[16] MR. BLUTE: I was just going to say
[17] that he's answered this many times today. If you
[18] want the answer again, we'll do it again. But go
[19] ahead.
[20] Q: Yeah, I want it in this context.
[21] A: As I have answered many times today, I
[22] drafted the article. I believed that my draft was
[23] consonant, and not a contradiction, with anything
[24] that Revelle had presented and written, specifically

Page 214

[1] Q: Therefore, you'd agree that this type of
[2] co-authorship is not the type of scientific paper
[3] where a research group leader writes the paper and
[4] laboratory assistants are added as co-authors?
[5] A: Well, sometimes it works the other way
[6] around.
[7] Q: Right. Okay. This is a different sort of
[8] collaboration?
[9] A: No, the paper is different. The kind of
[10] paper is different. Let me put it this way. I think
[11] you're under misapprehension.
[12] In a scientific paper there is — there
[13] are two priorities. There are new results presented.
[14] Well, this here is not a scientific paper. It
[15] incorporates subjective views held by the co-authors,
[16] opinions in some cases. It is written at a level
[17] which is understandable to the layman.
[18] Q: Why is Dr. Ellsaesser not a co-author?
[19] A: He never asked to be a co-author. We
[20] never asked him to be a co-author. But he agreed to
[21] advise or contribute his thoughts on the particular
[22] issue in this paper. Technically, also, to be a
[23] co-author on a Cosmos Club Journal paper, you had to
[24] be a member of the club.

Page 213

[1] his AAAS paper in New Orleans.
[2] Q: But at that point you were the author of
[3] that material?
[4] A: At that point in time, there was no author
[5] in the sense that it had not been published with a
[6] name on it. At that point I was the drafter of the
[7] material.
[8] Q: The collaboration had begun?
[9] A: There's no formal contract signed among
[10] the three authors. The understanding had been
[11] entered into.
[12] Q: Let's see if we can use the last few
[13] minutes more productively.
[14] Would you agree that the Cosmos Club
[15] Journal article is not a scientific research article,
[16] and that you did not report findings of a research
[17] group in which all the authors were participating,
[18] and it was not offered for publication in a peer
[19] review scientific journal?
[20] A: That is absolutely correct. It is not a
[21] scientific paper. It was not intended as a
[22] scientific paper. And it therefore was not treated
[23] by any of the co-authors as we would a scientific
[24] paper.

Page 215

[1] Q: Is this relevant to the collaboration,
[2] that three members of the Cosmos Club sat down at
[3] breakfast in New Orleans and decided to collaborate?
[4] A: Well, we had not thought of the Cosmos
[5] Club at the time. In fact, I didn't — hadn't had a
[6] very clear idea whether it was going to be published.
[7] To save you some time, I will just tell
[8] you that the editor of the Cosmos Club contacted me
[9] and asked me if I would write a paper on global
[10] warming. And I said to him, "Well, it so happens
[11] that Revelle and Starr and I are working on this."
[12] Q: So when you talked to the Cosmos Club
[13] editor, you represented this as a collaborative work?
[14] A: Yes.
[15] Q: What date was that?
[16] A: In, the best of my recollection, the
[17] latter part of '91.
[18] Q: 1990, or 1991?
[19] A: 1990, excuse me. I misspoke.
[20] Q: This would have been the autumn of 1990?
[21] A: I don't remember.
[22] Q: Could it have been the spring of 1990?
[23] A: No, I don't think so.
[24] Q: Why weren't Drs. Revelle or Starr credited

Page 216

[1] with authorship for the Environmental Science and
[2] Technology piece?
[3] **A:** The editors asked me to write an article.
[4] Had they been willing to publish the Cosmos article,
[5] it certainly would have meant that Starr and Revelle
[6] were co-authors. I consider this to be like an op-ed
[7] article, summary piece.
[8] **Q:** You don't consider the Cosmos Club Journal
[9] article to be a summary piece?
[10] **A:** No, it's a longer piece, a more serious
[11] piece. It has data. It has graphs.
[12] **MR. LANCASTER:** Let me just close —
[13] take 10 more minutes.
[14] (Discussion off the record.)
[15] **BY MR. LANCASTER:**
[16] **Q:** Dr. Singer, are you well acquainted with
[17] Dr. Robert Balling?
[18] **A:** No.
[19] **Q:** Do you know Dr. Robert Balling?
[20] **A:** Yes.
[21] **Q:** Do you know Dr. Patrick Michaels?
[22] **A:** Yes.
[23] **Q:** Are you well acquainted with him?
[24] **A:** Yes.

Page 217

[1] **Q:** Are you aware that Dr. Patrick Michaels
[2] published a chapter in his recent book titled
[3] "Revelle's Last Testimony"?
[4] **A:** Yes.
[5] **Q:** Do you know if Dr. Michaels refers to this
[6] paper or cites this paper in that book?
[7] **MR. BLUTE:** "This paper," referring
[8] to —
[9] **Q:** I'm sorry, the Environmental Science and
[10] Technology paper.
[11] **A:** I don't know that. I have not actually
[12] read his book. And only — my attention to this
[13] Revelle thing you referred to was only drawn to it
[14] about a week ago.
[15] **Q:** Do you know a scientist named Dr. Sherwood
[16] Idso?
[17] **A:** Yes.
[18] **Q:** Do you know Dr. Reed Bryson?
[19] **A:** Yes.
[20] **Q:** And Dr. Richard Lindzen?
[21] **A:** Yes.
[22] **Q:** Dr. Hugh Ellsaesser?
[23] **A:** Yes.
[24] **Q:** Would it be fair to say that Drs. Balling,

Page 218

[1] Idso, Bryson, Michaels, Ellsaesser, and Lindzen are
[2] perceived as a related group by many in the global
[3] warming science community?
[4] **A:** I would prefer if you asked me a question
[5] that I could answer from my personal knowledge.
[6] **Q:** Okay. If these scientists were together
[7] in the room, would you feel welcomed in their midst?
[8] **MR. BLUTE:** I object. Well, I object
[9] to that question. But go ahead and answer, if you
[10] can.
[11] **A:** Let me say I'd feel comfortable with them.
[12] I would feel comfortable with others. I also count
[13] Steven Schneider as a friend. And he came to my
[14] house. So I feel comfortable with many scientists.
[15] **Q:** That's a fair response. Would you say
[16] that in the Cosmos text — Cosmos article, that you
[17] relied strongly upon this group of scientists, in
[18] that you cite six of them and refer to four of them
[19] twice?
[20] **A:** Yes.
[21] **Q:** In Dr. Revelle's AAAS talk, did he make a
[22] single reference to the work of any of these
[23] scientists?
[24] **A:** No, but he covered a different aspect of

Page 219

[1] this problem. He covered the problem of mitigation.
[2] The people you've mentioned work on the
[3] problem of climate, climate data, which Revelle did
[4] not specifically discuss in his New Orleans paper.
[5] So it is natural that there would be this
[6] discrepancy.
[7] **Q:** Isn't it true that Dr. Revelle, in his
[8] AAAS talk, began his talk by saying there is a good
[9] but by no means certain chance that the warming in
[10] the next century —
[11] **A:** Significant.
[12] **Q:** — would be significantly warmer?
[13] **A:** Yes, he said that.
[14] **Q:** Would you think that any of those
[15] scientists, Dr. Balling, Idso, Bryson, Michaels,
[16] Ellsaesser, or Lindzen, would concur with that
[17] statement of Dr. Revelle, any of them?
[18] **A:** Yes, I think they might agree that there's
[19] a chance.
[20] **Q:** Are you familiar with Western Fuel
[21] Association?
[22] **A:** I have heard of it, yes.
[23] **Q:** Do you know any of the persons associated
[24] with that organization?

Page 220

[1] A: Yes, I have met two persons associated
[2] with the organization.
[3] Q: Who are those people?
[4] A: I cannot remember their names, but they
[5] are officers, functionaries, whatever, of this
[6] association.
[7] Q: Would Fred Palmer be one of them?
[8] A: Yes.
[9] Q: You've met Mr. Palmer?
[10] A: Yes.
[11] Q: How about a Barry McCarthy?
[12] A: No.
[13] Q: You don't recognize that name. Are you
[14] aware that Drs. Balling, Michaels, and Idso testify
[15] on behalf of Western Fuel Association at state
[16] regulatory hearings, that they have testified on more
[17] than one occasion?
[18] A: I've heard indirectly that Michaels has
[19] testified. I can't speak about the others.
[20] Q: Has Western Fuel Association — let me
[21] follow that up.
[22] Would it surprise you to learn that
[23] Dr. Balling, and Dr. Michaels, Dr. Idso testify at
[24] hearings for the Western Fuel Association?

Page 221

[1] A: No, it would not.
[2] Q: Would it surprise you to learn that the
[3] Western Fuel Association has paid their expenses for
[4] travel?
[5] A: No, it would not.
[6] Q: Would it surprise you to learn that
[7] Dr. Idso's film venture was funded by Western Fuel
[8] Association?
[9] A: I know that to be the case.
[10] Q: You know that to be the case.
[11] A: I think it says so right on the film.
[12] Q: Are you familiar with the Cato Institute?
[13] A: Yes.
[14] Q: Are you affiliated with the board of
[15] directors of that institute?
[16] A: No.
[17] Q: Are you aware of any affiliation or
[18] financial support from Western Fuel Association to
[19] the Cato Institute?
[20] A: No, I'm not familiar with that.
[21] Q: Do you know if Western Fuel Association
[22] has purchased copies of Dr. Idso's book?
[23] A: I'm not aware of that.
[24] Q: Do you know if Western Fuel Association

Page 222

[1] has purchased copies of Dr. Michaels' book?
[2] A: I'm not aware of that.
[3] Q: Has Western Fuel Association ever paid any
[4] of your expenses?
[5] A: Yes.
[6] Q: Can you detail those?
[7] A: Yes, I was asked to attend a meeting in
[8] Phoenix. And I was reimbursed for my travel
[9] expenses.
[10] Q: Was this the first time — was that the
[11] only time you ever received moneys from Western Fuel
[12] Association?
[13] A: Actually, the money did not come directly
[14] from them. I'm trying to remember. I think it was
[15] reimbursed by Bob Balling, but I believe that he
[16] received the money from the Western Fuel Association.
[17] But to answer your question, I made
[18] another trip. So all together, I think there have
[19] been two visits to Bob Balling in Phoenix.
[20] Q: And each time, as far as you know, funding
[21] to support those trips was supported by Western Fuel
[22] Association?
[23] A: As far as I know.
[24] Q: Do you have any knowledge about Western

Page 223

[1] Fuel Associations' support for projects at the
[2] University of Virginia?
[3] A: Could you be more specific?
[4] Q: Any projects at the University of
[5] Virginia, any support from Western Fuel Association
[6] for projects involving either you or Dr. Michaels.
[7] MR. BLUTE: That's more specific.
[8] Thanks.
[9] A: I have no support at all from Western Fuel
[10] Association. I can categorically say that.
[11] Q: I asked —
[12] MR. BLUTE: You asked two questions.
[13] He answered one of them. Do you want to ask the
[14] other one now?
[15] Q: Are you aware of any support from Western
[16] Fuel Association to the University of Virginia
[17] relating to any work in environmental sciences?
[18] A: I have no direct knowledge of that.
[19] Q: Would it surprise you if that existed?
[20] A: No.
[21] Q: Would it surprise you if Dr. Michaels'
[22] publication was supported in part through funding to
[23] the University of Virginia from Western Fuel
[24] Association?

Page 224

- [1] A: No.
[2] Q: Have you ever received consulting fees for
[3] work done in the environmental — relating to the
[4] environmental sciences, the topic of global warming,
[5] or to the topic of — relating to environmental
[6] regulation from any corporation related to the coal
[7] industry?
[8] A: What do you mean corporation related to
[9] the coal industry?
[10] Q: Any association, nonprofit or profit, of
[11] energy companies, coal, mining companies, electric
[12] utilities.
[13] A: The answer is yes.
[14] Q: Could you detail those for me, please?
[15] A: Yes, I received what amounts to consulting
[16] income from the Global Climate Coalition, which I
[17] believe derives part of its support from the coal
[18] industry.
[19] Q: Can you name a person at the Global
[20] Climate Coalition with whom you have communicated?
[21] A: The director is John Shlaes, S-h-l-a-e-s.
[22] Shlaes.
[23] Q: And where is he located?
[24] A: In Washington, D.C.

Page 225

- [1] Q: To your knowledge, is the Global Climate
[2] Coalition a nonprofit organization?
[3] A: Yes.
[4] Q: Is it a 501(C)(3) organization?
[5] MR. BLUTE: Object.
[6] A: I have no idea.
[7] Q: Do you know which companies contribute to
[8] the Global Climate Coalition, or which companies are
[9] members?
[10] A: No, but it should be easy for you to find
[11] out.
[12] Q: You have received consulting moneys from
[13] the Global Climate Coalition on how many occasions?
[14] A: I would say less than half a dozen.
[15] Q: When were these — were these consulting
[16] contracts?
[17] A: No.
[18] Q: Can you describe what the consulting
[19] relationship was?
[20] A: I was asked to speak, I was asked to give
[21] advice, I was asked to prepare a written summary of a
[22] scientific and policy situation. These are the kinds
[23] of things I've done.
[24] Q: Do you know of any relationship between

Page 226

- [1] Western Fuel Association and Global Climate
[2] Coalition?
[3] A: No, I'm not sure. If you're asking, do
[4] they support the GCC, I don't know that.
[5] Q: Would you be surprised if they did?
[6] A: No, I would not be surprised.
[7] Q: Do you know — did your moneys from the
[8] Global Climate Coalition come directly from Mr.
[9] Shlaes?
[10] A: No, they came from either his office or
[11] through a public relations firm which works for the
[12] Global Climate Coalition.
[13] Q: What's the name of that firm?
[14] A: E. Bruce Harrison.
[15] Q: Have you received any other work through
[16] the E. Bruce Harrison Company other than this work
[17] done for the Global Climate Coalition?
[18] A: Not that I recall.
[19] Q: Do you receive payments for any of your
[20] op-ed writing?
[21] A: Yes.
[22] Q: For how many years have you been receiving
[23] those payments?
[24] A: I've been op-ed writing for approximately

Page 227

- [1] 25 years.
[2] Q: Through this entire period, have you been
[3] paid for your op-ed pieces?
[4] A: Always.
[5] Q: Even while you were employed by the
[6] federal government?
[7] A: Yes, that was permitted.
[8] Q: Is it still permitted?
[9] A: I don't know that. Rules may have
[10] changed.
[11] Q: When were you last employed by the federal
[12] government?
[13] A: From 1987 to 1989.
[14] Q: Are you a professor at the University of
[15] Virginia now?
[16] A: Yes.
[17] Q: Do you receive a salary?
[18] A: No.
[19] Q: Are you teaching?
[20] A: No.
[21] Q: Are you emeritus?
[22] A: Yes.
[23] Q: Do you know if it's customary behavior for
[24] emeritus professors to refer to themselves as

Page 228

[1] emeritus professor when they describe their
[2] association with a university?
[3] A: If you are solely emeritus, it is
[4] customary.
[5] Q: Are you solely emeritus?
[6] A: No.
[7] Q: Why not?
[8] A: I'm on a leave of absence as well.
[9] Q: Are you on a permanent leave?
[10] A: No, it's a leave that's renewed yearly.
[11] Q: Have you done other energy consulting,
[12] energy-related consulting?
[13] A: Yes.
[14] Q: For what companies?
[15] A: Perhaps a dozen or so.
[16] Q: Can you name half of them?
[17] A: Yes, I've consulted for oil companies,
[18] like Exxon, Shell, Arco, Unical, Sun. I've consulted
[19] for electric power companies, like EPRI, or Florida
[20] Power. I've consulted for gas companies, like the
[21] American Gas Association.
[22] Q: What work do you do for these companies?
[23] A: It varies.
[24] Q: Can you describe the work you did for

Page 229

[1] Exxon?
[2] A: Yes, I was a technical consultant helping
[3] them in their acquisition program.
[4] Q: And for Shell?
[5] A: I was a technical consultant giving
[6] lectures on oil pricing.
[7] Q: You've also written op-ed pieces on oil
[8] pricing?
[9] A: Yes, I have.
[10] Q: But Shell doesn't pay you to write op-ed
[11] pieces?
[12] A: No, they don't. No, the newspaper pays
[13] me.
[14] Q: How much does — how much do you charge
[15] for your op-ed pieces?
[16] A: They're established rates. I don't
[17] charge.
[18] Q: Okay. So you're paid whatever the
[19] established rate is for op-ed at each of these
[20] papers?
[21] A: Yes.
[22] Q: The work for Arco?
[23] A: Again, consulting on oil pricing.
[24] Q: Unical?

Page 230

[1] A: Consulting on oil pricing.
[2] Q: Sun?
[3] A: The same.
[4] Q: Work for Florida Power?
[5] A: Attending a conference and giving a talk.
[6] Q: What conference was this?
[7] A: I don't recall.
[8] Q: Do you remember what the talk was about?
[9] A: No, I don't recall.
[10] Q: Do you remember what year or what decade?
[11] A: Yes, sometime in the '70s.
[12] Q: Gas companies?
[13] A: Yes.
[14] Q: Which?
[15] A: American Gas Association.
[16] Q: The work for them?
[17] A: To give a talk.
[18] Q: What decade?
[19] A: In about middle '80s.
[20] Q: Do you remember what that talk was on?
[21] A: Not directly.
[22] Q: Any other gas companies?
[23] A: No, not that I recall.
[24] Q: Have you received any such consulting

Page 231

[1] moneys from oil companies, electric companies, or gas
[2] companies since 1988?
[3] A: Yes.
[4] Q: Can you detail that?
[5] A: I, of course, received no money until I
[6] left the federal government.
[7] Q: Of course.
[8] A: I don't know if this is a trick question.
[9] Q: It wasn't a question. I withdraw any
[10] comment. Strike that.
[11] I'll remind you you said you were with the
[12] federal government —
[13] A: '87 to '89.
[14] Q: — '87 to '89.
[15] A: And your question was, have I received any
[16] money from oil companies since '88?
[17] Q: Since '88. So none in 1988, none in 1989.
[18] A: No, I wouldn't say that.
[19] Q: You wouldn't say that?
[20] A: I left the government in April of 1989.
[21] Q: Okay. So after that?
[22] A: Yes.
[23] Q: From what companies?
[24] A: I'd have to consult my records, but they

Page 232

[1] would include the companies that I — some of the
[2] companies that I mentioned.
[3] **Q:** What was the work for?
[4] **A:** Generally technical reports, summaries of
[5] scientific topics, and particularly how these would
[6] interact with policy.
[7] **Q:** Any of those topics related to global
[8] climate change?
[9] **A:** Yes.
[10] **MR. LANCASTER:** I think we'd like to
[11] have details of that, if we could. I'll draw you up
[12] a formal request.
[13] **MR. BLUTE:** You're going to request
[14] that. I'm not prepared to respond now, but —
[15] **MR. LANCASTER:** I think it's already
[16] in the interrogatories. But let's be specific, then,
[17] if those do exist. They are relevant.
[18] **MR. BLUTE:** Just so it's clear, the
[19] request was made in interrogatories to which we
[20] objected to today.
[21] **MR. LANCASTER:** I understand.
[22] **MR. BLUTE:** I stated at the outset
[23] that I'd permit you to inquire, and you have, and I
[24] think Dr. Singer has been very candid in his

Page 233

[1] responses. We will consider your request. But I
[2] don't want to — I'm not agreeing here that I will
[3] produce them.
[4] And with that, I'd like to say it's
[5] after five, and I'd like to break. And we can
[6] suspend and we can try and reschedule this at another
[7] time. I'm not sure — unless you're going to tell me
[8] that you can finish in 10 minutes or something.
[9] **MR. LANCASTER:** No, no. But I can
[10] tell you that I'm eager to settle this thing.
[11] **MR. BLUTE:** Let's go off the record
[12] if we're going to discuss that.
[13] (Discussion off the record.)
[14] (Deposition suspended at 5:05 p.m.)
[15]
[16]
[17]
[18]
[19]
[20]
[21]
[22]
[23]
[24]

Page 234

[1] C_E_R_T_I_F_I_C_A_T_E
[2]
[3] I, S. FRED SINGER, do hereby certify that I have
[4] read the foregoing transcript of my testimony, and
[5] further certify that said transcript is a true and
[6] accurate record of said testimony.
[7] Dated at this _____ day of _____,
[8] 19____, under the pains and penalties of perjury.
[9]
[10]
[11]
[12]
[13]
[14] S. FRED SINGER
[15]
[16]
[17] Sworn to and subscribed before me this ____ day of
[18] _____, 19____.
[19]
[20]
[21] Notary Public
[22] My commission expires:
[23]
[24]

Page 235

[1] COMMONWEALTH OF MASSACHUSETTS)
[2] SUFFOLK, SS.)
[3]
[4] I, Kimberly A. Edwards, Registered Professional
[5] Reporter, Certified Shorthand Reporter, and Notary
[6] Public in and for the Commonwealth of Massachusetts,
[7] do hereby certify that there came before me on
[8] Friday, the 24th day of September, 1993, at 9:40
[9] a.m., the person hereinbefore named, who was by me
[10] duly sworn to testify to the truth and nothing but
[11] the truth of his knowledge touching and concerning
[12] the matters in controversy in this cause; that he was
[13] thereupon examined upon his oath, and his examination
[14] reduced to typewriting under my direction; and that
[15] the deposition is a true record of the testimony
[16] given by the witness.
[17] I further certify that I am neither attorney or
[18] counsel for, nor related to or employed by, any of
[19] the parties to the action in which this deposition is
[20] taken, and further that I am not a relative or
[21] employee of any attorney or counsel employed by the
[22] parties hereto or financially interested in the
[23] action.
[24] In witness whereof, I have hereunto set my hand
and seal this 5th day of October, 1993.

Notary Public
My commission expires
March 30, 1995

\$	16 99:17; 112:20; 118:17, 20; 119:23; 120:2, 12; 125:13 16th 127:21; 128:4, 7 1861 74:1; 76:22 1862 76:21 1880 52:14; 53:22; 55:1 1900s 180:8 1946 14:24 198 134:6 1980s 55:2 1984 134:5 1987 227:13 1988 53:10, 23; 74:1; 231:2, 17 1989 227:13; 231:17, 20 1990 19:9, 22; 55:3, 8; 94:14; 99:17; 106:4; 107:16; 112:20; 114:3; 118:17; 119:23; 120:13, 14; 128:7; 132:14, 23; 133:10; 135:8, 10, 16; 136:6, 24; 137:17; 139:14; 143:6, 13, 18; 144:4, 4, 7; 147:22; 149:3; 151:2; 153:14, 21; 157:22; 166:20; 203:7; 211:14; 212:2; 215:18, 19, 20, 22 1991 95:11; 104:6, 12, 13; 106:5; 117:1, 21; 118:20; 120:2, 12; 121:20; 127:14; 128:4; 131:4; 135:6, 7; 142:8; 153:14; 157:17; 174:18; 185:15; 215:18 1992 133:19; 184:16 1993 108:2 1:00 120:23 1:38 120:24 1st 127:14	2	2 72:9, 11; 79:15, 21, 22; 80:5, 10; 81:4, 18; 86:18; 87:22; 89:2; 94:17; 143:17; 144:4; 146:8; 147:22; 148:10, 10; 149:9, 24; 150:3; 168:16; 189:16 2-27-90 137:16 2-28-9 136:1 2.5 57:23; 58:18 20 20:15; 110:22; 132:5 200 17:21, 23 20th 148:19; 149:3 22032 8:20	24 203:6 25 227:1 27th 137:17 28 146:1 28th 136:6 2nd 136:24; 142:12	3	3 79:17, 18, 23; 84:23; 85:1, 3; 86:13, 19; 87:15, 16, 18; 88:16; 89:2; 148:18, 24; 149:6, 24; 153:4 3-1-2-27-90 137:12 3/19/90 149:6 3/5/90 143:17 3/5/90/SFS 143:17 31 50:15; 104:6, 13; 117:1; 174:23 31st 142:8, 14	4	4 79:18, 18, 23; 80:21; 81:22; 84:7, 8, 9, 23; 86:19, 22, 23, 24; 87:16, 18, 20, 24; 88:1, 6 4.5 59:5; 175:8; 178:22 40 41:5; 207:12 400 16:24; 17:19, 23 4:30 201:23; 210:6	5	5 51:22; 94:3, 5; 128:16, 17; 140:5; 169:16; 173:2, 3; 193:11 50 21:15; 28:6, 19; 170:5 501(C)(3) 225:4 5:05 233:14 5th 143:18	6	6 51:19, 22; 133:21; 185:20; 186:8 6th 143:6, 13; 144:4	7	7 136:2; 140:12, 18; 173:1 70s 17:15; 171:23; 230:11	8	8 137:2, 7; 141:23; 193:3; 203:7 80s 230:19 87 231:13, 14 88 231:16, 17 89 231:13, 14	9	9 143:8, 10; 150:2; 193:1, 3 90 73:7, 12, 16; 74:19; 79:7, 16; 136:6 91 50:15; 110:9; 125:13; 215:17 9812 8:19	A	A's 198:14, 23; 199:14, 18; 200:1; 201:11, 17 AAAS 93:24; 94:8; 95:1; 106:6; 110:11; 111:11, 17, 18, 19, 21; 112:8; 113:5, 7, 10; 114:7, 15, 22; 115:20; 123:3, 17, 21, 23; 124:6, 15; 126:12, 16; 127:3, 19; 128:14; 131:5; 138:20; 141:18; 142:6; 167:8, 23; 168:2, 9, 19, 24; 169:16; 170:2; 171:4; 172:24; 174:2; 207:3; 212:14; 213:1; 218:21; 219:8 ability 28:4; 49:16 able 6:18; 26:8; 28:23; 158:12; 165:14; 166:15; 172:8 abnormal 64:18 abolish 190:3 above 51:22; 55:22; 126:24 abs 72:14 absence 228:8 absolute 46:3, 4; 76:23; 77:12; 78:8, 15 absolutely 67:18; 185:10; 213:20 abstract 135:24; 152:2 abuse 9:19, 22; 25:9; 36:8 accept 76:13; 78:2; 80:3; 81:13; 164:18; 175:22; 178:23; 179:24; 190:8 acceptance 203:22; 204:10	accepted 166:5; 179:24; 190:6; 197:11 accepting 81:8 access 128:12; 187:1 accidentally 45:2, 9 accuracy 42:21; 45:22; 89:5; 183:17 accurate 39:17; 42:1, 6; 43:10, 15; 44:9, 23; 45:18; 49:17; 80:10; 81:12; 88:16; 89:8; 178:8 accurately 80:4; 81:16; 95:8 accused 206:19; 209:24 accusing 75:20; 210:1 achieve 165:8 acknowledging 75:12; 126:7 acquainted 133:12; 216:16, 23 acquisition 229:3 act 127:18 acting 7:18; 83:22 action 49:19; 54:24; 55:22; 111:2, 10; 112:6; 113:2; 126:17; 204:6, 17; 208:14 actions 182:18, 19; 200:1 actively 96:8 activists 204:2, 13, 15 activities 193:10 activity 200:1 actual 67:9, 11; 91:10; 141:9 actually 51:11; 54:15; 61:17; 127:3; 138:5; 163:20; 185:4; 217:11; 222:13 adapt 111:3; 170:4; 171:6; 172:22 adaptation 171:13; 172:1 adapted 170:19; 171:7; 172:20 add 180:24, 24 added 150:7, 11; 152:24; 179:1; 180:21, 23; 214:4 addition 35:3; 152:20 additional 162:1 additions 188:16 address 8:18; 82:17; 105:24; 200:21; 211:6 addressed 27:8 adhere 12:14 adherence 12:10 adjust 163:17; 172:9	adjusting 172:16 adjustment 125:3 administer 18:16 administered 18:18 admit 114:1 admitted 195:13 advice 116:23; 225:21 advise 214:21 advocate 49:18 Advocates 54:23; 55:22 affiliated 221:14 affiliation 15:14, 18, 20; 221:17 affirm 106:3 afterwards 180:23 again 16:10; 27:24; 35:24; 37:18; 41:1, 17; 44:13; 55:24; 57:23; 58:2; 59:7; 60:3, 10, 23; 63:21; 66:9, 17; 80:1; 92:8; 125:21; 127:9, 15; 149:14, 24; 152:4; 157:16; 163:3; 172:24; 179:21; 196:3; 207:8; 212:18, 18; 229:23 against 9:9 age 170:7 Agency 194:22 ago 27:11; 52:18; 106:20; 208:6; 217:14 agree 7:2; 10:23; 11:4; 25:6; 26:4, 7, 14; 27:19; 32:2, 8, 11, 18; 33:1, 4, 15; 38:15, 19; 39:9; 43:17; 80:18; 103:22; 142:3; 149:23; 150:6; 160:12; 164:4; 167:6, 19; 174:7; 177:19; 195:2; 212:10; 213:14; 214:1; 219:18 agreed 95:7; 99:18; 102:22; 130:24; 132:12; 165:5, 17; 199:10; 200:12; 209:15; 214:20 agreeing 165:16; 233:2 agreement 6:21; 59:1; 135:19 agrees 100:17 Agricultural 30:24; 196:18 ahead 8:7; 10:9; 11:15, 19; 13:7; 29:2; 32:10; 33:8; 36:9; 44:17; 82:6; 98:2, 24; 101:21; 102:17; 105:13; 132:20; 134:18, 19; 136:20; 139:12; 152:16; 182:3; 186:24;
-----------	--	----------	---	--	----------	--	----------	---	----------	--	----------	--	----------	--	----------	--	----------	---	----------	---	--	---

206:11; 210:18;
212:19; 218:9
Alliance 6:14
allow 14:4; 63:9;
158:16; 191:10
allowed 73:3; 101:9;
130:9; 189:5
alone 28:24; 198:2
along 6:9; 186:12
already 98:13, 15;
101:17; 167:5;
170:19; 171:7;
172:20; 232:15
altered 186:7
although 67:18;
74:15; 172:13;
188:15; 202:1
altitude 19:11; 20:9;
19, 22; 21:2
always 13:21;
181:22; 182:1; 227:4
ambiguous 54:23
American 228:21;
230:15
among 29:14;
134:22; 198:4; 213:9
amount 21:18; 186:7
amounts 224:15
Analysis 16:12;
32:6; 49:5; 75:18;
192:10
analyzed 193:24
and/or 106:10
Andrew 65:21
annotations 104:7;
14; 105:10; 121:13;
156:22
annual 54:9; 63:2;
72:19; 74:5; 76:24
annually 54:7;
55:18; 56:4, 12;
58:19; 59:11; 60:17;
61:11; 62:1; 63:12;
84:12, 20; 85:5
anomalies 72:19;
79:16
anomaly 76:22, 22
answered 37:4;
44:16; 114:12;
212:15, 17, 21;
223:13
answering 40:19
Antarctic 124:10;
183:1, 9, 23; 184:7,
10, 12
anticipate 42:14;
57:2, 6; 212:7, 8
anyone 103:1; 180:9
anywhere 110:10;
141:5; 174:4
apologize 79:22;
124:18; 209:5
appalled 209:23
apparently 149:2, 8;
187:14

appear 72:17; 144:3;
147:20; 148:23;
153:21, 22; 154:20;
164:10; 197:20;
198:4, 6, 18
appeared 68:15;
197:16; 209:14
appears 81:17;
125:19; 136:7; 142:7;
147:15; 197:7; 198:23
applied 70:10; 84:11
appreciate 210:3
approach 12:23;
130:10
approached 187:24
appropriate 41:1;
61:5; 107:9; 112:23
approximate 16:11;
86:16
approximately
14:24; 17:19; 19:22;
174:18; 226:24
April 9:10; 174:18,
19; 231:20
archives 153:10, 12,
21, 22; 154:6, 8
archiving 155:12
Arco 228:18; 229:22
area 35:14; 36:2;
44:3
areas 11:1; 29:6;
41:15
argue 64:5, 7; 93:10;
96:12; 108:19;
138:19; 158:10;
159:21
argued 158:11;
192:11
arguing 101:5, 13;
145:11
argument 24:7;
40:22; 64:1; 66:20;
106:15; 151:12;
202:19
argumentation
182:20
argumentative
182:22
around 16:22; 26:8;
38:21; 53:22; 72:18;
96:21; 97:5; 99:4;
102:19; 135:17;
158:2; 160:6; 188:4;
214:6
Arrhenius 180:7
arrived 107:20;
108:4; 109:16
article 43:10; 51:2;
57:2, 5; 60:6; 61:2;
62:4; 64:19; 65:1, 2;
66:13; 70:11; 83:19;
85:23; 86:8; 87:21;
88:14, 24; 89:2, 6, 7,
7, 8, 17, 17; 91:4, 13;
92:18, 19; 93:3, 21;
98:5, 5; 102:20;

103:19; 111:16;
112:3, 23; 118:24;
120:7; 125:23;
132:15; 134:4;
137:10; 138:7;
148:11; 156:18;
167:20; 168:3, 11,
14, 19; 69:12, 24;
170:15; 171:14, 21;
173:6, 21; 174:9;
177:22; 179:11;
180:16; 182:13;
183:7; 184:17;
185:24; 186:3; 188:1;
190:10; 197:8, 12,
15, 19; 199:17, 18;
203:2, 5, 16; 204:9;
205:6, 20, 23; 206:2,
18; 207:6; 208:12;
211:13; 212:1, 12,
22; 213:15, 15;
216:3, 4, 7, 9; 218:16
articles 10:6, 11, 15;
19:19; 34:22; 35:1, 3,
8; 37:7, 24; 38:22;
39:7; 41:22; 49:11;
70:5; 209:16
aspect 218:24
assemble 52:21;
53:6
assembled 80:20
assembling 14:12
asserted 6:16
assess 33:19; 38:21
assessing 59:15
assessment 39:15;
48:24; 87:17; 100:9;
194:2, 8, 13
assessments
33:17; 39:13
assistants 214:4
associated 219:23;
220:1
Association 219:21;
220:6, 15, 20, 24;
221:3, 8, 18, 21, 24;
222:3, 12, 16, 22;
223:5, 10, 16, 24;
224:10; 226:1; 228:2,
21; 230:15
Associations 223:1
assume 39:11, 12;
56:6; 59:11; 75:2;
129:11; 138:12;
146:4; 149:19; 154:2,
5, 6; 175:1
assumed 39:9
assumes 66:11, 12,
15
assuming 88:16;
152:5; 199:9, 11;
201:19
assumption 35:14;
56:11
assumptions 40:1;
194:24; 196:6
assure 207:24

Atlantic 184:5
atmosphere 20:20;
22:3, 14; 23:20; 26:8;
27:15; 31:7, 17
Atmospheric 19:18;
28:8; 29:8, 17, 20;
56:8; 82:19; 134:8
attach 155:12
attached 137:11;
143:13; 148:20
attempt 40:9
attempting 181:20
attend 222:7
Attending 230:5
attention 46:21, 21;
47:11; 105:24;
125:11, 13, 15;
136:10, 21; 217:12
attentive 27:17;
139:10
attorney 8:3; 13:6;
70:21; 82:19; 83:19;
133:17
attributable 124:20;
126:14; 127:13; 198:2
attribute 103:4
attributed 121:19
attribution 119:19
audience 151:13,
15, 17
Australia 173:22
author 30:11, 12;
61:21; 93:5; 94:20;
95:9; 97:24; 100:22;
101:8; 102:4; 115:12;
155:16; 197:5, 10,
13, 14, 14, 17;
198:10, 15, 18, 19,
23; 199:1, 19;
200:14, 15; 205:17,
19; 213:2, 4
authored 30:11;
66:3; 89:10, 16;
90:18; 92:16; 113:3;
199:15
authoring 65:23
authorization
199:12
authorized 199:14
authors 66:10, 13;
67:8, 11; 186:14;
197:21, 22; 198:5;
213:10, 17
authorship 36:7;
97:10, 16, 24; 197:4,
7, 24; 198:1; 199:3;
216:1
autumn 215:20
available 48:5;
156:5; 172:6; 194:21
average 42:12, 15;
52:8, 10; 53:21; 54:5,
10; 55:11, 24; 57:10,
13, 15, 24; 58:3, 11,
12, 13, 15, 23; 59:7,
8, 19, 22; 60:3, 9;

62:11; 63:5, 11;
65:17; 66:4, 6; 71:22;
76:24; 83:7; 85:6, 15;
86:21; 87:1, 3, 13;
126:19; 128:19;
129:7, 12, 21; 134:6;
141:20; 142:15;
150:14, 18; 158:5;
163:7; 164:14, 19;
166:20; 75:2; 177:20;
182:12; 183:20, 22;
190:23
averaged 53:20;
54:8, 10; 55:18; 56:4,
12; 58:6, 8, 19; 59:11;
60:18; 61:11; 62:1;
63:2, 12; 84:12, 20;
85:5
averages 53:3; 55:12
Averaging 60:10;
62:6
avoid 6:18
aware 9:18; 11:10;
12:5, 13; 22:9, 10, 12;
85:21; 125:11; 175:5,
10; 176:11; 194:5;
210:20; 217:1;
220:14; 221:17, 23;
222:2; 223:15
away 42:18, 21, 24
**A_F_T_E_R_N_O
_O_N_S_E_S_S
_I_O_N** 121:1

B

B 198:13, 16; 199:13,
15, 17; 201:6, 14, 20
B's 198:17, 20;
201:8, 9
back 13:9; 23:10;
37:11; 48:13; 50:21;
70:22; 71:2, 14, 19;
86:11; 98:6; 106:21;
107:6; 108:7, 8;
109:10, 23; 110:5;
114:19; 120:9, 15;
124:18; 127:9;
145:19; 157:14;
160:22, 23; 186:13;
190:11; 192:4;
200:13; 202:10;
203:23; 204:11;
207:12
backgrounds 197:1
backup 69:18
bacteria 181:15
bad 89:7; 171:17
badgering 101:14
baggage 182:14
balance 171:18
balanced 39:17;
42:1, 2; 134:2; 171:15
Balling 67:23; 91:24;
124:22; 125:18;
216:17, 19; 217:24;

219:15; 220:14, 23;
222:15, 19
band 74:6
Barry 220:11
base 33:3; 111:8;
112:5; 113:1; 178:14;
204:24; 205:7, 8;
208:12
based 39:24; 67:5;
78:18, 20, 22; 82:8;
86:15; 110:12;
111:11, 17; 112:7;
113:5, 9; 114:8;
131:7; 136:16;
138:20; 139:1, 6;
142:24; 145:15;
148:11, 14; 162:16;
164:4; 167:4; 168:19;
174:1; 178:22; 190:20
basic 176:3
basis 18:13; 38:12;
68:23; 134:24;
177:14; 192:13;
198:1, 2
battle 6:10
bear 28:22
bearing 146:2, 12
bears 50:10, 14;
133:17
became 206:17;
209:13
become 13:22;
128:19; 129:5, 8;
135:19; 141:20;
168:14
becomes 13:20
bed 144:14
began 219:8
begin 5:12; 207:21
beginning 91:3;
172:3, 14; 188:6, 7,
10
begins 59:1
begun 213:8
behalf 220:15
behavior 12:19;
13:12, 16, 19;
209:23; 227:23
belief 163:7; 165:11;
166:19, 22, 23;
190:20
believable 196:8
believe 9:11; 15:23;
25:14, 15; 44:2, 6;
45:24; 49:24; 54:6;
62:5; 70:12; 89:20;
117:22; 118:3; 120:6,
17, 17; 123:9, 14;
128:15; 131:11, 21,
21; 133:16; 135:1,
11; 138:8; 139:10,
17; 144:8; 148:1;
150:13; 153:4; 155:6;
159:14; 162:4; 166:8;
170:10; 176:6; 177:2;
178:7, 9; 179:23;

183:13, 16; 184:24;
87:2; 189:6; 190:18,
22; 192:4; 195:17,
22; 196:1; 210:23;
222:15; 224:17
believed 97:13;
132:16, 18; 134:22;
135:12; 139:6, 11;
151:3; 164:13;
186:16; 187:11;
190:15; 212:22
believes 102:3;
186:21
belonged 68:22;
69:2
Below 54:12; 63:4;
68:6; 90:9; 91:20;
129:13, 22; 130:13,
16, 21; 131:10;
142:16; 158:2, 6, 6, 8,
17; 163:15; 164:15,
19; 175:3; 177:23,
24; 186:18, 23;
190:17, 24; 191:12;
193:8; 196:11
beneficial 46:16, 18
benefit 172:6
Besides 102:22
best 7:11; 9:3; 19:5;
24:12; 40:10; 49:15,
16; 66:19; 92:12;
93:4, 13; 99:1;
127:22, 23; 128:1, 3,
5; 163:16; 187:5;
193:10; 215:16
better 27:11; 110:22;
111:3; 122:17;
147:11; 190:10;
205:4, 10
beyond 6:21; 36:3;
41:16; 49:8; 156:4;
210:11
bidding 99:13, 22;
100:1
biology 27:22; 28:8;
30:18
biota 171:8, 9, 11
bit 188:15; 193:4
black 74:6; 76:20
BLUTE 5:12; 7:5, 11;
8:5; 9:14; 10:8; 11:8,
12, 15, 19, 22; 13:1,
4; 18:11; 21:13, 16;
23:8; 24:1, 6, 10, 19;
25:7, 16, 20; 28:11;
29:1; 31:20; 32:9;
33:7, 21; 35:10, 12,
18; 37:14, 19; 38:11;
39:3, 19, 21; 40:2, 6,
15, 21; 41:8, 13; 42:3;
44:15; 47:9; 48:15;
50:4, 8, 16; 51:17;
54:18, 21; 55:7;
56:13, 18; 58:1; 0:20,
23; 61:8; 63:15, 21;
64:4; 66:7, 9, 23;
70:22; 71:6, 11, 15;
72:5, 8, 20, 24; 73:4;

74:21, 24; 75:4, 9;
76:3, 7, 11; 77:1, 6,
13, 17, 24; 78:14, 18,
22; 79:2, 5, 14, 22;
80:1, 7, 23; 81:3, 10,
16, 20; 82:5; 83:2, 8;
84:8; 86:4, 7; 88:3,
12, 18, 22; 89:19;
90:13, 18, 20; 91:12;
92:4, 8, 22; 93:10;
94:22; 96:7, 11, 15,
18; 8:2, 4, 12, 21;
100:23; 101:5, 10,
13, 16; 102:5, 7, 10,
17; 103:11, 13;
105:12, 15, 21;
106:13, 15; 108:16;
22; 109:3, 11; 110:2;
111:23; 112:15, 18;
113:17; 114:9, 12,
20; 115:1, 14, 21;
116:1, 5, 12, 16, 20;
130:3; 131:13;
132:20; 134:19;
136:20; 139:12;
140:17, 22; 141:4;
145:3, 8; 147:2, 11;
149:14, 18; 51:24;
152:4, 10, 15; 154:1,
5; 156:4, 23; 157:5;
158:23; 159:8, 22;
162:22; 164:3;
165:21; 166:12;
167:14; 169:1; 170:8;
176:13, 17; 182:3;
184:21; 185:2;
186:24; 189:11;
191:2, 15; 192:1;
195:7; 199:8; 201:21;
202:17; 204:18;
205:16; 206:11, 15;
207:7, 11, 20; 208:8,
23; 209:2, 8; 210:4,
10, 13; 11:17, 20;
212:16; 217:7; 218:8;
223:7, 12; 225:5;
232:13, 18, 22;
233:11
Blute's 133:17
board 221:14
Bob 222:15, 19
body 34:3, 5; 198:9
bold 72:12
book 46:15; 73:20;
125:5; 197:12; 217:2,
6, 12; 221:22; 222:1
books 46:9
Boston 9:6
both 14:19; 32:24;
45:24; 50:9; 51:18;
88:24; 116:2, 13;
129:18; 191:16;
199:13; 205:17;
210:15
bottom 51:9; 72:14,
15; 121:21; 124:11;
178:12
branches 29:11, 17;
30:2

break 11:10; 79:12;
80:24; 209:10; 233:5
breakfast 135:17;
215:3
bring 142:22
broad 30:14; 33:11
Broecker 167:9
Bruce 226:14, 16
Bryson 217:18;
218:1; 219:15
burden 38:16; 39:1,
5; 43:22
burning 204:15
business 34:16;
119:8

C

C 55:1, 24; 57:23;
58:19; 59:5
calculate 178:20
calculated 19:10;
52:7; 58:23
calculations 205:5,
11
California 152:8
call 14:5; 50:1, 4, 6;
197:13; 198:7; 204:3,
14
called 8:11; 11:13;
73:7; 82:10; 84:1;
117:3
calls 35:20, 22; 40:22
came 5:15; 79:9;
81:5; 91:16; 92:19;
104:11; 117:8; 127:1;
141:5; 143:22;
155:16; 180:3;
218:13; 226:10
can 5:19, 20; 6:24;
10:18, 20; 11:8, 9;
13:5, 22; 14:16;
26:23; 27:7; 28:12,
12; 29:7, 15; 30:1;
31:21; 34:11; 35:2;
36:10; 37:11; 39:3;
10; 40:2, 3, 8, 9, 10;
44:15; 49:18; 50:24;
56:13, 14, 20; 61:8;
62:3; 63:15, 16, 17;
64:7; 66:18; 72:4;
75:3, 11, 19; 79:12;
80:23; 81:6; 83:1, 9;
85:10, 12, 17; 87:2, 5,
6; 0:21; 91:1, 6; 92:5,
12; 93:3, 4, 13; 96:15;
99:1; 103:8; 107:4;
108:19, 23; 110:10,
17; 111:4; 112:3;
113:12, 19; 115:1,
19; 116:8, 9, 9; 119:6,
20; 121:14, 18;
122:4; 123:10; 124:8,
19; 125:1, 12;
128:22; 144:1;
145:24; 146:19;
150:13; 152:16;

154:16; 157:8, 16;
159:3; 166:12;
169:15; 170:19;
172:1, 6; 78:14, 16,
17; 180:18, 20;
181:2; 182:7, 10, 19;
183:21; 185:10;
191:3; 193:10; 195:6,
20; 201:2, 22;
203:11; 206:6, 8;
207:24; 208:4, 24;
209:21; 210:8, 17;
213:12; 218:10;
222:6; 223:10;
224:19; 225:18;
228:16, 24; 231:4;
233:5, 6, 8, 9
candid 232:24
caption 51:10
captured 141:22
carbon 26:9; 31:5, 6;
73:8; 134:3; 173:8;
174:5; 204:4
care 36:12; 190:11
career 14:2, 19
careful 179:8, 9
carefully 77:3;
188:9; 196:18
careless 136:17;
140:15; 141:16
Carl 10:19; 37:6, 20
carried 14:10; 15:3;
113:18; 161:19;
168:3; 173:5; 191:11;
194:13, 17
carry 14:22; 19:16;
32:5; 194:10
carrying 15:7
case 6:13, 16; 25:13;
33:9, 13, 13; 36:4, 6;
40:23; 41:2; 69:9;
79:6; 89:6, 10;
160:15; 198:8; 202:3,
15; 221:9, 10
cases 214:16
categorically 223:10
Cato 221:12, 19
cause 140:3
caused 64:16
CDIC 73:7, 10, 19;
80:15
Celsius 51:13, 22;
60:1; 84:13, 17, 21;
85:19, 20; 86:2;
87:10, 13; 88:10;
90:5, 7, 22; 129:13,
22; 130:13; 138:14;
139:23; 140:5;
142:13, 16; 146:6;
148:7; 149:21; 151:9,
23; 152:14; 158:22;
163:9; 164:7; 165:15;
166:21; 175:8, 8;
177:23; 186:18, 21,
23; 187:11; 189:16,
20; 191:1; 192:22;
196:11, 13

Center 73:8
centigrade 86:17;
88:15; 130:16, 19;
131:10; 135:14;
152:19; 190:17;
191:13
century 59:24; 63:4;
128:20; 129:9, 13,
21; 130:1; 132:19;
135:12; 138:14;
139:24; 140:5;
141:21; 142:13, 15;
146:6; 148:7; 149:21;
151:4, 6, 7; 164:14;
166:9, 21; 175:2, 9;
176:1; 177:20;
186:15, 17, 22;
190:16, 23, 24;
192:21; 195:4; 219:10
century) 134:9
century-old 208:15
certain 5:16; 16:17;
85:20; 127:24;
128:18; 129:7;
131:23; 132:3;
141:19; 158:5; 181:6;
206:12; 219:9
certainly 18:24;
26:18; 47:3; 67:13;
71:4; 104:4; 156:19;
158:8; 165:17; 166:4;
173:24; 178:2; 193:1;
196:15; 216:5
cetera 43:15;
128:21; 134:3
CFCs 204:12
CFCs) 203:24
chance 7:7; 108:20;
128:18; 129:5, 7;
131:23, 24; 132:2, 4,
5, 6, 9, 11, 17;
141:20; 142:10;
154:21; 210:17;
219:9, 19
chances 102:21
change 26:14, 16,
19, 21, 23; 27:2, 5;
28:3, 6; 32:20; 43:14;
48:24; 55:18; 57:9;
59:8, 21; 106:16;
129:11, 23; 136:11;
138:10; 139:18;
141:24; 142:23;
146:3, 8; 148:3, 9, 14;
149:12; 157:16;
163:4; 170:5; 171:16;
175:6, 23; 176:2;
185:10; 186:3, 13;
193:10; 194:1, 4;
232:8
changed 87:3;
149:24; 162:6; 227:10
changes 27:15;
67:5; 69:10, 13;
104:11, 16, 18;
105:4; 106:10; 107:3,
9; 108:15; 109:5;
145:21; 167:2; 170:6;

16, 19; 171:24;
172:1, 20; 190:9;
193:23
changing 26:9;
27:10; 135:22, 24
chapter 117:2;
118:14, 16, 19;
121:23; 217:2
character 50:13
characterization
207:23; 211:18
characterize 28:7;
55:5; 82:3; 208:5
characterized 208:1
charge 122:18;
229:14, 17
Charles 15:12
chart 75:6; 76:21
charts 79:18
Chauncey 123:5;
126:20
Chauncy 124:7;
126:14; 207:5; 209:19
check 70:23; 71:12;
75:23, 23; 94:1;
144:1; 146:20, 23;
154:21; 164:2; 184:8;
203:11
chemical 27:14
chemicals 31:16
chemistry 27:22;
28:8; 31:5, 10, 15
children 8:22, 23
**chlorofluorocarbo
ns** 203:24; 204:11
choice 127:11, 12;
168:12
choose 40:8; 190:1
chose 189:23
circle 156:21; 160:6
circling 15:6; 16:15
circulated 200:19
circumstances
200:5; 202:13
cirrus 19:11; 20:10
citation 168:24
citations 19:14
cite 218:18
cited 167:7; 168:2,
20
cites 217:6
citizens 196:22
civil 9:16
claim 24:16; 55:16;
110:12; 139:16
claimed 131:6;
194:17
claims 25:8, 10
clear 7:21, 22; 8:1;
63:3, 18; 64:3; 79:8,
10; 96:22; 114:11;
141:1; 147:12;
151:24; 158:24;

159:2; 185:4; 191:9; 13; 215:6; 232:18 clearly 92:2; 111:20; 115:4, 5; 121:18; 159:18; 160:12; 166:2; 171:10 client 41:11 climate 26:14, 15, 19, 21; 27:2, 5, 10, 11; 28:3, 6; 48:24; 51:10; 54:20; 59:21; 82:10, 18; 128:19; 129:5, 7, 10, 24; 135:22, 24; 136:12; 138:10; 139:18; 140:13; 141:20, 23; 146:2; 148:2; 149:11; 150:12; 157:16; 163:4; 170:5; 171:16, 24; 175:6, 23; 176:2; 178:20; 179:3; 186:13; 193:9, 22, 23; 194:1; 193:3, 3; 224:16, 20; 225:1, 8, 13; 226:1, 8, 12, 17; 232:8 climate-balancing 178:24 climatology 27:23; 28:10 close 216:12 closely 43:5; 159:11 closer 167:1 closest 166:7 cloud 16:14, 16 clouds 15:5; 16:13; 19:11 Club 94:16; 103:19; 203:1; 206:1; 208:12; 211:13; 212:1, 12; 213:14; 214:23, 24; 215:2, 5, 8, 12; 216:8 co-author 91:13; 92:17; 96:4, 6; 98:5; 99:19; 102:15; 122:14; 127:8; 135:19; 207:15; 212:10; 214:18, 19, 20, 23 co-authored 91:3; 103:18; 112:23; 168:19; 201:8, 9, 16, 20; 208:19, 21; 209:13; 211:16; 212:7 co-authors 61:15; 64:15; 104:19; 120:18; 131:21; 153:16; 177:21; 178:9; 201:6; 207:5; 213:23; 214:4, 15; 216:6 co-authorship 96:21; 168:4, 23; 214:2 co-principal 16:7; 18:2, 16 CO2 134:8; 175:13, 15, 16, 19; 204:6, 15	coal 182:18; 224:6, 9, 11, 17 Coalition 224:16, 20; 225:2, 8, 13; 226:2, 8, 12, 17 code 11:7, 11, 13, 16, 18, 24 codes 11:24 collaborate 165:8; 215:3 collaboration 133:2; 169:10; 212:3; 213:8; 214:8; 215:1 collaborative 92:9; 211:15; 215:13 collaborators 15:9; 197:23 colleagues 10:14; 166:7 collecting 155:11 column 74:11, 19; 75:16; 77:5; 78:24 comfortable 87:11; 97:9; 218:11, 12, 14 coming 32:1; 107:10; 110:5; 121:14; 145:19; 186:13; 201:23 comment 67:15; 117:9; 145:16; 148:5; 160:16; 161:9; 163:6, 19; 165:13; 178:11, 14; 179:12; 180:12, 15, 22, 22; 186:14; 231:10 commentators 118:23; 119:4, 19; 121:15; 123:12; 124:21; 146:14; 153:3 commented 107:7; 146:18 comments 105:3; 106:8, 10, 21; 107:10, 15; 108:5, 7, 8, 13; 109:8, 10, 23; 110:7; 116:24; 118:11; 119:24; 120:8, 15; 121:13; 122:5, 8; 124:3, 24; 126:14; 127:14; 142:22, 24; 144:19, 24; 145:18; 147:16, 21, 24; 148:11, 14; 156:21, 22; 157:1; 160:8, 20, 24; 161:8; 162:1, 3; 181:3 commit 192:16 common 55:17, 19; 200:24 communicated 125:18, 22; 127:1; 133:9; 224:20 communicates 48:7 communicating 39:13; 43:20	communication 27:17; 39:15, 16; 49:14 communications 42:13; 44:9, 22; 49:7; 153:13, 19 community 52:16; 218:3 companies 224:11, 11; 225:7, 8; 228:14, 17, 19, 20, 22; 230:12, 22; 231:1, 1, 2, 16, 23; 232:1, 2 company 9:6; 226:16 comparable 87:19 compare 55:11; 116:10; 150:1 compared 196:24 comparison 113:13, 20 compel 5:14; 6:23 complaint 9:14 complete 49:17; 127:16; 157:8; 178:19; 181:23; 182:2, 5; 195:18, 19; 196:1; 197:9; 206:8 completed 20:1 completely 40:22; 86:15; 122:15 completion 7:14 complex 26:2; 27:20; 28:7, 14; 95:7, 15; 97:13; 100:15; 101:2; 102:3 complexity 32:12; 33:15 complicated 33:22; 40:4, 14 components 170:4; 171:5 composition 30:9 compound 39:23; 40:15; 42:3 comprehend 183:21 comprehended 27:21 comprehensive 195:24 comprised 186:8 comprises 93:23 compromise 165:9; 187:10, 12 compromised 158:13; 187:8 computer 68:18, 21, 22, 24; 69:1; 70:18, 20 concede 141:1 conceding 81:11 concentrations 26:5 concept 184:4 concepts 43:7	concern 25:4, 5, 8; 39:12, 18; 44:7, 8, 21; 45:6, 13, 17; 196:22; 199:22; 201:12, 18; 202:11 concerning 49:10; 53:11; 157:18 concerns 197:3 conclude 88:2; 195:6; 196:10 concluded 195:9 concluding 134:24 conclusion 43:13; 112:4; 126:23; 128:2; 194:7; 195:13 conclusions 20:7, 9; 34:20; 38:14 conclusive 195:3 concur 219:16 condensation 209:18 condition 144:10; 175:24 conditions 175:19, 20, 21 conduct 8:2 conducted 30:5; 156:2; 194:2, 6, 8 conference 230:5, 6 conferences 204:2, 13 conferring 71:17; 81:2; 163:1 confidence 76:1; 85:12 conflict 104:1; 123:23; 142:2 conformed 74:18 confuse 42:11 confused 86:4 Congress 34:3, 6; 53:12 connection 15:23; 70:9 connections 114:24 connotation 200:8 connotations 200:11, 12 conscious 27:16; 70:23 consequence 195:10 consequences 134:2 conservative 158:15 consider 29:18; 192:15; 207:15; 216:6, 8; 233:1 considerable 74:6 considered 24:8; 54:5; 177:21; 201:19; 203:24 considering 109:2	consistency 130:9; 131:5 consistent 106:24; 108:13, 18, 21; 123:21; 129:9, 16, 19; 130:5; 131:17; 139:20; 142:1, 6, 14, 19; 170:14, 24; 171:1, 2, 3; 172:20 consonance 111:13, 14; 113:6; 114:15; 122:13 consonant 212:23 constitute 185:24 constitutes 197:5 constrain 12:19 construct 75:3 constructed 169:21 consult 70:21; 72:1; 75:17; 231:24 consultant 229:2, 5 consulted 228:17, 18, 20 consulting 18:10; 224:2, 15; 225:12, 15, 18; 228:11, 12; 229:23; 230:1, 24 contact 161:20 contacted 215:8 contain 103:3; 155:3, 4 contains 100:12; 103:1 contend 48:18; 186:9 contended 207:4 contention 131:9; 175:22; 206:22 context 61:24; 212:20 continue 7:3; 25:20 continuing 19:23 continuously 53:9 contract 18:12; 20:3; 213:9 contracts 225:16 contradiction 212:23 contribute 104:8; 116:23; 127:6; 214:21; 225:7 contributed 97:2, 4; 110:7; 115:8; 118:23; 119:4, 16; 197:19; 198:22 contribution 97:22; 121:12; 126:8, 11; 198:2, 5 contributions 198:7 contributors 197:23 control 133:17 controls 204:3, 14 controversial 95:7, 15; 97:13; 100:16; 101:3; 102:4, 24; 117:12 controversy 45:23, 24 convected 183:9; 184:6, 12 convection 20:19; 183:2, 24 conversation 97:7, 22; 100:9; 104:11; 117:8; 118:10; 135:17; 186:16 conversations 98:13; 121:13; 122:11 conversion 21:5; 152:13 converted 151:23 convey 35:9; 41:21, 24; 48:1; 183:12 conveyance 47:1 conveyed 36:19, 20; 54:7; 119:10, 12; 143:5 convince 158:12; 166:15 copies 106:9; 107:2, 5, 6, 14, 19; 108:15; 109:19; 120:7; 154:17; 155:9; 156:11; 177:7; 221:22; 222:1 copy 69:6, 8, 11, 11, 12, 13, 18; 136:7; 161:16, 24; 177:11, 13, 16; 184:10 core 93:8 corner 145:24; 146:1 Corporation 9:2; 224:6, 8 corrected 109:13 correcting 120:14 correctly 172:15 Cosmos 51:1; 70:11; 83:19; 87:21; 88:13; 94:16; 103:19; 111:16; 112:3; 120:7; 138:7; 141:10; 157:21; 167:20; 168:3, 10; 169:12; 170:15; 171:6, 14, 21; 173:6, 20; 174:9, 15, 24; 177:22; 179:11; 180:16; 183:7; 184:17; 185:13, 23; 186:9; 203:1; 204:8; 205:6; 206:1, 17; 207:1, 6; 208:11; 209:13, 22; 11:12; 212:1, 12; 213:14; 214:23; 215:2, 4, 8, 12; 216:4, 8; 218:16, 16 cost 173:19 cost-effective 173:16 costs 116:12
--	--	--	---	--

couldn't 155:22;
167:17; 187:16;
200:15
counsel 5:4; 8:11;
71:17; 81:2; 163:1
count 9:15; 87:5, 6;
218:12
counterclaim 9:19;
24:16; 36:9
counterclaims 25:8
counts 9:12
couple 210:8
course 31:23; 46:15;
124:6; 128:9; 157:20;
168:12; 173:19;
179:21; 196:7; 231:5,
7
court 6:10, 22; 8:19;
36:7
cousin 68:23
cover 78:20, 22;
136:23; 173:21;
188:12
covered 89:22;
218:24; 219:1
created 21:9, 19;
53:3; 68:18; 99:16;
139:4, 15; 143:20
creating 69:24
creation 95:12;
97:21
credence 180:7
credited 215:24
criticizing 48:23
crop 172:6, 13
crops 170:18
cross 186:21
cross-out 159:19
cryptic 77:14
culminating 184:24;
185:13
current 16:8; 18:5,
23; 24:8
currently 17:4
currents 29:21
curve 74:14, 18; 85:7
custom 34:23
customary 34:19;
227:23; 228:4
customs 12:1
cut 168:16
cycle 63:2
cycles 125:19

D

D-o-u-l-t-o-n 8:20
D.C 224:24
data 14:8; 17:5; 53:6;
54:22; 55:18; 58:20;
74:12, 12, 18; 75:19;
78:18; 82:2; 86:15;
88:7; 125:10; 167:1;
187:1; 192:11, 17;

193:16; 195:3; 207:1;
216:11; 219:3
date 50:14; 120:15;
135:5; 144:3; 174:17;
215:15
dated 133:19; 143:6;
148:19
dates 144:2
Daughters 9:7
day 7:12, 13; 24:13;
53:1, 2, 9; 116:4;
137:18; 181:3;
185:18, 19, 21;
201:23; 210:6
days 35:1; 107:22;
143:24
deadly 207:18
deal 71:11; 173:19
dealing 65:18; 132:8
debating 24:14
debris 15:5; 16:13,
14
decade 26:22; 27:5;
208:18; 230:10, 18
deceased 64:15
decided 36:6; 85:23;
112:22; 178:1; 191:7;
215:3
decision 70:24
decompose 150:14
deep 183:2, 24
deep-sea 30:10
deeper 183:10;
184:6, 13
deeply 25:22
defendant 7:24; 8:4,
12; 9:9, 18; 135:21;
184:16, 16
Defendant's 105:18,
23
defense 168:23;
169:4, 5
define 42:2; 46:5;
96:6; 132:10, 11
defined 64:21
definition 92:13;
98:22; 197:7, 9, 11,
18; 198:15, 17;
199:19
definitions 13:10
degree 60:1; 86:2,
17; 90:6, 22; 129:13,
22; 130:13, 16, 19;
131:10; 135:13;
141:11; 142:16;
146:6; 149:21; 158:6;
164:6, 22; 165:5, 7,
15; 186:18, 20, 23;
187:8, 11; 189:19;
191:6; 192:22; 193:12
degrees 51:13, 21;
55:1, 24; 57:23;
58:18; 59:5; 84:13,
16, 21; 85:19, 20;
86:23; 87:4, 10, 13;
88:10, 15; 90:5;

134:7; 136:13;
139:23; 140:5, 14;
148:7; 151:4, 8;
152:18, 18; 158:21;
163:8, 9; 164:13, 21;
165:12; 166:10, 21;
175:8, 8; 177:23;
189:16; 190:17;
191:1, 13; 193:1, 2, 3,
5, 8, 8, 11; 196:11, 12
delaying 208:15
deleted 86:1;
163:18, 19
delineated 51:19
deliver 136:6
demonstrate 58:18
denitrifying 180:13;
182:9
density 16:16
Department 73:9,
18; 194:23
depend 196:6
depends 27:24;
31:22; 33:9; 102:18;
142:9; 171:8; 202:12
depicted 86:19
depicts 76:8; 77:10;
86:22
deponent 5:6
deposition 5:5;
6:24; 7:1, 3, 4, 15;
37:14; 80:2; 107:21,
23, 24; 120:24;
121:4; 233:14
derived 80:19;
97:17; 106:6; 114:22;
123:16; 166:17
derives 111:5;
123:3; 200:17; 224:17
descendants 9:2
describe 72:11;
225:18; 228:1, 24
described 34:21;
200:3, 4
describes 77:19
description 47:14;
77:16; 189:7
detail 108:6; 122:4;
130:10; 146:10;
170:1; 222:6; 224:14;
231:4
detailed 77:15;
124:24; 169:22;
181:9; 185:14, 18, 24
details 18:22; 53:22;
232:11
detect 27:2; 28:3
determination
200:16
determine 55:8;
82:4; 85:4; 91:8;
115:11
determining 68:1
develop 13:11; 32:5
deviation 83:22

devoted 193:18
difference 14:9;
43:8; 45:21; 63:5;
76:23; 86:20; 87:11;
181:15; 182:9; 193:6,
11; 196:10
differences 10:24;
11:5; 43:6; 76:19;
77:12; 78:9, 16; 87:1,
8, 9
different 27:3;
36:20; 37:2; 39:22;
43:1, 3, 13; 44:11;
53:7; 62:6, 7; 71:8;
74:3, 15; 103:8;
107:7; 126:17; 130:7;
131:14; 145:5; 178:4;
196:19; 206:24;
214:7, 9, 10; 218:24
differently 12:24
difficult 170:3;
171:4; 172:21; 179:6
difs 72:15
dioxide 26:9; 31:6,
6; 73:8; 134:3; 204:4
DIRECT 8:15; 26:11;
30:3; 47:11; 124:4,
12; 145:9; 169:2;
173:13; 208:4; 223:18
directed 5:21; 6:12,
18; 86:5, 8, 8, 10
direction 46:12;
136:12; 139:1, 5, 15;
211:14; 212:2
directly 26:16;
89:16; 127:13;
128:12, 13; 207:2;
222:13; 226:8; 230:21
director 35:4; 36:16;
224:21
directors 221:15
directory 138:3
disagree 159:20
disagreeing 76:12;
78:4
disagreement
191:17; 192:20
disagrees 100:20
disappointment
204:4, 16
discard 155:8
discern 140:2
discerned 13:18;
140:6
disciplines 27:20;
28:22; 29:5, 22
discomfort 81:7
discovered 125:10;
179:21
discovery 5:15
discrepancy 219:6
discuss 57:1; 80:24;
89:9; 92:18; 135:15;
160:21; 164:23;
165:19; 174:3;

176:23; 202:4; 219:4;
233:12
discussed 33:15;
83:23; 85:22; 88:4;
141:14; 163:16;
188:21
discussing 174:4;
189:2
discussion 95:6, 22;
99:18; 101:24;
102:12; 120:22;
131:1, 3; 135:2;
157:17; 158:1; 160:2;
162:24; 168:9;
179:13, 20; 181:1, 7,
18, 23; 182:2, 4, 21;
185:7; 186:5; 191:4,
24; 216:14; 233:13
discussions 5:14,
17; 96:19; 135:3;
167:4; 179:22; 181:9
disk 69:4, 7, 19, 19;
70:16, 16, 17, 18
disks 70:20
display 88:17
displayed 53:18, 19;
87:24
dispute 36:5; 41:16;
74:23
disputed 177:2
disputing 81:13
distinction 14:13;
43:18
distinguish 26:24
distorted 50:13
distributed 177:7
distribution 64:22;
84:2, 2; 131:20
Doc 143:17; 149:6
document 47:18,
20, 24; 49:23, 24;
50:9, 21, 22, 24;
54:13; 69:3; 72:22;
73:7; 77:9, 18, 18;
78:16; 79:2, 10, 15;
92:1, 94:9, 11, 15;
110:8, 13; 113:13;
116:9, 10; 133:16;
135:21, 22; 137:4, 8;
141:5; 147:23; 150:4;
156:5; 161:13, 19;
164:1, 7; 169:19;
170:12; 173:12
documents 48:11,
17; 70:20; 76:5;
77:21; 116:7, 8;
129:17; 147:9;
154:24; 155:3, 4;
156:5
dollars 18:21; 19:2
done 49:5; 52:18;
55:13; 65:8; 126:17;
182:10; 190:5;
195:13, 18; 209:19;
224:3; 225:23;
226:17; 228:11

doubling 134:8;
175:13, 15, 16, 17, 18
doubt 74:17, 23;
137:24
doubtful 176:6
Doulton 8:19
down 11:10; 51:7;
57:16, 19; 58:24;
59:20; 95:17; 114:23;
115:6, 18; 139:10;
162:20; 170:21;
182:24; 188:3, 17;
209:6, 12; 215:2
dozen 225:14;
228:15
Dr 5:16, 23; 6:1, 4, 6,
10, 15; 7:18, 20; 8:21;
10:19, 21; 13:5;
15:13, 18, 20, 22, 24;
18:15, 18, 20; 23:10;
25:5; 31:12, 18; 37:6;
40:9; 41:20; 50:22;
51:3; 53:10; 56:19;
63:24; 66:12, 24;
67:20, 23; 72:16, 21;
79:19; 80:3; 81:7;
88:23; 89:4, 13;
90:14, 14, 15, 16, 19;
91:9, 12, 23, 23, 23,
24; 92:3, 12, 17; 3:1,
13, 19, 23; 94:5; 95:4;
96:4, 19; 97:20, 23;
98:12, 14, 14, 19;
99:16, 21; 100:10,
13; 101:20; 102:14,
15; 103:15; 105:6, 9;
107:14; 108:5; 109:3;
115:7, 10, 18; 117:9,
20; 118:11; 119:13,
15; 121:4, 14, 18, 20;
122:5; 123:16;
124:21, 21; 127:6,
13; 132:23; 133:3, 9,
13, 18, 23; 134:13;
136:15, 23; 138:5;
39:6, 11, 16, 16, 18;
140:9, 12; 141:17;
142:5; 143:1, 1, 5, 6,
10, 12, 23; 144:6, 6,
18, 19; 145:1; 146:7,
14; 147:16, 20, 21;
148:11, 19, 19, 23;
149:2; 150:24; 151:2,
5; 152:12, 22; 153:5,
5, 8, 13, 13, 14, 22,
24; 154:15, 18, 24;
155:7, 14, 14, 16;
156:24; 157:9; 159:3,
6, 7, 9, 23; 161:4, 7,
9, 16, 20, 20, 22;
62:3, 6, 13; 163:6;
164:5, 13, 23;
165:11; 166:7; 167:7,
8, 8, 8, 9, 9, 10, 10,
21, 21; 168:2, 6, 7,
18, 19; 170:2; 171:3;
173:3; 176:23; 177:2,
12; 178:12; 180:6, 7,
12; 181:2; 182:23;
184:18; 186:7, 16;

188:1, 8, 21; 189:8,
18; 190:12, 15, 15,
15, 22; 191:16, 17;
193:13; 194:12;
196:21; 201:22;
202:4; 203:2; 05:18,
22; 207:4, 5, 22;
208:11; 209:3;
210:16, 20, 20;
211:6; 212:4, 4, 13;
214:18; 216:16, 17,
19, 21; 217:1, 5, 15,
18, 20, 22; 218:21;
219:7, 15, 17;
220:23, 23, 23;
221:7, 22; 222:1;
223:6, 21; 232:24

draft 67:4; 68:15;
70:7; 93:20; 94:23;
95:13; 96:1; 99:10,
20; 100:1, 4, 13;
102:20; 103:17;
104:3, 17; 106:5, 9;
107:2; 109:17, 19,
20; 118:16; 122:5, 8,
12; 123:23; 124:20;
125:14, 23; 132:15;
136:23; 137:10, 17;
138:6, 6, 24; 139:2, 4,
5, 9, 9, 14; 141:23;
142:12, 23; 143:5,
13, 16, 20, 22, 23, 24;
144:20, 21; 45:1, 16,
22; 146:4, 8, 8;
147:16, 21, 24;
148:10, 10, 10, 17,
24; 149:9, 12, 17, 24,
24; 150:3; 153:4, 5,
24; 154:12; 155:13;
156:11, 11, 17;
157:21; 160:19, 21,
22, 24; 161:16, 22,
24; 162:2, 5; 166:24;
168:16; 169:23;
171:6, 14; 181:8, 14;
185:14; 206:12;
211:14; 212:9, 10, 22

drafted 97:17, 20;
99:4; 111:15, 17, 17,
20; 112:7; 113:5;
115:7; 117:14;
118:24; 119:23;
122:12; 126:13;
132:14; 135:8;
167:20; 212:2, 22

drafter 92:10, 13,
14; 93:2; 117:15;
122:8; 213:6

drafting 67:3; 71:10;
95:10; 96:8, 20;
98:19; 115:8; 117:20;
127:6, 11; 131:4;
141:22; 201:6

drafts 69:20, 22;
105:5, 5, 10; 106:22;
107:5, 15; 109:20;
120:7, 18, 18;
121:14; 153:20, 21;
154:18, 22; 155:4, 5,

9, 14, 15, 16; 156:9,
12; 199:17
dramatically 178:4
drastic 111:2, 10;
112:6; 113:2; 208:14
draw 14:12; 43:13;
134:13; 136:9, 14,
21; 194:7; 232:11
drawn 79:19; 85:9;
86:14; 212:14; 217:13
drew 125:11, 12, 15
drive 137:24
Drs 18:5; 119:24;
120:8; 156:12;
168:10; 215:24;
217:24; 220:14
duly 8:12
Duration 17:10
during 128:20;
129:8, 24; 136:10;
141:21; 142:20, 24;
144:7, 10; 162:6
dust 29:14

E

E 226:14, 16
each 70:1; 87:9;
91:16; 93:2; 103:18;
156:12; 187:17;
222:20; 229:19
eager 233:10
earlier 70:7; 83:23;
88:4, 6; 113:8; 151:1;
207:4, 24; 211:18
early 174:21; 211:8
earth 15:6; 16:16,
22, 22; 17:7, 17, 19;
134:5; 141:9
earth's 22:5; 134:6
easier 184:1, 3
easily 74:4; 146:20;
188:13
easy 225:10
echoing 134:21
ecological 170:4;
171:5
ecology 30:13, 14,
17, 24; 31:2
economics 174:3
economist 127:2
economists 32:4
Eddy 193:21, 24
edge 136:8
editing 67:9, 12;
85:23
editor 69:13, 14, 15;
190:11; 215:8, 13
editors 216:3
effect 54:20; 82:11;
182:19
effectively 38:23
effects 19:10; 20:10;
122:20; 193:23

efficient 146:23
effort 48:3; 83:14,
15; 92:9
Eight 87:7, 9; 167:7,
19
either 24:15; 40:9;
67:8; 72:23; 124:21;
142:21; 156:14;
157:24; 160:15;
162:10, 13; 166:14,
14; 172:7; 223:6;
226:10
electric 224:11;
228:19; 231:1
elementary 34:7
elevation 16:23;
17:18; 20:11, 16;
62:20
eliminate 59:17;
131:1
Ellsaesser 67:17;
91:23; 119:13; 120:1,
8; 124:22; 156:12;
214:18; 217:22;
218:1; 219:16
else 51:4; 61:1;
100:21; 126:4;
198:10; 209:17
else's 100:19; 148:14
elsewhere 153:1;
173:20
emerged 95:23
emeritus 227:21, 24;
228:1, 3, 5
empirical 130:23
employed 227:5, 11
encompassed
139:11
encouraged 204:2,
12
end 7:12; 56:7;
62:20; 170:6, 10;
172:2; 176:1; 204:19
endorsement 95:11
Energy 73:9, 18;
121:23; 122:24;
124:4; 194:23;
224:11; 228:11
energy-related
228:12
engaged 184:16
English 200:24
enough 178:23;
179:2, 16, 18; 196:9
entered 105:20;
213:11
entire 28:24; 92:17;
205:22; 227:2
entirely 130:7;
142:1; 202:12
entitled 40:10;
79:15; 90:1
environment 122:21

Environmental
5:22; 32:20; 35:5;
36:15, 17; 43:14;
46:7, 10, 13; 48:3, 7,
11, 17, 22; 49:8;
95:16; 194:22; 203:6;
204:2, 13; 205:3, 19,
23; 206:5, 20;
210:21; 211:1; 216:1;
217:9; 223:17; 224:3,
4, 5
EPRI 228:19
equal 136:11; 196:22
equaling 77:4
equatorial 150:21
equilibrium 175:19,
21
equivalent 175:16,
17, 18; 183:15, 18;
184:14
Eric 9:5
espouse 48:12
essentially 77:4;
181:8; 190:14; 209:17
established 229:16,
19
estimate 21:18;
26:22; 35:7, 19; 85:7,
10, 12; 87:2, 5; 165:2,
19; 175:7; 193:11
estimated 21:20
estimates 178:22
estimating 193:9, 14
estimation 37:5
et 43:15; 128:21;
134:3
ethical 11:6, 11, 18;
12:15, 19; 38:16;
39:1; 41:20; 199:6, 7,
22; 201:11, 18;
202:11
ethics 12:11
even 45:2, 10;
130:23; 148:13;
172:5; 190:19; 193:3;
211:9; 227:5
events 64:17
every 52:24; 53:2, 8;
60:7; 71:10; 101:1;
103:10, 18; 153:9;
208:16
everyone 100:17,
19, 21
everything 30:17;
155:7; 185:3
evidence 13:11;
32:6; 130:23; 153:23;
195:12
evidently 102:22
evoke 186:4
evolved 142:23
exactly 140:11;
147:4; 173:18; 202:16
examination 8:11,
15; 24:12

examined 8:12
example 14:8; 28:3
examples 48:5
exceeding 87:10
except 5:8; 62:19;
69:13; 70:6; 104:18
exchange 185:1
exchanges 185:13,
17
Excuse 71:15;
175:10; 215:19
exercise 113:16;
116:17
exhaustive 29:24
exhibit 49:23; 50:3,
17; 72:2, 4, 9, 11;
74:9; 79:7, 15, 17, 17,
20, 21, 22; 80:5, 10,
21; 81:4, 18, 22; 84:7,
8, 9, 23, 23; 85:1, 3;
86:13, 18, 19, 19, 22,
24; 87:15, 16, 18, 20,
22, 24; 88:1, 6, 16;
89:2, 2; 94:3, 5, 17,
19; 105:17, 20;
110:5; 128:15, 17;
133:20, 21; 135:21;
136:2, 22; 137:1, 2, 6,
12; 140:12, 18;
41:23; 143:5, 7, 8, 10,
16; 146:22; 147:3, 8,
15, 17, 20; 148:18,
20, 21; 150:2; 152:1;
156:20; 167:12;
169:16; 173:1, 14;
174:10, 10, 12;
178:13; 185:8;
202:22, 23; 203:19,
19, 21; 205:3;
206:16, 17
exhibits 79:13, 18,
23; 146:24
exist 93:23; 95:1;
115:20; 175:24;
232:17
existed 69:18;
104:6; 115:9; 137:18;
223:19
existence 113:4
exists 138:10;
163:24
exosphere 29:21
expand 126:18
expanded 123:1, 2,
14; 126:8; 127:16
expanding 123:8
expansion 117:3, 4,
9
expect 60:16; 61:1;
63:13; 84:3
expected 10:7;
170:5, 17; 186:14,
22; 190:3; 191:8, 11;
192:21
expecting 161:19
expection 208:16

expense 25:1
expenses 19:4, 5;
221:3; 222:4, 9
expensive 24:22
experiences 197:2
experiment 15:2, 4,
7; 16:3, 17; 17:11, 12,
16; 18:2, 4, 5; 117:23;
118:4
experimental 14:17,
22; 16:5
experiments 14:10;
16:12; 179:4, 9
expert 23:18; 29:18;
35:5; 75:17; 82:13;
133:6; 159:24;
166:16; 192:15;
193:22
expertise 11:1; 25:5;
28:21; 29:5, 11;
31:13, 19, 24; 35:14;
36:18, 24; 37:1, 2;
38:8; 193:13
experts 167:4
explain 14:16;
122:4; 157:17, 19;
179:19; 208:20
explained 43:19;
88:6; 98:12, 16;
99:23; 158:4
explains 173:10
explanation 169:7
explore 130:8
Exposure 17:10
expressed 97:6;
118:12; 174:1; 204:4,
16
expressing 43:4
expression 160:7
extends 7:10
extensive 205:5, 11
extent 6:17; 26:15;
40:17; 42:11; 44:16;
98:19; 109:11; 115:7,
12; 127:7, 10
Exxon 228:18; 229:1

F

face 196:23
Facility 17:10
fact 11:6; 91:23;
97:18; 100:14;
162:21; 164:18;
168:8; 171:23; 172:4;
198:22; 215:5
facts 43:11, 12, 16,
17; 205:1, 9
factual 32:23; 115:24
Fahrenheit 151:9,
14, 20, 22; 152:13
fair 27:14; 28:6, 14,
18, 20; 29:23; 38:5;
46:23; 48:10, 16, 21;
57:17, 18, 21; 59:10;

61:23; 65:5, 11;
77:19; 79:20; 84:10;
15, 19; 102:2; 123:6;
162:5; 166:19; 182:1;
190:7; 196:14;
217:24; 218:15
Fairfax 8:20
fairly 26:2; 27:19
faith 179:22
falls 71:3
Falsification 14:8
familiar 9:17, 21;
11:16; 18:22; 23:3,
13, 15, 23; 31:23;
53:12, 14, 24; 54:2;
65:6, 9, 12, 13, 15;
66:5, 21; 73:9; 74:14;
219:20; 221:12, 20
family 9:1
far 105:6; 170:16;
222:20, 23
faster 91:7
fax 145:24
feature 125:9
February 94:14;
95:11; 99:17; 104:12;
106:4, 5; 112:20;
114:3; 117:21;
118:17, 20; 119:23;
120:1, 12; 121:20;
125:13; 127:14, 21;
128:4, 7, 11; 131:4;
135:6, 7, 16; 136:6;
137:17; 157:17;
174:20; 185:14, 20;
186:8
federal 46:13; 227:6,
11; 231:6, 12
feel 41:10, 20, 24;
42:5, 8, 18; 43:21;
108:22; 113:4;
180:19; 184:14;
218:7, 11, 12, 14
feeling 122:18; 190:9
fees 224:2
felt 97:9; 122:12
fertilize 124:10
few 171:10; 213:12
fewer 190:9
field 133:6; 182:18
fifth 112:3; 123:24;
149:12, 15, 16
fight 6:10; 37:15
fighting 75:9
figure 178:2, 5
file 50:11; 137:23;
138:2, 4, 5
filing 5:7; 155:20
film 221:7, 11
final 61:16, 16;
70:15; 71:7, 7; 89:23;
109:17; 132:12;
157:21; 160:19, 22;
164:10; 174:14;
185:14

finally 158:13
financial 221:18
find 57:17; 58:24;
72:18; 98:18; 110:10;
115:19; 155:23;
167:17; 170:20;
196:7; 225:10
findings 213:16
fine 32:10; 89:22;
92:11, 19; 115:1, 14;
141:3; 154:4; 160:10;
176:20; 202:4;
207:22; 208:5; 209:1;
210:10
finish 6:23; 7:7, 13;
24:19; 195:7; 201:24;
206:23; 211:5; 233:8
finished 83:4;
121:16; 181:7
fires 30:23
firm 226:11, 13
firmlly 190:20
first 8:12; 27:1;
35:12; 39:21; 40:19;
49:23; 51:4; 52:6;
54:16, 18; 61:13;
66:9; 72:12, 16; 75:7,
23; 76:9, 20; 77:5;
83:5; 93:17, 22, 23;
94:11, 16, 20; 95:23;
96:1, 2; 99:8, 10, 20,
21; 100:1, 2, 3, 3, 5,
8, 12, 24; 101:11;
102:16, 22; 104:3, 5;
105:13, 18; 106:5;
107:23, 24; 108:17;
109:20; 111:5;
112:10; 13:9; 117:5,
10, 15; 122:8; 123:8;
124:11; 125:2, 14;
128:17; 129:3, 4;
130:5; 132:15;
136:23; 138:6, 12,
24; 139:4, 9, 17;
142:6; 143:16, 24;
144:7, 20; 145:1, 16,
22; 149:5; 154:20,
22; 155:10; 157:18;
163:4; 168:15;
171:14; 178:13;
188:12; 205:6, 24;
210:5; 211:14;
212:12; 222:10
fisheries 31:2
fit 208:24; 209:3
five 106:20; 136:13;
140:14; 141:11;
151:4, 8; 173:7;
193:5; 210:11, 13;
212:11; 233:5
five-eighth 152:17
five-minute 53:1
floppy 69:6, 19, 19;
70:16
Florida 15:19, 21;
16:1; 228:19; 230:4
follow 220:21

following 139:4;
167:6; 181:24
follows 8:13
force 116:6
forecast 180:7
foreign 95:16
forest 30:23; 170:3;
171:5; 172:11, 17, 22
Forestry 30:20, 21
forests 173:14
form 5:8; 10:8;
11:23; 16:16; 28:11;
29:1; 31:20; 32:9;
33:7, 21; 76:8;
121:12; 195:12
formal 213:9; 232:12
formed 5:23; 46:11,
12
forming 33:2
formulating 100:13
forth 107:7
forward 41:10; 80:2
fossil-fuel 204:15
found 128:22
foundation 27:12;
35:15, 17; 36:14, 22;
132:22
founder 9:2
four 9:12; 39:22;
43:12, 17; 53:8; 68:4;
122:1; 143:24; 155:2;
170:10; 197:19;
208:5; 212:11; 218:18
four-day 145:15
fourth 51:7; 57:18;
182:24
frame 27:24; 28:1
FRED 8:9, 19; 121:4;
205:17; 220:7
freelance 10:5
frequent 10:12
frequently 10:7
friend 218:13
front 167:12
Fuel 6:14; 219:20;
220:15, 20, 24;
221:3, 7, 18, 21, 24;
222:3, 11, 16, 21;
223:1, 5, 9, 16, 23;
226:1
fulfilled 212:9
full 54:16
functionaries 220:5
funded 194:10;
221:7
funding 5:22; 6:4;
16:2; 222:20; 223:22
funds 18:17, 18
Fung 167:10
further 13:19; 78:4
future 122:18;
178:20; 188:19; 194:3

G

gain 113:14; 179:3
gained 120:5
Gainesville 15:21;
16:1
galley 50:1, 5, 7;
51:5; 54:16; 91:1;
94:17; 103:19; 104:2,
4, 15, 17; 110:5;
111:5, 16; 115:17;
117:1, 18; 118:7;
121:10, 16, 17, 23;
124:1, 19; 125:20;
126:10, 23; 128:22;
131:5, 6; 141:10, 11;
142:7; 157:15, 16;
161:12; 170:20;
172:2, 3; 173:14;
178:11; 182:23;
185:23; 203:18
game 115:2; 185:2,
5; 207:8, 9, 17, 18
games 96:13
gas 25:11; 26:4;
228:20, 21; 230:12,
15, 22; 231:1
gases 31:11; 117:3;
180:11; 181:20, 21
gather 34:13
gathered 153:1
gathering 17:5;
156:4
Gaussian 84:2
gave 114:16; 123:17;
127:3; 147:9; 162:1
GCC 226:4
general 26:7; 27:6;
32:2; 34:2, 4, 20, 21,
23; 43:21; 59:1;
69:24; 70:4; 95:6;
103:7; 123:18;
138:13; 139:13, 22;
142:12; 146:5; 148:6;
149:20; 169:24
generally 52:16;
53:3; 65:9; 89:4;
160:24; 232:4
geographic 58:12,
15
geographically
60:11, 12
Geyer 156:17
given 7:17; 64:19;
80:17; 94:12; 117:19;
118:10; 121:12, 19;
152:7; 155:6; 156:9;
210:5
gives 42:18; 209:21
giving 5:24; 202:15;
209:16; 229:5; 230:5
glad 167:18; 190:10
glance 154:20
glob 72:13

global 25:5; 26:1;
31:11; 32:6; 33:12,
13, 14; 34:8, 10; 36:5;
39:11; 43:11; 45:7,
13; 48:8, 12, 13, 18;
49:2, 10, 13; 51:6;
52:5, 8; 54:5, 7, 24;
55:1, 17, 23, 24; 56:4,
8, 12; 57:13, 14, 24;
58:3, 14, 23; 59:4, 7,
8, 11; 60:3, 8, 9, 17;
61:11; 62:1, 11, 17,
23; 63:5, 11, 12; 65:6,
17; 66:4, 6; 71:21;
72:12; 74:12; 7:21;
78:24; 79:15; 83:7;
84:12, 20; 85:5;
86:20; 87:1, 3, 12;
88:17; 89:13; 122:18;
133:6; 135:12;
136:15; 150:17;
186:15, 17; 188:22;
190:23; 191:18;
193:14; 194:4, 14;
195:4; 196:22, 23;
215:9; 218:2; 224:4,
16, 19; 225:1, 8, 13;
226:1, 8, 12, 17;
232:7
globe 58:6; 196:16
goes 89:15; 93:8
good 47:16; 51:21;
89:7; 113:23; 128:18;
129:5, 6; 131:24;
132:2, 3, 16; 141:19;
155:11; 171:17;
178:23; 179:2, 16,
18; 188:15; 219:8
government 47:7;
48:1, 2; 227:6, 12;
231:6, 12, 20
governmental 36:19
grant 16:8, 10; 18:6,
7, 8, 21, 23; 20:2;
97:10, 12, 15
graph 74:5; 76:7;
78:2; 79:7; 86:5, 11,
13
graphic 76:8
graphically 81:17;
86:19
graphs 80:4; 207:1;
216:11
grasp 27:21
great 155:12; 173:19
greater 39:1; 46:21;
63:11; 150:17;
170:16; 192:22
greatest 87:10
green 156:21, 23, 24
greenhouse 19:10;
20:10; 26:4; 31:11;
57:22; 100:15; 101:2;
102:3; 111:9; 112:5;
113:1; 117:3; 137:14,
23; 138:2, 3; 170:18;
180:11; 181:19;

203:3, 17; 204:24;
205:8; 208:13
GRNH2 143:17;
149:6
ground 40:24;
56:17; 60:22; 66:8;
89:22; 98:3; 106:14
grounds 9:21;
11:20; 13:4; 24:4;
35:11; 39:20; 63:19;
88:21, 22; 92:7;
200:8; 211:19
group 15:9; 16:15;
39:1; 213:17; 214:3;
218:2, 17
growth 29:20
guess 21:14; 35:23;
77:6; 85:6; 136:7;
146:21; 148:20;
149:12; 174:23
guessing 176:18

H

habits 154:3
hadn't 215:5
Hague 204:3
half 60:14; 86:16;
129:4; 172:16;
187:23; 188:13;
201:16; 210:14;
225:14; 228:16
Halfway 58:24;
188:2; 201:15
hand 146:17;
156:22; 182:15
handle 6:20
hands 162:6
handwriting 135:23;
157:6, 9; 159:7, 9, 13,
23, 24; 160:11;
161:1; 162:2; 178:12;
179:2; 180:4
handwritten 50:10;
51:23; 141:10;
154:17; 157:22
Hansen 53:10
happen 170:5
happened 162:21;
189:13
happens 215:10
happy 122:13;
190:8; 192:14
hard 41:5; 69:3;
70:17; 130:22; 187:22
hardly 100:16
Harrison 226:14, 16
hasn't 72:24; 154:15
haven't 57:22;
138:24; 139:2, 8;
195:13
head 19:16; 198:15
heading 121:23;
129:10; 138:10;
149:11

heard 73:12; 124:16;
219:22; 220:18
hearings 220:16, 24
heat 183:9; 184:5, 12
heated 25:12
held 23:4, 7, 14, 17,
23; 162:7, 8, 9;
214:15
help 8:1; 170:3;
171:5; 172:21; 200:21
helped 122:5
helping 229:2
hemisphere 53:20
Hemispheric 72:12;
79:16
high 19:11; 20:9;
22:8; 62:21; 129:15;
149:22; 150:7, 15;
152:21; 175:4
higher 17:22; 21:2;
38:7; 150:20; 172:7;
189:9, 23
highlighter 91:1;
96:3; 157:3
himself 56:19; 61:4
historical 65:6;
193:16, 23
hold 22:10, 12;
51:17; 176:7
Hole 65:22
home 144:14
hope 41:1; 209:6
hoped 7:8; 46:14
hospital 144:14, 14;
145:13
hour 53:2; 116:2;
188:13; 210:14
hours 53:8; 208:5
House 204:5, 16;
218:14
How's 152:10
huge 57:22
Hugh 67:17; 217:22
human 193:10, 14,
24
hundred 136:10
hundredth 186:9
hypothetical 22:16,
17; 39:10; 189:14;
201:5
hypotheticals 202:1

I

i.e 136:12
ice 170:7
idea 110:22; 119:3;
124:10; 215:6; 225:6
ideas 95:23; 100:13,
14, 18; 103:3, 18, 21;
119:5; 121:12; 122:9;
126:20, 21; 198:21;
201:9, 16; 206:18,
19; 212:13

identical 69:11, 12
identification 50:18;
72:10; 79:24; 94:4;
133:22; 136:3; 137:3;
143:9; 147:18;
148:22; 174:13;
185:9; 202:24
identified 86:16
identify 119:6; 146:1
ldso 217:16; 218:1;
219:15; 220:14, 23
ldso's 125:5; 221:7,
22
ignorance 205:2
ignore 104:14;
145:16
ignoring 104:6
ill 144:16
imagine 7:9; 43:9;
201:2, 5
immateral 181:18;
193:1
immediate 54:23;
55:22; 204:5, 17
immense 195:1
impact 157:15;
171:15; 194:2, 8, 13,
17; 195:23; 196:3, 7,
10
Impacts 59:21;
129:10; 138:10;
139:17; 141:23;
146:2; 148:2; 149:11;
163:4; 170:20;
171:16; 174:22;
186:13; 193:9, 14,
24; 194:7; 195:3, 9;
196:1, 5, 19
impasse 127:9
imperceptible 26:5
importance 155:12
important 21:20, 23;
22:13; 114:11;
192:23; 193:7
impossible 151:19
impressed 127:4
impression 34:16;
163:14; 187:4; 189:4
improper 11:23
improperly 195:8
improved 208:17
improvements
155:13
inaccurate 45:5, 11;
189:1, 20
inaction 49:19
inappropriate
56:20, 21
inclination 187:14
include 47:23;
147:10; 169:24;
206:19; 232:1
Included 47:4
includes 35:13;
204:24; 205:8

including 32:3, 3;
50:12; 60:7
income 6:7, 8, 12;
224:16
incomplete 47:15
inconsistent
108:19, 23; 109:12;
139:18; 141:7, 9
incorporate 69:10;
212:13
incorporated 93:20;
100:18; 107:9; 122:8;
183:6; 201:10
incorporates 40:16;
214:15
incorrect 163:11;
175:11
increase 46:24;
51:11, 12; 52:2, 7, 16,
17; 53:11; 58:24;
59:4, 8; 63:12;
158:17; 166:4; 190:4;
191:18
increased 20:20;
22:19; 23:1; 134:2
indeed 140:24; 151:6
indicate 91:2;
137:16; 160:6; 163:6
indicated 134:5;
165:13
indicates 158:20, 21
indicating 137:23;
157:7, 10
Indirectly 31:1;
220:18
individual 63:23
individuals 6:15
industrial 195:11
industry 224:7, 9, 18
Inez 167:10
influence 46:12, 16,
19; 48:3
influenced 166:23
influences 193:22
inform 6:21; 181:20;
182:6
information 5:24;
14:12; 21:17; 32:20;
33:5, 19; 34:14;
36:19; 38:9; 41:21;
42:1, 6, 9; 45:18, 19;
47:1; 48:2, 5, 22;
49:12; 73:8; 75:6;
76:9; 80:4; 81:17;
103:2; 113:12, 15;
115:11; 118:4; 120:5;
146:11, 13, 16, 17,
19; 152:24; 182:11
informed 6:1; 9:20
initial 67:4; 92:13;
93:20; 95:13; 96:20;
104:17
initially 96:16
initials 137:21
initiated 9:9

input 95:4
inputs 67:5; 104:19,
21, 22, 24; 105:2;
124:6; 142:21; 146:10
inquire 6:4, 11;
232:23
inquiries 5:16
inquiry 6:7
insofar 150:12
instances 198:4
institute 68:23; 69:2;
221:12, 15, 19
Institution 65:22
instructed 99:11,
12, 19
instructions 99:9
intelligible 126:19
intend 7:14; 24:13
intended 213:21
intent 45:10, 16
intention 48:4
intentionally 45:1, 4
interact 232:6
interannual 77:22
interest 6:9
interested 71:9
interesting 182:11;
202:2
interfere 7:14;
24:11; 41:9, 13
Intergovernmental
48:23; 175:6, 23;
176:2
interject 178:21;
199:8
international 204:13
interplanetary 29:14
interpret 57:3, 6;
64:9
interpretation 62:9;
64:21; 163:10, 11, 12
interpreted 56:4;
130:24
Interrogatories
105:19, 23; 107:1;
108:14, 24; 110:3;
144:24; 232:16, 19
interrogatory 5:21;
106:3, 17; 109:12,
15; 110:4
interrupt 7:1; 13:7
interval 26:18;
52:12, 13; 53:1;
145:15
intervening 142:20
interventions
124:5, 12; 173:13
interview 34:16
into 6:7; 7:9; 22:13;
23:20; 25:22; 52:21;
79:13; 85:18, 19;
104:15; 113:19;
117:20; 124:20;

135:9; 168:3; 180:15;
187:20; 195:1; 213:11
investigate 82:22;
83:6, 12
investigation 20:1, 2
investigator 16:7;
18:1, 2, 3, 10, 16
invisible 27:16
involve 29:12
involved 31:11
involves 28:8
involving 212:3;
223:6
ionospheric 29:21
IPCC 49:5; 176:12,
23; 177:3, 6, 16;
178:3, 21; 180:1;
190:19, 20
irrelevant 40:23
Irvine 136:1, 6; 152:8
Isaac 9:1
issue 6:13; 24:20;
32:1; 36:3, 6, 7;
39:11, 18; 44:7, 21;
45:6, 7, 12, 13; 66:22;
85:22; 89:5, 15; 93:9;
95:7; 97:14; 100:16;
146:12, 15; 192:23;
193:7; 196:13; 202:3;
214:22
issues 5:15, 17, 19;
24:15, 23; 25:1, 4, 7,
13; 41:2; 89:13;
95:16; 98:10; 202:2
item 7:16; 202:4
items 89:8
itself 39:18; 47:16;
63:22; 164:3; 211:21

J

J&W 72:13
James 53:10
January 50:15;
104:6, 13; 110:8;
117:1; 142:7, 14
Jerry 15:12
job 53:5
Joe 76:18; 114:24;
116:19; 207:10
John 15:11; 124:10,
14; 126:12; 167:8;
193:21, 24; 224:21
joint 133:3
jointly 30:11; 85:23;
99:4
Jolla 161:14, 17, 18,
23
Jones 54:1, 4;
72:14; 73:22; 74:19;
77:11; 78:15; 79:7;
80:15; 192:11
journal 19:17; 51:2;
65:3; 69:15; 87:21;
157:21; 174:15;

185:24; 203:10, 14;
204:8; 206:1; 208:12;
213:15, 19; 214:23;
216:8
journalist 10:2, 4, 5
journalists 201:2
journals 38:24
judge 31:24; 93:11
judged 169:23
judging 192:13
judgment 28:4;
38:12; 120:19
judgments 28:23;
182:8
jump 188:4
jury 116:9
justifiable 44:7
justification 168:22
justified 113:4; 198:1
justify 111:9; 112:6;
113:2; 208:13

K

K-i-n-a-r-d 15:11
Karl 125:10
keep 7:4; 8:1; 30:1;
70:8; 107:8; 170:15;
171:6; 209:6, 12;
210:15
keeping 154:3
kept 153:9; 154:17;
155:15, 24
kerning 50:12
kilometers 16:24;
17:21, 23; 20:15, 17,
18; 21:2, 7
Kinard 15:11, 13,
13; 18:6, 15
kind 15:23; 163:17;
165:7; 170:1; 214:9
kinds 126:17; 225:22
knew 108:6, 8;
132:15, 18, 23;
179:21
knowledge 8:24;
9:3, 7, 8; 12:9; 23:5,
7; 38:6, 8; 49:15;
82:8; 154:3; 176:16,
17; 177:1; 189:1;
205:10; 218:5;
222:24; 223:18; 225:1
known 21:10; 75:19;
82:9; 206:13
knows 152:14; 199:9

L

L-D-E-F 17:9
L-i-n-d-z-e-n 67:19;
119:11
La 161:14, 17, 18, 23
laboratory 214:4
lack 32:15; 205:9

Lancaster 5:16; 6:1, 11, 15; 7:2, 6, 20, 23; 8:16; 11:20; 12:2, 4; 13:2, 8; 23:9, 12; 24:4, 18; 25:3, 14, 18, 21, 24; 35:11, 16; 36:11; 37:11, 17; 39:20, 24; 40:4, 13, 20; 41:4, 12, 19; 49:22; 50:6, 14, 20; 56:16, 24; 60:21; 63:19; 64:2, 8; 66:8; 67:1, 71:5, 9, 13, 18; 72:3, 6, 23; 73:2, 5; 75:8, 13; 76:6, 10, 15, 16; 7:11, 14, 20; 78:6, 17, 20, 23; 79:4, 12, 19, 21; 80:6, 11; 81:1, 9, 15, 19, 21; 86:6, 10; 88:5, 21; 89:5, 15, 21; 90:2, 16, 19; 91:15, 18; 92:6, 20; 93:7, 15; 96:14, 17, 24; 98:3, 9, 17; 101:7, 12, 15, 22; 102:1, 13; 105:17; 106:1, 14, 18; 109:1, 6, 14; 113:22, 24; 114:10, 17, 21; 115:4, 16, 23; 116:3, 11, 15, 18, 21; 21:3, 5; 130:8, 11; 133:15; 135:20; 140:20; 141:3; 143:4; 146:21; 147:7, 14, 19; 148:17; 149:16; 152:3, 6, 12; 154:4, 9, 11; 156:7, 8; 157:2, 13; 159:2, 5; 160:3; 163:2; 165:23; 167:16; 174:8; 176:14, 20, 21; 184:23; 191:22; 192:3, 7; 202:6, 9, 21; 207:9, 13, 14; 208:7, 9; 209:1, 11; 210:7, 12, 19; 211:19, 22, 24; 16:12, 15; 232:10, 15, 21; 233:9	largest 86:20, 23 laser 50:11; 51:1; 86:1; 160:22 last 19:8; 54:12; 89:24; 107:22; 119:21; 122:23; 126:22; 127:12; 153:5; 170:6; 173:11; 188:16; 213:12; 217:3; 227:11 late 171:23 later 64:6, 7; 70:8; 206:17 Latin 200:17 latitude 42:18, 23; 150:21, 22 latitudes 22:8; 62:21; 129:15; 149:22; 150:7, 15; 152:21; 175:4 latter 215:17 law 200:18, 19 lawful 200:18, 19 laws 13:11 lawyer 13:6; 49:1 lawyers 12:18, 22; 32:4; 200:20; 201:3 lay 35:16; 36:14; 77:15; 132:22 layer 204:1, 12 laying 36:22 layman 214:17 LDEF 17:9; 18:3 lead 21:18; 43:12; 172:1 leader 214:3 leading 114:13; 141:18 leads 194:6 leaking 25:12 Leap 203:4 learn 34:9, 12; 111:2; 144:13; 220:22; 221:2, 6 learned 144:15; 177:15 least 5:18; 21:10; 36:16; 54:23; 59:18; 137:17; 176:5; 189:1 leave 13:23; 45:20; 52:5; 95:18; 139:3; 179:5; 184:1; 191:7; 210:13; 228:8, 9, 10 leaving 158:13; 161:17; 186:20; 187:8; 190:13; 191:9 lectures 229:6 led 14:2; 62:5 left 121:9; 130:2; 165:7; 182:21; 191:20; 231:6, 20 legal 11:5, 6, 11; 12:17; 199:4, 5; 200:8, 11, 12, 16	legislative 33:18; 34:3, 5 legislators 32:4 legit 200:18 legitimate 199:1, 3; 200:7, 14, 15, 17, 18, 23 length 206:24 less 19:6; 21:15; 45:14, 15; 54:2; 59:24; 77:4; 84:13, 16, 21; 85:13, 19; 86:2; 90:6, 22; 129:13, 21; 130:12, 19; 135:13; 142:15; 164:6, 22; 165:4, 6, 15; 172:7; 186:8, 17, 20; 187:7, 11; 189:16, 19; 190:4; 191:5, 12; 192:22; 193:3, 4; 225:14 letter 133:18, 23; 136:23; 143:5, 12; 148:18; 168:18; 184:15, 22; 185:4 letters 154:16 level 38:8; 214:16 levels 26:9; 183:10; 184:6, 13 libel 9:12, 13; 25:8 licensed 12:7 lifetime 171:9, 12 light 29:16 lighter 159:15 likelihood 28:5; 136:15; 144:18 likely 63:8, 13; 110:23; 129:11; 131:19, 22; 132:18; 135:13; 136:11, 13; 138:13; 140:14; 144:22; 145:18; 146:5, 10, 13; 148:13; 149:20; 151:14; 163:7; 164:14; 165:12; 166:9; 175:1, 7, 24; 177:22; 179:18; 188:12; 190:16, 23; 191:11 limited 6:17 limits 203:23; 204:10 Lindzen 67:19; 91:23; 119:11, 15, 24; 120:8; 124:22; 156:12; 217:20; 218:1; 219:16 line 51:7; 76:20; 102:20, 20; 148:6; 163:21 list 29:7, 10, 15; 30:1; 34:5 listed 74:19; 80:13; 159:8 listen 34:17 lists 126:16	literature 23:15, 23; 65:10 litigate 89:12, 13 little 41:14; 47:16; 86:4; 183:8; 184:4, 11; 193:4; 195:9; 198:22; 208:14 located 52:19; 137:24; 224:23 location 15:14; 62:14; 170:16 locations 52:19; 62:16 Long 17:9; 57:9; 95:22; 168:15; 183:2, 24; 188:14; 201:23; 210:6 long-lived 173:9 longer 216:10 look 71:2; 73:24; 74:8, 14, 22; 77:3; 84:22, 23; 85:1, 3; 91:7; 116:9, 9; 129:1; 137:5; 159:11; 167:1; 203:4 looked 65:16; 87:18, 22; 113:19; 193:18; 196:17 Looking 51:5; 74:2; 81:22; 82:2; 84:4; 86:13, 18; 87:15, 16, 20; 114:23; 115:18; 145:22, 23 looks 74:15 lose 14:4; 40:12 lost 140:7; 199:16 lot 194:16 lots 169:22; 205:1, 9 low 17:19, 19 lower 20:13, 14, 22; 22:2; 150:22; 178:2 lowest 190:19 Lunch 120:23	man 34:6 managed 128:8 manner 14:14, 15; 210:9, 16 manufacture 203:24; 204:11 manuscript 67:9, 12, 15; 68:18; 70:1; 157:14; 162:11; 203:9 many 10:6; 13:10; 17:1; 18:21; 19:2, 19; 25:23; 27:20; 28:20; 34:24; 37:24; 38:21; 41:7; 50:2; 67:4; 87:2; 95:22; 104:18; 105:2, 3; 107:6, 7, 10; 122:9; 123:9, 19; 124:24; 132:23; 154:5, 24; 187:20; 195:21; 196:3; 198:3; 212:17, 21; 218:2, 14; 225:13; 226:22 March 136:24; 139:14; 142:12; 143:6, 13, 18; 144:4, 4, 7; 147:22; 148:19; 149:3; 153:20; 156:10; 166:20; 174:21; 211:14; 212:2 margin 165:13 mark 50:16; 72:4; 90:24; 96:2; 133:15; 135:20; 136:24; 143:7; 146:22; 147:1, 2, 8, 11, 15; 148:17, 18; 157:8; 174:10; 180:21, 23; 202:21 marked 50:3, 17; 51:22; 54:15; 72:9, 13, 15; 79:23; 94:3, 5; 104:10; 115:18; 117:17; 124:1; 128:15; 133:21; 135:23; 136:2; 137:2, 6, 11; 143:8, 16; 147:17; 148:21; 152:2; 157:14; 162:7, 8; 174:12; 185:8; 202:23 marking 51:22; 146:24; 147:3 Martin 124:10, 14; 126:12; 167:8, 21 Massachusetts 9:16 match 183:4 matches 75:6 material 103:24; 104:2; 117:4, 22; 118:7; 119:12; 124:19; 125:7, 18; 131:16; 193:2, 6, 12; 207:2, 6; 210:21; 211:1; 213:3, 7 Mathematical 58:22; 118:13, 15, 20; 119:22; 134:22; 166:16, 18; 179:23; 180:3; 188:18	matter 125:3, 3; 160:13; 187:16; 191:4; 198:20, 22 matters 24:21; 25:9 may 6:11; 22:12; 36:10; 50:13; 61:3, 16; 66:15, 16; 73:20; 78:12; 90:20; 91:22; 105:6; 112:11, 14, 21; 114:1, 4, 5, 13; 117:23; 119:4; 120:4; 138:22; 141:16; 143:17; 146:18; 153:2; 160:5; 170:3; 171:4; 172:8, 21; 173:15, 19; 174:9; 176:8; 181:17; 206:23; 211:8, 10, 11; 227:9 maybe 91:13; 138:2; 141:15; 147:7; 157:2 McCarthy 220:11 mean 10:3; 26:6, 11; 46:19, 20; 52:11; 57:24; 59:11; 60:16; 61:1, 2, 2, 10, 10, 24; 64:10; 65:14; 75:3; 83:21, 21; 90:5, 8; 96:13; 97:15, 19; 98:8; 99:2, 3; 102:18; 107:19; 109:18; 137:20; 148:10; 150:16; 151:12; 159:12; 173:17; 181:11, 12; 185:5; 194:3, 10; 224:8 meaning 62:5; 63:6, 10; 71:19; 84:11; 88:13; 90:3; 99:7; 172:15; 191:10, 14; 212:6 means 64:14; 65:4; 111:1, 1, 1; 128:18; 129:6; 131:19; 132:3, 11; 141:19; 197:7; 200:18; 219:9 meant 58:2; 61:9; 64:3, 14; 92:24; 131:11; 191:20; 216:5 meantime 110:24 measure 52:17; 76:1 measured 56:9 measurements 15:5, 52:21 measuring 59:15 meeting 99:16, 22, 24; 106:7; 112:13; 114:2, 5; 115:10; 127:3; 161:3, 6, 9, 10, 11; 162:6; 187:20; 207:3; 222:7 meetings 133:10 member 214:24 members 215:2; 225:9 memory 66:19; 91:9; 92:1; 104:8; 109:4;
--	--	---	--	---	--

119:18; 145:4; 146:7, 24
mention 7:16; 168:6, 7; 193:21
mentioned 29:23; 49:10; 167:5; 176:8; 187:6; 219:2; 232:2
merely 47:7; 140:15
Merritt 9:1
message 34:17; 112:4, 10; 183:12; 190:14
met 220:1, 9
meteorites 29:13
Meteorology 19:18; 27:23; 28:9
methane 21:6, 9, 19; 22:1, 2, 4, 7, 11, 12, 13, 19, 21; 23:1, 3, 7, 14, 18, 23; 24:9; 25:11; 26:9; 29:20; 32:1; 117:13; 182:16
Michaels 67:21; 91:23; 124:22; 125:8; 216:21; 217:1, 5; 218:1; 219:15; 220:14, 18, 23; 222:1; 223:6, 21
middle 17:15; 230:19
midst 218:7
might 7:8; 43:16; 68:9; 70:8; 89:9; 125:24; 126:2; 134:7; 140:7, 7; 151:18; 153:19; 155:22; 162:19; 164:10, 12; 170:17; 176:19; 198:22; 219:18
million 18:24
mind 14:3; 21:23; 43:4; 56:19; 61:4; 62:9; 71:20; 74:5; 90:12, 14, 14, 15, 15, 17, 19; 170:15; 171:6; 186:1; 206:7
mine 158:15
mines 182:18
mining 224:11
minor 195:9; 198:5
minus 76:22; 83:21
minutes 106:20; 187:20; 213:13; 216:13; 233:8
misapprehension 214:11
mischaracterize 208:8
misinformed 166:15
misleading 82:7, 8; 84:14, 18; 92:24; 93:6
misled 45:1, 2, 4, 10
misplace 155:8
misread 131:15
misrepresent 78:5

misrepresentation 88:7
misrepresented 88:20
misrepresenting 88:24
mission 46:7, 9, 24; 47:5, 6, 14, 17, 24
misspoke 215:19
mistake 159:10; 164:11, 12
mistaken 166:11, 14
misunderstanding 91:14
mitigate 111:3
mitigation 219:1
mix 98:7
mixed 95:17
mixing 89:2
mm-hmm 72:19; 74:8, 13; 98:17; 137:13, 15; 138:11, 16; 143:3; 149:18; 150:5, 9; 167:24; 172:18; 203:15
modeled 124:5
Modeling 183:8; 184:4, 11
Models 58:22; 118:13, 15, 20; 119:9, 15, 22; 134:22; 150:12; 166:17, 18; 167:2; 178:19; 179:16, 23; 180:3; 188:18
modest 59:21; 63:12; 129:12, 21; 138:13; 139:22; 142:12, 14; 146:5; 148:6; 149:20; 163:7; 166:20; 175:2; 177:20
modifications 185:23
modified 176:5
modify 179:15
moisture 172:8
moment 10:22
money 116:12; 173:19; 194:16; 222:13, 16; 231:5, 16
moneys 222:11; 225:12; 226:7; 231:1
Montreal 203:22; 204:10
moon 29:13
more 7:13; 10:6, 12, 15; 12:3; 13:3; 19:6; 21:24; 31:13, 18, 24; 37:6, 24; 38:23; 40:16; 45:7; 46:21; 52:11; 87:4; 122:19; 126:19; 129:2; 130:10; 146:22; 148:13; 155:4; 158:5, 15; 170:3, 6, 17; 171:4, 24; 172:7;

174:22; 179:3; 181:9; 196:8, 18; 205:4, 5, 10, 11; 206:8; 210:8; 213:13; 216:10, 13; 220:16; 23:3, 7
morning 192:12
most 15:2, 4; 38:9; 55:19; 63:7, 13; 117:2; 129:11; 131:19, 22; 132:18; 135:13; 138:13; 146:5; 149:19; 164:14; 166:9; 175:1, 7, 24; 177:21; 190:23; 191:11
mostly 129:14; 149:21; 150:7; 152:20; 175:3
motion 5:14; 6:23
motions 5:8
mouth 37:9; 200:10
move 6:9; 24:18, 23; 25:2, 19, 21; 41:2, 10; 46:6; 76:17; 80:2; 89:20, 21; 115:13; 117:17; 123:24; 126:22; 160:1; 165:14; 182:23
moving 59:20; 118:6; 157:15; 186:12
much 6:24; 24:20; 45:14, 15; 106:5; 158:5, 15, 16; 167:3; 179:18; 187:3, 16; 189:23; 190:19; 192:24; 196:6; 229:14, 14
multiple 14:10; 29:5; 45:3
Munk 117:23; 167:10, 21
Munk's 118:4; 167:17
must 12:10; 27:8, 21; 69:8; 184:6; 201:1
myself 7:24; 8:3; 51:2; 85:14; 177:10; 192:16

N
N-o-r-d-h-a-u-s 128:12
N2O 181:16
nail 115:6
name 8:18; 10:18; 37:23; 38:2; 73:11; 89:11; 140:24; 167:17; 169:14; 181:11; 197:7, 12, 16; 198:9, 11, 14, 17, 23; 199:10, 11, 14, 18; 201:11, 17; 209:14; 213:6; 220:13; 224:19; 226:13; 228:16
named 138:2; 217:15

namely 167:21
names 15:10; 167:5; 194:19; 197:20; 198:4, 6; 220:4
narrow 6:11
NASA 15:16; 16:3; 17:1, 2, 3, 15; 18:12
natural 32:1; 169:10; 219:5
nature 13:12, 16; 170:18; 171:7; 172:19
near 134:6
necessary 117:11; 180:20; 182:5; 187:10, 12
need 64:5; 105:19; 113:14; 114:19; 147:8; 202:10
needed 122:19
needs 196:17; 205:4
neighboring 78:9
New 93:21; 94:8, 14, 15; 106:7; 110:14; 117:5; 122:10; 124:10; 127:3; 207:3; 213:1; 214:13; 215:3; 219:4
newspaper 34:15, 22; 35:1, 8; 37:6, 24; 38:22; 41:22; 43:10; 229:12
newspapers 10:6, 11, 15; 34:12, 13; 42:14; 43:21; 55:16
next 59:24; 60:18; 61:16; 63:4, 6; 86:21; 87:3; 105:17; 110:22; 118:7; 128:20; 129:8, 12, 21; 130:1; 132:19; 133:20; 135:12, 21; 136:10, 22, 24; 138:14; 139:24; 140:4; 141:21; 142:13, 15; 143:4, 7; 146:6; 147:15; 148:7; 149:21; 151:4, 6, 7; 164:14; 166:9, 21; 175:2, 9; 176:1; 177:20; 182:24; 186:15, 17, 22; 87:17; 190:16, 23, 24; 192:21; 195:4; 204:23; 207:21; 208:18; 219:10
nighttime 125:9
nitrous 26:10; 180:10
Nodding 28:17; 82:24; 120:10; 130:20
noise 140:8
none 155:17; 162:2; 231:17, 17
nonlawyers 200:24
nonprofit 224:10; 225:2

nonscientific 56:5; 88:8; 151:12, 13
nonscientist 32:3
nonscientists 65:3
nor 84:2; 117:11; 179:2, 17, 24; 180:1; 187:13; 192:16
Nordhaus 127:2; 128:11
Nordhaus's 128:9
normal 60:15; 61:24; 63:4; 64:10, 11, 13, 22, 23; 65:3; 66:3, 5; 68:6; 71:20, 21; 82:4, 21, 22; 83:19, 20, 24; 84:1, 11, 15, 19; 85:4, 18; 87:12, 24; 88:11, 14; 90:3, 9, 10; 91:21; 129:14, 22; 130:13, 18; 142:16; 158:6, 8, 10, 17; 163:15; 164:15, 19, 24; 165:19; 166:5; 175:3; 177:24; 186:18; 189:2, 8, 9, 15, 18
normally 58:19; 59:17; 83:15
normative 32:22; 44:6
northern 53:19
notary 5:6
notation 162:14, 16; 182:24
notations 50:10; 157:19
note 157:22; 158:14
notes 97:22; 141:10; 196:24
nothing 77:9; 102:23; 117:12; 123:22; 182:10; 202:2; 209:15
notify 210:24
notion 12:23
nuance 71:10
number 36:20; 44:11; 49:24; 54:11; 67:14; 80:13, 20; 82:15; 85:11, 12, 13, 18, 20, 24; 86:16; 90:10, 11; 104:10; 133:17; 134:23; 135:1; 141:7, 12; 145:24; 146:1; 152:18; 156:14, 14, 14, 15; 158:12, 14; 163:18; 164:24; 165:3; 167:4; 178:1; 187:9; 190:20
numbers 52:24; 80:10, 12, 19; 81:4, 6, 12; 82:1; 131:2; 135:9, 15; 136:18; 140:16; 158:7; 166:17; 169:22; 176:8; 180:1, 2
numerical 191:8

numerous 177:7

O
o's 159:15
oath 114:6; 121:7
object 10:8; 11:15; 13:1; 28:11; 29:1; 31:20; 32:9; 33:7, 21; 44:16; 47:9; 51:18; 56:13; 72:20; 74:21, 24; 82:5; 83:8; 88:3, 12, 18; 89:3, 4; 91:12; 92:4, 6; 96:7; 101:20; 103:11; 105:15; 106:13; 114:9; 115:21; 152:11; 154:1; 169:4; 182:3; 186:24; 191:2, 15; 201:21; 202:18; 210:17; 211:17; 218:8, 8; 25:5
objected 5:16, 24; 6:7; 186:19; 232:20
objection 6:3, 8, 19; 11:8, 12, 19, 21; 18:11; 21:13, 16; 23:8; 24:1, 5; 35:10, 21; 38:11; 39:3, 19; 40:7, 8, 11, 13; 42:3; 55:7; 56:16; 58:1; 60:20, 21; 63:15, 20; 64:5; 66:7; 93:12; 94:22; 98:2; 100:23; 101:23; 102:5; 130:4; 131:13; 132:20; 139:12; 166:12; 176:13; 189:11; 192:2
objectionable 211:7
objections 5:8; 6:19; 41:7, 11
objective 43:16, 22, 24; 44:9, 23; 47:1; 49:14, 16; 88:17; 178:8
objectives 47:3
objectivity 42:24; 43:3; 49:20
obligation 41:10, 21, 24; 42:5, 8
observations 13:19; 14:11; 179:4, 9; 190:21; 205:4, 10
obtained 87:21; 113:12; 118:3
obvious 210:11
Obviously 47:16; 122:14; 156:6; 206:23, 24
occasion 220:17
occasions 180:5; 225:13
occur 14:7; 21:4; 57:8; 64:12; 95:24; 185:18
occurring 104:9
occurs 26:15

ocean 31:17;
180:13; 181:17;
182:9; 183:1, 9, 23;
184:5, 12
Oceanographic
65:22
oceanography
27:22; 28:9; 30:6
oceans 31:7
odd 104:1
off 71:12; 101:24;
102:9, 10, 12;
120:22; 121:9; 130:2;
136:7; 141:18; 160:2;
162:22, 24; 181:8,
10, 12; 185:7;
191:23, 24; 216:14;
233:11, 13
offer 136:22
offered 213:18
office 104:12;
155:18; 184:18;
185:15; 187:1; 226:10
officers 220:5
often 48:18
oil 182:18; 228:17;
229:6, 7, 23; 230:1;
231:1, 16
old 70:2
Oliver 15:11; 18:6
Oliver's 15:18
omitted 43:12
omitting 43:16
once 13:20; 176:5
one 7:13; 9:15;
10:23; 11:1, 4; 13:14,
20, 21; 14:14, 17;
19:20; 36:14, 15;
39:9; 40:16; 41:5, 6;
43:1, 9, 15, 16; 47:3;
55:5, 8, 10; 57:10;
59:24; 60:18; 62:13;
63:5; 64:15; 68:4;
71:15; 72:4; 79:10;
83:5; 84:3, 6, 22, 23;
86:2, 21; 87:2; 89:23;
90:6, 22; 92:13;
94:18; 96:15; 100:19;
105:24; 110:11, 16,
17; 11:24; 119:6, 21;
129:13, 22; 130:13,
16, 19; 131:10;
135:13; 136:8;
138:14; 139:23;
140:1, 17; 142:13,
15; 144:1, 3; 145:10;
146:6; 148:6; 149:21;
150:13; 153:2;
156:14, 16; 157:24;
158:1, 6, 19, 21, 24;
159:6, 11, 11, 14;
160:4, 5, 7, 13, 13,
14, 14; 163:5, 6, 8, 9,
10; 164:6, 13, 21, 22;
165:5, 6, 12, 15;
66:10, 21; 168:15;
169:10; 173:7;
174:22; 186:8, 18,

20, 23; 187:8, 11;
189:19; 191:6;
192:22; 193:3, 4, 8,
12; 196:12; 197:16,
17; 199:9; 220:7, 17;
223:13, 14
ones 97:6; 176:9;
178:21
ongoing 127:16
only 14:11; 37:5, 20;
38:4; 86:22; 87:20;
96:15; 100:18;
107:20; 118:6;
120:18; 122:19;
132:9; 147:5, 13;
167:20; 180:4;
192:24; 195:20;
197:16, 16, 20, 20,
22; 200:8, 11;
201:11, 17; 217:12,
13; 222:11
onto 51:11
op-ed 49:11; 209:16;
216:6; 226:20, 24;
227:3; 229:7, 10, 15,
19
open 7:4; 165:7
operation 144:9;
197:6, 18
operational 198:17;
199:19
operations 182:18
opinion 22:19;
40:22; 45:21
opinions 214:16
opposed 59:13, 14
opposite 136:11
orange 157:8
orbit 16:22; 17:19, 20
orbiting 15:5; 16:13,
14
order 12:11; 18:23;
80:2; 84:23; 113:14;
171:14; 177:23
organization 5:23;
6:5; 46:24; 47:5, 7,
14; 73:10; 219:24;
220:2; 225:2, 4
organizations 6:13,
15
organized 155:20
original 31:8; 51:21;
65:8; 100:16; 103:1
originally 180:21
originates 21:1; 22:2
originating 20:22
Orleans 93:21; 94:8,
14, 15; 106:7;
110:15; 117:5;
122:10; 127:4; 207:3;
213:1; 215:3; 219:4
others 29:14, 15;
104:19; 124:7, 23;
126:15; 196:8;
218:12; 220:19

otherwise 40:11;
118:4; 166:16
ought 147:2; 209:9
out 5:18, 19; 14:10,
22; 15:3, 7; 23:17;
32:5; 43:11; 77:15;
79:6; 85:24; 87:8;
92:19; 98:7, 11, 18;
104:11; 120:17;
158:1, 13; 163:17;
165:6; 166:4; 170:8;
171:19, 23; 179:5;
182:21; 186:21;
187:9; 191:7, 20;
192:24; 194:13, 17;
207:20, 20; 212:14;
225:11
outcome 63:8, 14;
129:12; 131:19, 22;
132:18; 135:13;
138:13; 146:5;
149:20; 163:8, 175:1;
177:22; 191:12
outline 50:13
output 50:11
outraged 210:3
outset 8:6; 232:22
outside 80:24
over 26:17, 22; 27:5;
28:6, 19; 53:20, 21;
54:10; 55:11, 12;
57:9, 10; 58:6, 8, 8;
59:19; 60:10, 10;
63:2, 2; 69:23; 70:1;
71:4; 82:15; 110:22;
113:19; 133:10;
142:24; 171:16;
191:17; 208:10
owe 117:12
owing 186:7
own 32:5; 38:14;
68:24; 95:18; 104:1;
123:4; 126:21;
138:23; 152:24;
155:19, 20; 179:1;
180:4, 4
oxide 26:10; 180:10
ozone 26:10; 29:20;
204:1, 12

P

p.m 120:23, 24;
233:14
page 41:4, 6; 51:6,
10, 12; 54:14, 15;
72:12, 13, 14, 14, 15,
16; 73:22; 74:8, 19;
75:7, 15; 76:8, 9, 17,
18; 77:16; 78:8, 23;
84:7; 91:19; 104:5, 9;
106:2, 2; 110:11, 15,
17; 111:5; 113:9;
115:13, 17, 20;
117:2, 17, 19, 20;
118:7, 8; 119:19;
121:16, 18; 123:24;

124:1, 11; 126:5;
134:1, 6; 137:11;
138:9; 143:15, 16;
46:2; 148:1; 149:5,
12, 15, 16; 169:17;
170:10; 173:7, 11;
174:23; 178:13;
180:12; 182:23;
188:12; 198:13;
212:12
pages 41:5; 72:3;
78:19; 118:6; 133:18;
207:12
paid 18:8; 19:4; 20:5,
6; 221:3; 222:3;
227:3; 229:18
Palmer 220:7, 9
Panel 48:23; 175:6,
23; 176:2
paper 20:8, 8; 30:9,
21; 65:18, 20, 21, 23;
72:1; 93:21, 24;
95:24; 96:16; 98:15;
103:9, 10, 17;
110:15; 114:16;
117:6, 24; 122:10;
124:6; 126:16; 127:1,
3, 19; 128:9, 12;
133:3; 135:18; 153:9,
16; 169:9; 171:23;
185:13; 201:6, 7, 7, 8,
9, 10, 10, 14, 15;
202:16, 17; 206:20;
207:1; 209:13, 18,
22; 211:16; 13:1, 21,
22, 24; 214:2, 3, 9,
10, 12, 14, 22, 23;
215:9; 217:6, 6, 7, 10;
219:4
papers 31:8; 198:4;
229:20
paragraph 54:17,
19; 56:7, 8; 57:17, 18,
19; 59:1; 60:7; 65:24;
93:16, 16, 17, 22, 23;
94:16, 20, 23; 95:1, 5;
96:2, 4, 9; 97:11;
98:18, 18; 99:8, 21;
100:2, 3, 5, 6, 6, 8,
10, 12, 24; 101:8;
102:16, 23, 24;
103:10, 12, 18;
110:14, 21; 111:6,
12; 112:3, 8; 113:7,
18; 117:5, 10; 119:8,
12, 14; 121:21;
122:1, 16, 23, 23;
23:7, 8, 10, 16;
124:11; 125:20;
126:24; 127:7, 12,
19; 163:21; 170:11,
21; 173:11; 182:16,
17, 24; 203:21;
204:9, 23; 205:7, 24;
206:4, 4
paragraphs 57:16;
70:7, 11, 13; 91:8, 16;
103:9; 110:10;
115:19; 169:16;

201:19, 20; 212:11,
13
part 8:2; 35:15;
45:10, 17, 17; 77:18;
95:23; 96:1; 163:18;
212:3, 9; 215:17;
223:22; 224:17
partial 126:24
participated 96:8;
97:21; 98:19, 22
participating 213:17
participation 91:10;
95:10, 12; 99:3, 3, 7
particles 16:15, 18,
20, 21; 17:16
particular 23:16;
61:6; 66:22; 67:6, 7;
105:23; 169:1; 202:3;
214:21
particularly 31:16;
57:11; 134:15; 232:5
parties 5:5
Partly 32:14; 118:14;
170:22; 180:19
parts 186:11; 206:12
pass 34:20
passage 35:6
passion 8:4
past 122:12; 125:4;
179:21; 204:14
patient 75:24
Patrick 125:8;
216:21; 217:1
pattern 188:9
Paul 167:9
Pause 94:2; 105:16;
184:9; 211:4
pay 18:7; 46:21;
229:10
pay-for-hours 18:13
paying 116:18
payments 226:19,
23
pays 18:6; 229:12
peer 213:18
pen 96:16; 98:15;
159:15
penalty 106:4
pencil 51:20
pending 24:2
people 34:7, 17;
53:5; 67:14; 75:20;
107:7; 120:19; 123:9;
131:20; 143:1; 165:8;
167:15; 170:18;
177:9; 193:17, 20;
194:16, 18, 20;
195:15, 21; 196:7;
197:15, 19; 198:6;
219:2; 220:3
perceive 26:8
perceived 26:23;
218:2
percent 21:15, 24;
132:5, 6

percentage 19:1;
21:8, 10, 22; 35:7, 19
perceptions 42:14
perfectly 63:18
perhaps 72:24;
119:10; 125:22;
138:14; 139:23;
142:13; 146:6; 148:6;
149:20; 177:9; 188:2;
197:2; 228:15
period 52:9, 12;
53:21; 227:2
periods 57:9
perjury 106:4
permanent 228:9
permit 6:2; 116:6;
232:23
permitted 6:3;
182:2; 227:7, 8
persistence 82:10,
12
person 92:13; 96:15,
19; 98:14; 101:1;
102:2; 193:21; 198:8,
11, 13, 14, 14; 224:19
personal 6:6, 7;
23:5; 218:5
personally 75:18
persons 39:13;
67:16; 219:23; 220:1
persuade 179:14,
14; 188:17; 191:5
Phoenix 222:8, 19
photo-oxidation
21:9, 19
photochemical 21:5
phrase 47:19, 22;
60:16; 68:6, 13;
88:14; 90:3; 112:24;
186:20
phrased 66:20;
92:23; 192:19; 195:8
physicist 82:19
Physics 19:18; 29:8,
9, 9, 10, 11, 17
pick 203:18
picked 126:2
Picking 121:9;
203:18, 19
picture 74:5; 171:15,
18
piece 126:23; 153:9;
198:21; 205:4; 216:2,
7, 9, 10, 11
pieces 227:3; 229:7,
11, 15
place 61:13; 85:14;
104:17; 169:2; 175:14
placed 180:6
places 122:10;
123:19
plain 205:1, 9
plaintiff 133:16
Plaintiff's 105:18,
22; 110:3

planetary 29:9, 10, 11, 13	173:17; 177:12; 189:5, 7	prevailing 52:8	Professional 11:13; 12:14; 13:21, 22; 15:14	19; 176:9; 177:5, 11, 13, 17; 178:3; 195:15, 21, 24; 196:4; 203:5, 12; 206:14; 213:5; 215:6; 217:2	range 64:21; 85:11, 19; 90:11, 12; 130:15, 21; 163:9, 9; 196:4
planned 7:23; 136:5	Possibly 17:24; 67:13, 17, 18; 91:24; 143:3; 156:15	prevalent 134:21	professor 36:15; 119:11; 227:14; 228:1	196:4; 203:5, 12; 206:14; 213:5; 215:6; 217:2	ranges 59:4
Planting 173:4, 21; 174:1	Post 133:19	previous 23:10; 34:22; 49:3; 69:22; 70:1; 78:10, 19; 91:19; 100:9; 132:23; 133:10; 135:7; 177:6; 182:16; 185:17	professors 227:24	publisher 160:22	rapid 170:17; 171:24, 24
plants 31:3, 7, 17; 173:9	potential 26:15; 31:11; 33:14; 49:13; 194:1, 4, 7	previously 37:4; 47:6; 105:9; 200:14	profit 224:10	publishes 48:11, 17, 22; 198:14; 199:18; 201:10, 16	rapidly 170:6; 186:12
play 96:13; 185:2; 207:7	power 228:19, 20; 230:4	pricing 229:6, 8, 23; 230:1	program 123:1, 2, 8, 15; 126:9; 229:3	publishing 37:24; 38:16; 43:9; 49:9; 211:7	rate 229:19
playing 102:6, 8; 115:2; 185:5; 207:17, 18	practically 153:9; 206:1	primarily 150:15; 183:19	Project 5:23; 35:5; 36:18; 46:8; 48:7, 11, 17, 22; 49:8; 194:11	pure 151:16	rates 229:16
please 8:17; 23:9; 31:14; 37:12; 44:18; 86:3, 9, 11; 91:4; 96:2; 115:13; 119:7; 145:16; 150:2; 175:12; 178:18; 224:14	practice 12:7, 11, 23; 14:2; 55:17, 20; 69:9, 24; 70:4	principal 155:15	projects 223:1, 4, 6	purpose 113:15; 145:20; 147:5, 13; 182:5, 6	rather 7:20; 8:3; 56:9; 74:6; 194:24
plot 78:8, 8, 12, 15	practiced 14:11	principally 29:8	prominent 169:9	purposes 76:13; 81:14	reach 20:19; 25:23
plotted 74:11, 18; 75:15; 76:19	practices 13:6, 14	principles 12:11, 15, 20	promise 209:11	put 25:1; 49:24; 56:19; 61:4; 82:1; 85:14; 96:15; 98:15; 139:10; 151:13; 168:13, 13; 178:1; 200:10; 214:10	reached 120:1
plural 198:12	practicing 12:18; 28:21; 34:8, 19, 23, 24; 35:7; 37:8; 38:10; 39:2; 43:20; 44:22	printed 137:18; 143:21; 157:20	proof 50:1, 5, 7; 51:1, 5; 86:1; 91:1; 94:17; 103:19; 104:2, 4, 15, 18; 110:6; 111:5, 16; 115:17; 117:1; 121:10; 128:23; 131:5, 6; 142:7; 157:15; 161:12; 178:12; 185:23; 203:18	puts 198:8, 11	reaches 38:23
plus 67:14; 83:21	practitioner 44:3	Prior 17:11; 104:13; 112:12, 20; 114:2; 115:9; 117:1, 21; 118:20; 119:23; 120:12, 15; 121:20; 127:14; 161:3, 17	proofer 50:12	puzzled 62:8	read 5:5; 7:21; 23:9, 11; 36:13; 37:11; 54:18; 61:19; 63:17; 65:3; 83:19; 86:11, 12; 114:19; 116:6, 8; 128:22; 129:4; 147:4; 149:19; 159:3; 176:19; 178:16, 18; 179:6; 183:1, 4; 192:6; 193:17; 202:10; 204:23; 205:14; 217:12
point 24:17, 20, 23; 36:2; 41:2; 54:12; 55:1; 62:4; 75:1, 1, 24; 82:3; 135:10; 145:5, 6, 11; 146:9, 18; 147:6; 158:24; 162:12; 163:3; 164:18, 24; 165:10; 170:8; 173:5, 7; 182:12; 187:18, 21; 190:10; 213:2, 4, 6	practitioners 38:21	priorities 214:13	proofs 160:22	puts 198:8, 11	reader 42:12, 15; 56:3, 5, 11, 19; 57:2, 3, 6, 23; 59:10; 60:16; 61:1, 4; 62:4; 63:9, 23; 64:9; 82:22; 83:6, 11, 15; 85:6, 15; 87:20; 88:1, 9; 117:13; 126:19; 172:14; 181:20; 182:6, 13; 183:13, 20, 22; 190:14
points 24:14; 75:15, 23; 85:8	preamble 102:23; 103:7	pro 7:18	properly 82:17	putting 37:9; 179:19	reading 56:22; 61:3; 106:2; 111:11; 116:2; 138:12; 140:18; 184:7; 203:21; 204:8; 205:6
polar 150:23	precise 42:9; 52:11; 58:5; 66:14; 96:13, 14	probabilities 132:8	property 125:19	puzzled 62:8	reads 109:15; 157:24; 173:8; 182:13
Policies 121:24; 122:24	precisely 10:3	probability 132:1	protect 204:12	P_R_O_C_E_E_D_I_N_G_S 5:1	realization 167:2
Policy 5:22; 11:2; 32:21; 33:3, 6; 35:5, 6; 36:17; 38:7; 44:4, 5; 46:7, 10, 13, 16, 20; 47:2; 48:1, 3, 7, 11, 17, 22; 49:8, 19; 95:16; 124:4; 182:19; 208:15; 225:22; 232:6	Predicate 169:5, 6	probably 26:19; 156:13	Protection 194:22	Q	realize 190:12
politicians 32:4	predicating 169:7	problem 26:1, 2; 28:23, 24; 171:10, 13; 208:15; 219:1, 1, 3	Protocol 203:23; 204:10	qua 88:11	realizing 145:6
popular 65:2	predict 150:13, 14	problems 140:3; 172:1	proved 9:22; 176:4	qualification 14:4	really 22:21; 23:4; 66:20; 167:3; 187:3, 6; 209:23
portend 196:2	predicted 196:5	procedures 53:7	provided 70:19	qualified 82:18	realm 32:20, 21
portrayed 81:17	prediction 151:13	proceed 101:21	prudent 127:16	quality 21:23	reask 108:10; 192:4
pose 22:17	predictions 179:17; 188:18	proceeding 8:3; 53:12	public 26:5, 7, 16; 27:2, 6, 9, 16; 32:3, 18; 33:1, 4, 16, 24; 34:2, 4, 21, 21; 38:17, 23; 39:8, 11, 12, 14, 18; 43:12, 21; 44:6, 8, 21; 45:1, 4, 6, 9, 13, 18; 226:11	quality 50:12	reason 7:15; 46:11; 60:16, 24; 62:3; 70:6, 18; 74:22; 81:7; 84:3; 135:11; 142:19; 147:3; 150:10; 168:1; 177:2; 181:14; 189:22; 202:14
position 158:15; 179:16; 185:22	preparing 99:15	process 9:19, 22; 25:9; 33:18; 35:6; 36:8, 19; 38:7, 9; 44:5; 46:17, 21; 47:2; 48:1; 92:18; 109:16; 126:20; 180:13	publication 10:6; 55:14, 15; 73:13, 15, 23; 80:12, 19; 119:10; 125:6; 174:17; 177:6; 213:18; 223:22	quantify 130:22; 142:9	reasonable 56:3, 10; 64:20; 82:22; 83:5, 11; 163:5
possession 107:17; 161:13	prepared 78:12, 16; 79:3, 18; 106:5; 141:6; 199:5; 206:13; 232:14	processes 178:24; 179:3; 181:17; 182:9	publications 29:12; 31:23; 43:23; 44:1; 46:15; 70:14; 74:2; 80:13, 20; 112:12; 125:6; 142:21; 193:17	quarters 201:17	reasonably 88:1; 90:4
possibility 174:5	preprint 128:9	processor 68:19; 113:13	publish 38:22; 42:6, 8; 52:20, 24; 53:2; 199:14; 211:15; 216:4	questioning 7:24; 36:2; 41:16; 76:14; 81:11, 14	reasons 88:4, 23; 210:11
possible 20:24; 42:10; 67:20, 22, 23, 24; 68:4, 8; 118:19, 21, 22; 119:1, 2, 22, 24; 120:11; 128:6, 8; 150:24; 151:20; 165:10, 18, 24;	present 15:1; 52:14; 94:7; 109:2, 4	produce 20:10; 70:24; 233:3	published 19:12; 29:19; 30:5, 9; 31:8; 49:6; 52:22; 53:4; 73:7, 17, 18; 85:17; 114:15; 125:4; 134:4; 140:23; 141:4, 8; 156:18; 163:23; 171:22; 174:9, 15,	quicker 37:17	
	presented 53:10, 15, 17; 74:3, 16; 85:7; 86:14; 88:8; 94:8; 207:3; 212:24; 214:13	produced 49:23; 110:8; 133:16; 135:21; 176:3; 180:1; 181:15	publications 29:12; 31:23; 43:23; 44:1; 46:15; 70:14; 74:2; 80:13, 20; 112:12; 125:6; 142:21; 193:17	quickly 172:9	
	preserve 40:11; 41:11	producing 59:14	publish 38:22; 42:6, 8; 52:20, 24; 53:2; 199:14; 211:15; 216:4	quite 74:3, 15; 141:9; 144:16; 164:8; 165:7; 176:4; 187:6; 190:8	
	preserving 40:7; 64:6; 155:13	productively 213:13	published 19:12; 29:19; 30:5, 9; 31:8; 49:6; 52:22; 53:4; 73:7, 17, 18; 85:17; 114:15; 125:4; 134:4; 140:23; 141:4, 8; 156:18; 163:23; 171:22; 174:9, 15,	quoting 128:13; 149:19; 185:12; 209:22	
	press 6:2	profession 11:5, 6, 11, 17; 12:6, 18	professional 11:13; 12:14; 13:21, 22; 15:14	R	

reassert 6:8	reduce 82:13	117:22; 123:18;	represented 100:8;	returned 17:6;	209:14; 212:13;
Rebuilding 173:14	Reed 217:18	223:17; 224:3, 5	103:21; 215:13	106:9; 107:2; 108:15;	217:3; 218:21
recall 31:4; 53:22;	refer 7:19, 24; 20:21;	relation 9:5	representing 7:17;	109:19; 147:21	review 78:5; 102:21;
54:2, 9; 61:13; 66:1;	46:4; 57:14; 59:4, 21;	relations 226:11	8:3; 76:4; 184:21, 23	Revelle 31:13, 18;	106:8; 125:23;
67:14, 17; 68:11;	60:3; 62:6, 16, 16, 19;	relationship 11:2;	represents 79:19;	36:8; 51:2; 67:9, 13;	161:22; 186:8;
69:5, 6, 9; 70:16;	76:21; 82:20; 94:16;	18:12; 225:19, 24	82:9; 89:17; 157:20	85:22; 89:16; 91:3, 9,	207:12; 213:19
73:21; 94:21; 104:16,	105:21; 123:10;	relationships 27:21	reprints 120:5	12; 92:3, 17; 93:19;	reviewed 76:5;
22; 105:3, 11; 107:4;	140:12; 143:18;	release 22:20	request 70:19; 71:3,	94:12, 19; 95:5; 96:4;	106:9; 107:2; 109:19;
108:4; 112:12; 114:4;	171:13, 22; 172:11;	released 22:22, 23;	4; 95:14; 156:6;	97:2, 20, 23; 98:14,	161:10; 177:16;
118:9, 18; 119:20;	197:13; 218:18;	23:2	232:12, 13, 19; 233:1	19; 99:17; 100:10;	209:14
144:1; 156:15; 164:8;	reference 80:17;	relevant 6:16; 24:15;	requested 71:1;	102:15; 103:4, 15;	reviewing 76:12;
187:5; 203:5, 11;	85:24; 124:14; 126:7;	43:11; 57:11; 115:10;	211:11	104:7, 21; 105:6, 10;	80:8; 107:5; 110:13;
211:3; 226:18; 230:7,	131:1; 163:17; 172:3;	215:1; 232:17	require 174:9	106:7, 8, 21; 107:1;	129:17; 137:8;
9, 23	187:9; 191:7, 8;	reliable 195:3, 18, 20	required 12:18	108:13, 15, 16;	147:23; 150:4;
receive 45:19;	218:22	relied 218:17	requirement 12:6,	109:5, 8, 10, 18, 23;	169:19; 170:12;
107:14; 120:8;	references 81:5;	relies 32:18; 33:16;	10, 13	112:13; 114:2; 115:7,	173:12
144:19; 226:19;	158:14	39:12	requiring 205:10	10, 12; 116:22;	revisit 174:22
227:17	referred 50:2; 58:5,	rely 33:1, 4, 18	rereading 129:18	117:9, 20; 118:11,	revolved 135:17;
received 19:5; 67:5;	23; 140:20; 167:20;	remark 183:7	reschedule 233:6	12; 21:15, 20;	158:2
120:15; 125:5;	169:12; 172:2; 217:13	remember 19:15;	research 19:12;	123:17, 20; 126:11,	rewrite 184:17;
126:20; 142:20, 22,	referring 7:19;	20:8; 47:13, 19, 20;	30:5, 8; 122:19;	16; 127:5, 6, 13;	185:14, 18, 24;
24; 144:24; 145:14;	26:18; 46:3, 3; 49:2;	67:2; 68:12, 15;	123:1, 2, 8, 14; 126:8;	131:11; 132:16, 23;	186:2, 10
146:11, 11, 13, 19;	52:3; 57:13; 58:3, 9;	73:24; 92:2; 93:2;	127:17; 171:23;	133:3, 9; 134:1;	rewrote 186:11
155:7; 222:11, 16;	90:14; 122:16;	95:4; 104:23, 24;	194:6, 8, 13, 17;	135:11, 24; 136:5,	Richard 67:18;
224:2, 15; 225:12;	126:11; 128:14;	105:1, 6, 7; 106:20;	195:14; 213:15, 16;	23; 139:11, 15, 16;	156:17; 217:20
226:15; 230:24;	134:1; 138:9; 147:5;	108:12; 109:4, 7, 9,	214:3	140:24; 141:2, 8;	ridiculous 98:6
231:5, 15	151:9; 169:8; 171:8,	23; 110:6; 112:19;	reservations 7:3	143:1, 6, 12, 23;	right 6:22; 7:5; 8:5;
receiving 226:22	9, 11; 172:5, 24;	117:8; 119:15;	reserve 6:22	144:6, 19; 145:1, 4;	26:21; 40:2; 76:11;
recent 15:2, 4; 217:2	174:8; 178:11;	121:14, 18; 124:19;	reserved 5:9	148:19; 149:2;	77:1, 3; 78:14; 79:5;
recently 107:6;	179:11; 180:10;	125:1, 2, 21; 126:5,	resolve 93:11	150:24; 151:2, 5;	91:3; 98:15, 21;
127:16	206:15; 217:7	13; 144:23; 145:9;	resolved 7:4	152:5; 153:5, 8, 13,	101:18; 102:7;
Recess 50:19;	refers 62:21; 63:1;	168:17; 169:3, 6;	Resourceful 134:5;	14, 22, 24; 154:22;	106:19; 108:9; 109:7;
120:23; 157:12	129:23; 169:20;	181:2; 184:15, 19,	141:8	155:15, 19; 160:20;	128:10; 135:23;
recognizable 74:4	200:19; 217:5	20; 187:24; 188:8;	respect 6:6	161:4, 7, 9, 10, 20;	140:11; 146:1; 152:6;
recognize 50:22;	reflect 80:4; 207:2	202:11; 11:10;	respective 5:5	162:6, 13; 64:6, 13,	158:19; 167:16;
94:8; 97:16; 126:12;	reflected 95:24;	215:21; 220:4;	respects 145:11	23; 166:8, 16; 167:7;	172:23; 173:10;
133:23; 137:4, 9, 10;	110:15, 18; 118:14	222:14; 230:8, 10, 20	respond 25:3;	168:2, 20; 170:2;	177:19; 214:7; 221:11
143:10; 157:9;	reflects 95:8; 97:17;	remembers 47:12	156:5; 232:14	171:3; 173:3, 18;	rights 9:16; 97:24
174:14; 220:13	122:17; 162:3	remind 8:1; 231:11	responded 9:19	174:3; 176:11, 18,	rise 60:8; 134:7
recollect 153:18	refresh 146:23	rendering 77:21	response 13:24;	23; 177:2, 13;	risk 22:19; 23:1;
recollection 19:6;	regard 129:11;	renewed 228:10	23:10; 38:1; 73:14;	179:12, 14; 180:6;	34:10; 48:18; 49:2;
127:22, 23; 128:1, 3,	175:1; 194:23	repeat 31:14; 44:18	103:10; 106:3; 107:1;	181:2; 186:16; 188:1,	208:14
5; 215:16	regarded 63:7;	repeated 109:16	111:22, 24; 125:23;	21; 189:8, 18;	risks 43:13, 14;
recommendations	197:14; 198:18	rephrase 12:12;	145:9; 218:15	190:15, 22; 191:16;	48:13; 49:10
135:18	regarding 75:18;	14:1; 33:23; 40:9;	responses 208:15;	196:21; 202:5; 207:2,	Robert 216:17, 19
record 5:13; 7:21,	116:24; 119:18;	41:17; 86:9; 127:10;	233:1	5, 15; 208:19, 22;	Roger 31:12, 18;
22; 8:18; 24:11; 40:7,	168:9; 186:14	176:15; 207:23;	Responsibility	209:20; 210:20;	36:7; 85:22; 89:16;
11, 18; 41:11; 50:9;	region 21:7; 150:21	211:23	11:14; 198:20	211:15; 212:3, 4, 24;	91:2; 92:3; 94:12, 19;
51:10, 18; 53:8, 15;	regions 150:23	rephrasing 127:18	responsible 32:19;	215:11, 24; 216:5;	95:5; 97:2; 103:4;
54:1; 55:1, 3, 6; 64:5;	registered 148:5	replace 169:6	33:5, 16	217:13; 219:3, 7, 17	104:7, 21; 106:21;
65:7, 12, 17; 71:12;	regularly 35:8;	report 49:6; 55:17;	responsibly 33:20;	Revelle's 90:15;	112:13; 113:5, 9, 18;
72:17; 73:6, 23, 24;	38:20; 48:7	176:12, 23; 177:3, 7,	49:18	93:21, 24; 99:22;	116:22; 117:5;
74:1, 20; 78:1; 79:8,	regulation 224:6	16; 213:16	rest 181:18; 184:20	100:13; 106:6; 110:7,	118:11; 121:14;
11, 14; 80:1, 16; 81:4;	regulatory 220:16	reported 81:6	restate 101:17	14; 111:11; 113:5,	127:5; 130:24;
84:4; 87:22; 88:17;	Reifsnyder's 125:6	reporting 43:15;	result 52:22; 104:19	10, 18; 114:7; 117:5,	131:11, 22; 132:16;
101:19, 23, 24;	reimbursed 222:8,	45:5, 12	results 33:17; 35:9;	23; 122:5, 10;	135:11, 23; 136:5;
102:9, 10, 12; 110:2;	15	reports 194:21;	39:13; 49:9; 52:20;	123:23; 124:6; 126:8;	138:21; 139:1, 5, 15;
120:22; 145:3;	related 6:12; 8:24;	232:4	53:11, 17; 59:15, 16;	127:19; 133:13;	140:23, 24; 141:2, 8;
147:12; 152:1;	9:4, 8; 28:22; 32:6;	represent 78:7;	183:8; 184:4, 11;	134:14; 136:15;	152:5; 157:22; 158:4;
154:12; 155:17;	43:5; 72:5, 7; 76:2;	136:4; 167:14; 186:6;	214:13	138:21; 139:1, 5, 19;	160:5, 13; 166:8, 8;
158:23; 60:2; 162:22,	79:9; 129:3; 218:2;	188:24	resumed 120:24	140:9, 12, 24;	176:11, 18; 79:1, 14,
24; 185:7; 188:22;	224:6, 8; 232:7	representation	resuming 121:4	141:17; 142:5; 154:3;	20; 185:12; 207:2,
191:23, 24; 205:17;	relates 15:4	76:13; 77:8; 78:1, 3,	return 156:20	157:9, 23; 159:9, 23;	15; 208:19, 21;
216:14; 233:11, 13	Relating 16:12;	24; 80:3; 81:14;		160:16; 163:6;	209:14, 20; 211:15;
records 108:17;	17:16; 25:9; 31:10;	189:18, 21; 192:11		165:11; 166:7, 8;	212:3
113:20; 154:3, 6;				168:19, 23, 23;	Roger's 160:7
155:9; 231:24				169:8; 72:21; 174:1;	role 16:5; 38:20
recovering 144:8				178:12; 180:12;	
				182:24; 184:18;	
				186:7; 188:9; 206:19;	

rolling 53:20; 54:10
rolls 203:23; 204:11
room 147:9; 218:7
Roughly 18:14;
19:1; 20:15; 21:8
RR 160:6, 11
ruled 6:23
Rules 227:9

S

S 8:9, 19; 205:17
S-h-l-a-e-s 224:21
S-o-l-o-w 65:21
S00034 133:18
Sagan 10:19, 21;
37:6, 20; 38:4
salary 227:17
same 27:4; 39:5;
56:8; 85:2; 88:3;
103:10, 13; 117:18;
142:17; 154:18, 21;
159:16; 183:12;
205:24; 206:18, 24;
209:20, 21; 230:3
sat 99:4; 188:3; 215:2
satellite 15:5; 16:2,
12; 17:1, 3, 4, 6, 8
satellites 17:2;
29:13; 56:10
save 70:7; 215:7
saved 69:8, 9, 11,
12, 19; 70:2
saving 69:6
saw 128:10; 142:22;
154:22; 177:13;
202:19
saying 23:13; 27:9;
41:17; 87:11; 96:5;
98:22; 112:19, 21;
113:4; 142:17;
166:10; 170:15;
184:4; 219:8
scenario 169:20;
176:4, 7; 194:4
scenarios 176:3;
194:1
Schneider 218:13
schools 34:7
Science 5:22; 11:2,
5, 17; 12:7, 11; 13:9,
11; 14:3, 23; 16:6;
19:7; 25:6; 27:19, 20;
28:7; 30:2; 32:13, 16;
35:4, 6; 36:17; 37:7;
38:7, 20, 21; 39:14,
15, 16; 41:3; 44:3, 4;
45:5, 12; 46:7, 10, 22;
47:8, 24; 48:6, 10, 16,
21, 24; 49:7; 122:20;
182:7; 203:6; 205:3,
19, 23; 206:5, 20;
210:22; 211:1; 216:1;
217:9; 18:3

sciences 28:9;
36:15; 223:17; 224:4
scientific 12:5;
14:12; 21:14, 18;
22:18; 24:14; 26:22;
28:4, 16, 23; 29:6;
31:15, 19; 32:6, 19;
33:2, 3, 5, 14, 17, 17,
19; 35:3, 9; 36:18;
37:7; 38:14, 24; 39:7;
43:3, 4; 45:23; 47:1;
48:2; 49:12, 19;
52:16; 53:11; 82:3;
83:24; 111:8, 8;
112:5; 113:1; 120:19;
151:18; 178:14;
182:12; 183:17;
198:4; 04:24; 205:7,
8; 208:12, 16;
213:15, 19, 21, 22,
23; 214:2, 12, 14;
225:22; 232:5
scientifically 42:9
scientist 9:24; 10:7,
13, 14, 18, 20; 12:10,
14; 13:13, 15, 21, 22;
14:5, 10, 11, 17, 18;
27:8; 29:4; 32:21;
37:3, 5, 8, 21, 23, 23;
38:4, 13; 43:9, 20;
45:11; 49:18; 83:18;
85:16; 129:3; 217:15
scientists 12:6, 22;
14:13; 27:17; 28:21,
24; 33:2, 6, 18; 34:8,
19, 23, 24; 35:8;
38:10, 15, 19; 39:1, 2;
44:22; 64:20; 68:5;
167:7, 19; 177:8;
218:6, 14, 17, 23;
219:15
scope 36:3; 71:3
script 51:23
se 7:18
sea 59:17
sealing 5:7
search 13:11, 15;
156:2
Searches 13:18
Searl 167:8; 168:2,
6, 7; 169:12, 21
Searl's 168:10, 20,
24
season 58:8
seasons 58:9
second 27:4; 37:12,
13; 51:6; 54:22;
60:14; 71:15; 72:13;
74:8; 75:15; 76:8;
78:23; 102:11; 105:2;
110:14, 21; 111:6,
12; 112:7; 113:7;
115:13, 17; 119:8;
14; 121:21; 125:19;
127:18; 134:4;
137:11; 143:15, 22,
23; 144:20; 162:23;

170:11, 20; 172:15;
180:11; 203:21
secondly 35:18;
40:21; 66:17; 101:13
secretary 155:19
section 58:22;
119:21; 120:11;
122:23; 157:16, 18;
178:13; 181:19
sections 207:1
sediments 30:10
seeing 82:11
seem 27:3; 187:19;
196:6
seemed 187:4, 15
seems 27:9; 63:23;
138:1
sees 208:24; 211:7
selectively 75:20
seminars 188:21
send 105:10;
156:11; 161:16;
190:14
sending 108:13;
144:19, 20
sense 10:4; 21:12;
26:11, 19; 27:10, 20;
30:17; 59:18; 64:24;
79:9; 83:24; 84:11;
99:23; 103:17, 20,
20; 140:1, 2, 6;
141:12; 189:12, 22;
213:5
sensed 26:16, 23;
27:6
sent 67:14, 20, 23;
105:5, 7; 106:7, 21;
107:5; 108:6, 8;
109:10, 23; 118:24;
119:11; 120:4, 7, 17;
126:3; 136:23;
139:14; 143:12;
145:1; 146:16;
147:22; 149:2; 153:5,
9, 20, 21, 24; 154:13,
18; 156:14
sentence 54:22;
55:21; 57:12; 59:2;
60:14; 61:7, 14, 18,
19, 23; 62:5, 20;
63:17; 66:3; 67:3, 6;
68:5, 6; 82:20; 85:17;
91:6, 6; 93:2, 22;
97:23; 98:1; 111:20;
117:10; 127:20;
128:17, 21; 129:4;
134:4; 138:12;
139:17; 142:6;
149:23; 157:18;
163:4, 18, 19; 172:5,
14, 16; 174:22;
178:19; 188:16;
191:10
sentences 91:2, 8,
11, 16; 92:1, 11; 93:5,
6; 115:6, 19; 118:9, 9;
121:19; 208:18

separate 79:6, 7;
98:6, 7, 11; 130:4;
199:2
SEPP 46:9
September 133:19
sequestered 22:7
sequestering 174:5
Sequestration 173:8
series 202:8
serious 140:3;
207:19; 216:10
seriously 210:2
serves 147:6, 13
set 12:19; 16:17, 20;
50:7; 105:18
sets 90:10
settle 187:16; 233:10
seven 138:9; 148:1
several 29:6; 35:12;
102:21; 105:5
several-year 53:21
severely 168:16
SF 137:20
SFS-A 137:14
shall 110:21
shared 97:24
sheet 78:21, 22
Shell 228:18; 229:4,
10
Sherwood 125:5;
217:15
Shlaes 224:21, 22;
226:9
short 80:24; 126:22;
206:20; 209:16
shouted 209:4
show 71:8; 72:2;
96:3; 110:17; 111:4;
121:3; 124:8; 147:8;
153:13; 163:20, 22;
169:15; 207:24
showing 74:6;
77:22; 147:12
shown 86:20; 87:1;
174:23
shows 154:18;
159:18
side 157:22; 162:10
sides 45:24
signed 5:6; 89:11;
98:5; 181:8, 10, 11,
12; 213:9
significant 7:7; 28:5;
131:16; 139:24;
140:1, 2, 6, 10;
142:10; 196:13;
219:11
significantly
128:20; 129:6, 8, 24;
131:10, 12; 132:10,
12, 17; 141:21;
189:9; 219:12

similar 123:7; 197:1,
2, 2; 204:3, 14, 21;
205:12
Simon 15:12, 22;
18:6
Simon's 15:20
simple 33:23; 44:19;
112:4; 115:23; 207:10
simply 69:23; 107:8;
115:12; 134:21;
192:18
simultaneous
185:21
Singer 5:23; 6:4;
7:19; 8:9, 19, 21; 9:1,
2, 5, 6; 13:5; 40:9;
41:20; 50:22; 51:3;
56:19; 63:24; 66:12,
24; 72:16, 21; 79:15;
80:4; 81:18; 88:23;
89:13; 92:12; 93:2,
13; 94:5; 96:19;
98:12, 14; 101:20;
102:14; 109:3;
115:18; 121:4, 18;
133:18, 23; 138:5;
143:5, 10; 144:6, 18;
146:7; 147:20;
148:19, 23; 52:12;
159:4, 7; 190:12, 15;
191:17; 193:13;
194:12; 201:22;
203:2; 205:17, 18,
22; 207:4, 22;
208:11; 209:3;
210:16; 216:16;
232:24
Singer's 6:6; 23:10;
25:5; 81:7; 90:14, 16,
19; 156:24; 159:6
single 28:24; 49:9;
218:22
sit 97:5; 102:19;
116:2, 12; 150:20
sitting 162:10;
187:17
situation 7:17;
225:22
six 43:10, 16;
126:16; 212:11;
218:18
size 18:20
skepticism 118:12,
14; 188:17
slightly 50:13
slow 27:15; 41:6
slowly 188:9
small 57:18; 190:19
smaller 187:7;
190:19
so-called 152:2
society 122:20;
193:14; 194:1;
195:10, 10, 11;
196:18
soften 179:15
softer 179:18

soil 23:4; 24:8;
125:3; 172:1; 181:16
soils 22:8, 10, 15,
18, 20, 22, 24; 23:7,
14, 24; 172:8, 16, 17
solar 193:22
sole 30:11, 12, 12;
205:19
solely 228:3, 5
Solow 65:21; 66:21;
74:16
Solow's 72:1
somebody 14:4;
115:11
someone 36:23;
56:22; 61:2; 82:17;
148:14; 192:15;
198:10
someone's 197:12;
199:11
something 16:11;
51:4; 61:1; 62:10;
66:15; 70:24; 80:24;
82:9; 116:7; 123:9,
16; 125:4; 126:3;
130:7; 133:8; 140:23;
162:17; 183:21;
196:17; 210:1; 233:8
sometime 157:21;
174:19; 176:19;
230:11
sometimes 214:5
somewhat 197:1
somewhere 176:19;
181:11
sophisticated 132:7
sorry 27:4; 51:4;
77:15; 94:19, 23;
149:14; 155:10;
184:6; 185:6; 205:2;
211:22; 217:9
sort 214:7
sound 192:14;
204:21; 205:12
sounds 167:16
source 21:21, 22;
22:13; 24:9
sources 5:21; 6:4,
12; 23:18; 32:1;
122:9; 146:19;
181:20; 182:17, 19
space 29:9; 182:2
speak 39:8; 51:6, 10;
60:8; 108:17; 200:9;
220:19; 225:20
speaking 14:14;
56:7; 58:11, 12, 13;
60:9; 151:12; 177:10
speaks 63:22; 164:3
special 70:6
specialized 53:5
specific 12:3; 13:3;
19:24, 24; 30:15;
31:22; 33:9; 45:7;
47:10, 21; 48:2, 4, 8,
12; 57:7; 62:16; 92:2;

95:4; 103:3; 104:8; 22, 24; 109:5; 110:7; 20; 111:4; 113:9; 114:21; 116:23; 117:7, 19; 118:8; 119:5, 19; 121:11; 123:15, 16; 124:8, 9; 126:4, 7; 127:13; 169:20; 193:21; 223:3, 7; 232:16 specifically 46:14; 62:19; 68:5, 14; 70:20; 104:7; 105:4; 118:10; 122:9; 123:18; 129:2; 212:24; 219:4 specify 26:17, 21; 28:1; 132:6; 151:21; 164:21 spectrum 196:5 speculating 177:14 speculation 35:23; 151:16 speculative 194:24 speeches 41:14 spell 192:24 spend 24:13; 116:2, 3; 188:15 spent 24:21; 194:16 spirited 184:17, 19; 185:1, 13, 17; 186:5 spoken 162:19 spread 85:8 spring 107:16; 135:8, 10, 16; 215:22 stage 68:3 stand 87:17; 88:10, 13; 106:11; 190:13 standard 83:21 stands 17:9; 211:21 staple 72:4 Starr 51:2; 67:8, 13; 106:8, 9; 107:15; 108:17; 109:18; 124:7, 21, 24; 126:14, 21; 139:6, 16; 143:2; 146:14, 16; 152:22; 153:6, 13; 154:15, 18; 155:7, 14, 18; 161:16, 20, 22; 167:8; 168:1, 5, 10, 12, 18, 20, 24; 169:9, 11, 21; 190:15; 207:5; 209:19; 210:20; 211:6; 212:4; 215:11, 24; 216:5 Starr's 90:15; 107:5; 108:5; 123:5; 147:16, 21; 148:11; 154:24; 155:16; 162:3 start 8:17; 49:22; 196:3 started 114:17; 188:6, 7	Starting 14:24; 53:22; 91:3; 121:22; 204:9 state 6:20; 8:17; 12:10; 35:21; 37:15; 40:10; 41:8; 50:8; 51:18; 73:1; 75:5, 11; 88:22; 96:11; 130:3; 205:16; 220:15 stated 12:19; 46:6; 47:4, 6; 88:24; 89:1; 93:11; 119:13, 16; 151:1, 2; 175:6; 232:22 statement 5:13; 35:13; 47:15, 17; 50:10; 80:8; 97:2, 3, 16, 19, 20; 102:4; 106:11, 24; 107:1; 108:12, 14; 123:19; 129:10, 20; 131:18; 134:14; 136:16; 140:10, 13; 141:2, 18; 142:11, 14; 151:7; 172:19; 178:7; 190:3, 13; 196:14; 208:11; 219:17 statements 89:11; 119:18; 129:16, 18; 171:1; 173:24; 183:15, 18; 187:14; 204:21; 205:12 States 136:12; 140:13; 150:17, 20; 151:3, 8, 14; 173:3, 4; 196:15, 20 stating 40:6 stations 53:6, 7, 7 statistical 64:22 statisticians 82:13 statistics 82:18 stenographer 116:19 stenographer's 116:13 Steven 218:13 stick 52:4; 166:4 still 87:17; 121:6; 141:17; 158:17; 163:15; 176:6; 186:9; 227:8 stipulated 5:4 stipulating 80:9 Stipulation 5:3 stone 59:18 stop 24:23; 41:14; 122:1; 210:4 store 69:3 strange 104:1 stratosphere 20:12, 13, 14; 29:20 stratospheric 204:1 stray 42:18, 21, 23 street 34:6 strike 5:9; 10:24; 51:4; 98:22; 103:24;	107:13; 142:4; 143:22; 151:1, 4; 156:10; 164:9; 165:16; 176:10; 231:10 striking 165:14 strong 20:10 strongly 218:17 struck 163:20, 24; 164:7 studied 31:5 studies 194:23; 195:1, 18, 23; 196:3, 7, 10 study 47:7, 17, 24; 49:9 studying 16:17; 47:16 subdirectory 138:3 subdued 210:8, 16 subheading 180:11 subject 23:16; 30:14; 42:16, 17; 65:19; 76:11; 78:4; 80:7, 8; 133:8; 193:18 subjective 214:15 subjects 29:12; 31:9 submission 210:21; 211:1 submit 192:14; 203:9 submitted 157:21; 211:8, 9, 10 subscribe 178:10 subsection 146:2 subsequent 78:11; 99:16, 22; 109:20; 118:16; 161:6; 181:3 substance 181:1 substantial 186:3 substantially 208:17 substantive 161:8 substitutive 122:15 subtracted 78:10 successive 86:23, 24; 120:18; 155:13 sued 209:7 sufficient 16:16; 28:21; 142:21 sufficiently 178:24; 182:7 suggest 43:8; 183:8; 184:4, 11; 185:3, 5 suggested 68:8, 10; 69:10; 92:2; 106:10; 107:3; 108:15; 125:8; 152:22; 153:2; 165:5; 173:18 suggesting 61:17 suggestion 212:5, 6 suit 9:9, 12; 24:15, 22, 24; 25:5, 8 sum 112:4 summaries 209:16; 232:4	summarize 5:20 summary 49:6; 206:20; 211:8; 216:7, 9; 225:21 summer 26:19; 108:2 Sun 228:18; 230:2 supplement 108:23 support 221:18; 222:21; 223:1, 5, 9, 15; 224:17; 226:4 supported 222:21; 223:22 supporting 204:5, 17 suppose 105:20; 201:1 supposition 192:10 sure 67:6, 18; 75:22; 78:13; 81:1; 91:20; 146:17; 191:6; 209:19, 20; 226:3; 233:7 surface 22:5, 5; 52:19; 56:9; 134:7 surprise 12:17; 153:8, 11, 12, 15; 177:15, 18; 188:20, 23; 220:22; 221:2, 6; 223:19, 21 surprised 12:21; 144:13, 15; 226:5, 6 suspend 233:6 suspended 233:14 swearing 114:6 sworn 8:12	talked 96:19, 20; 131:20; 173:15; 180:20; 201:7; 215:12 talking 49:4; 56:11; 57:8; 58:10, 14; 66:3; 90:8; 100:5; 104:15; 114:17; 131:3, 4; 148:2; 151:20, 22; 152:1; 160:15; 162:13; 172:16 talks 181:16; 209:17 tall 76:20 Tanzer 69:16, 17 Taro 167:10 taught 188:21 teachers 34:6 teaching 227:19 technical 64:24; 65:1; 229:2, 5; 232:4 technicalities 9:17 Technically 214:22 Technology 203:6; 205:3, 20, 23; 206:21; 210:22; 211:2; 216:2; 217:10 television 34:12, 15 televisions 34:13 telling 23:6, 22; 111:7; 112:2, 9; 123:12, 15; 151:17; 184:16 tells 77:10 temp 72:13 temperature 51:11, 12; 52:1, 8, 15, 17, 24; 53:2, 8, 11, 15, 20, 24; 54:4, 5, 8; 55:18; 56:1, 5; 57:9, 13, 24; 58:3; 59:7, 9, 12; 60:4, 8, 9, 18; 61:12; 62:1, 7, 11, 13; 63:5, 11, 13; 65:7, 12, 17; 66:4, 6; 71:22; 72:19; 73:23; 74:1, 12; 76:21, 22; 77:22; 79:16; 83:7; 84:12, 21; 85:5; 86:21; 87:2, 3, 8, 13, 21; 88:17; 58:16; 167:2; 176:8; 188:22; 190:4 temperatures 55:2; 56:9, 12; 57:15; 58:6; 62:17; 72:17; 73:6; 74:5; 76:24; 79:1; 125:9; 134:6; 172:7 temporal 58:13 tendentious 113:11 terms 183:17 tested 13:18 testified 8:13; 105:9; 109:3, 6; 120:6; 131:17; 159:23; 165:21; 220:16, 19 testify 13:5; 220:14, 23 testifying 131:18	testimony 89:1; 97:1; 105:11, 14; 109:2, 13, 22; 159:22; 191:16; 207:12; 208:2; 211:18, 20; 217:3 tests 13:19 Thanks 223:8 themselves 14:5; 108:18; 116:8; 172:8; 227:24 theoretical 14:18; 19:7; 174:4 theories 205:5, 11 theory 52:8 therefore 40:17; 57:18, 21; 65:4; 74:4; 85:24; 88:7; 130:24; 213:22; 214:1 thereof 5:7 thermometers 52:19 they're 6:17; 7:4; 22:13; 64:7; 87:19; 108:18, 22; 142:19; 166:11, 14; 184:14; 195:20; 229:16 They've 176:5 third 51:12; 54:15; 72:14; 74:11, 18; 75:15; 76:17, 18; 78:7, 8, 24; 84:7; 117:17; 119:12; 163:21; 204:9 Thomas 9:5, 6; 125:10 though 41:15; 73:21; 151:19; 172:6 thought 79:9; 103:21; 112:13; 139:20; 151:1; 163:16; 167:3; 169:8; 187:2; 215:4 thoughts 214:21 threat 204:1 three 19:8, 8; 36:16; 39:22; 54:18; 64:20; 66:10, 13; 72:3, 6; 114:12; 118:6; 134:7; 152:18, 18; 153:20; 154:18; 155:2, 4, 14, 15; 156:9, 15; 157:24; 158:1, 20, 21, 24; 159:6, 11, 14; 160:5, 5, 13, 14, 14, 15; 163:5, 6, 8, 9; 164:13, 21; 165:12; 166:10; 169:17; 173:11; 193:5, 8; 196:12; 201:17; 204:14; 12:11; 213:10; 215:2 three-degree 166:4 threshold 130:19 throughout 57:14; 60:6 throwing 96:21 till 7:4
--	---	---	--	--	---

times 50:2; 87:2;
114:13; 138:23;
162:7, 8; 170:5;
212:17, 21
tired 187:18, 19
Tiros 56:9
title 16:10, 11; 20:8;
203:1, 16
titled 118:14;
135:22; 217:2
today 5:19; 6:3, 24,
24; 7:7; 89:1; 109:22;
120:6; 130:17; 145:4;
147:10; 154:23;
207:4; 212:17, 21;
232:20
today's 113:15
together 87:16, 19;
97:5; 161:23; 218:6;
222:18
told 6:10; 66:12;
114:13; 136:17;
138:24; 139:2, 8;
145:8; 158:18; 160:4;
165:4; 195:17; 211:13
tone 188:17
took 7:13; 161:18
top 50:11; 51:5, 11;
54:16; 77:13; 106:2;
115:18; 117:18;
137:11; 146:1; 149:5;
197:8, 16, 20
topic 30:22; 31:22;
34:9; 36:24; 120:1;
168:8; 181:4; 224:4, 5
topics 25:23; 29:19;
31:10, 15; 120:4;
232:5, 7
Toronto 204:3
toxin 43:14
traceable 124:15
track 107:8; 114:23
training 32:15
transcript 147:4;
208:1
transfer 32:19; 33:5,
16, 20; 38:9
transient 175:19
transmission 38:6;
44:4
transport 31:6, 16
travel 19:4; 221:4;
222:8
traveled 161:13
treated 213:22
Tree 173:21, 24
trees 170:3; 171:5;
172:11, 17, 22;
173:4, 8
Trends 73:7, 12, 16;
74:19; 79:7, 16
trial 5:9; 7:22; 40:8
trick 92:9, 16, 23, 24;
93:6, 8; 231:8

tried 165:2; 188:16;
191:5
trip 222:18
triple 124:5; 169:10
trips 222:21
trouble 183:22
true 12:22; 13:20;
29:4; 48:6; 60:6;
66:16; 75:10; 96:5;
132:14, 17, 24;
145:19; 159:10;
163:23; 168:8, 17;
169:11, 13; 173:20;
183:6; 189:9, 14, 17;
194:12; 196:2;
198:16; 202:20;
205:18, 22; 208:2;
211:12; 219:7
truly 95:18
trust 53:14
truth 12:23; 13:15,
17, 19; 39:6, 6, 7;
42:19; 43:4; 46:1, 2,
4, 4
truthful 39:17;
41:21; 44:9, 23;
45:19, 22; 49:16;
178:8
try 7:10; 8:1, 2;
25:18, 21; 34:20;
58:17; 83:12; 93:13;
102:14; 122:17;
130:9; 165:8; 183:1;
210:15; 233:6
trying 6:9; 37:15;
64:2; 72:18; 82:3;
85:14; 98:10, 10, 17;
114:23; 115:5, 6, 11;
130:8; 222:14
tundra 22:10, 15, 18;
25:12
tuned 119:9, 9, 15
turn 71:4; 85:17;
190:10
turned 160:21
turning 121:17, 22;
126:10; 149:11;
157:14
twice 53:8; 98:13;
218:19
two 19:8; 40:1; 42:4;
43:6; 57:10, 16;
61:15; 76:23; 77:21;
78:19; 79:13, 18;
98:10; 106:2, 3;
117:2; 129:15; 130:4;
131:14; 133:18;
134:1, 7; 138:14;
139:23; 142:1, 13;
148:7; 149:8; 156:14;
157:4; 166:21;
167:21; 169:16, 17;
187:23; 192:4;
197:15, 20, 21, 22,
22; 204:20; 205:12;
208:18; 212:11;
14:13; 220:1; 222:19;
223:12

type 50:12; 51:19,
19; 214:1, 2
typed 50:9
types 14:13
typically 53:1; 54:5;
55:13
typo 184:7

U

unable 32:5
unacceptable
117:4; 176:5
unanswerable 154:2
unbalanced 45:11
uncertain 111:9;
112:6; 113:2; 208:13
uncertainties 122:2,
22
uncertainty 181:21;
205:1, 9
unclear 27:1; 40:18;
81:4
uncomfortable
202:14
under 16:8; 20:2;
51:9; 58:22; 71:3;
106:4; 114:6; 121:6,
23; 124:12; 129:10;
139:17; 141:23;
148:2; 157:18;
159:18; 163:3, 14;
170:20; 172:17;
173:13; 178:13;
180:11; 181:19;
187:4; 201:17; 205:7;
214:11
underlying 46:22;
49:12
understandable
42:16, 17; 183:20;
214:17
Understood 62:24;
80:6, 11; 81:19; 84:4;
88:5; 117:14; 164:5;
165:11; 179:1; 181:24
uneconomic 173:22
unethical 200:2;
209:24
unfair 47:10
Unical 228:18;
229:24
unique 38:24;
123:20; 126:11
uniquely 103:4, 6;
124:16
United 136:12;
140:13; 150:17, 20;
151:3, 8, 14; 173:4;
196:15, 19
University 15:19,
22; 152:8; 223:2, 4,
16, 23; 227:14; 228:2
unless 24:2; 28:1;
46:3; 146:22; 200:5;
233:7

unlikely 145:7, 13;
148:9
unobjective 45:5
unreasonable 24:24
unreasonably 83:22
unrelated 24:21
unreliable 176:4
unrestrained 8:4
unsophisticated
88:8
unusual 29:5; 37:1;
64:16; 133:4; 151:11
up 5:15; 13:9; 14:24;
48:13; 52:18; 53:22;
60:7; 62:3; 75:6;
90:10; 112:4; 121:9;
124:18; 126:2;
148:17; 157:14;
160:23; 165:3; 176:7;
180:3; 181:13, 24;
202:21; 203:18, 19,
19; 210:5; 211:13;
220:21; 232:11
updates 49:12
upon 33:18; 38:16;
39:1; 78:4; 110:11;
111:11; 112:7; 113:9;
131:6; 218:17
upper 135:23
use 48:4, 23; 64:9,
10; 70:8, 13; 100:14;
126:18; 145:24;
157:3; 168:22; 169:4;
198:12; 200:23;
213:12
used 17:3; 27:11;
44:4; 47:21, 24; 49:1;
64:23; 75:19; 83:24;
112:11, 21, 24;
114:14; 178:20;
199:10, 11; 206:18
useless 116:17;
182:13
uses 47:7; 169:22
using 17:1; 58:19;
68:23; 86:22, 24;
201:3; 209:22
usual 65:4, 5; 81:23;
84:11; 88:11; 165:8
utilities 224:12

V

vague 10:10; 13:17;
97:4
valid 28:23; 179:17
validity 118:13
value 78:10, 11;
81:23; 82:4, 4;
151:23; 189:23
valued 120:20
vapor 20:19, 21;
21:1, 8, 19; 182:21
variability 82:14, 14

variation 59:18;
60:15, 17; 61:11, 24;
62:10, 13; 64:13;
65:16; 66:4, 6; 68:7;
71:20, 21; 77:23;
82:21, 23; 83:6, 12,
20, 21; 84:12, 16, 20;
85:4, 8, 18; 87:12;
88:1, 11, 15; 90:4, 9,
10; 91:21; 129:14,
23; 130:14, 18;
142:17; 158:3, 7, 9,
11, 18; 163:16;
164:16, 20; 165:1,
20; 166:5; 175:3;
177:24; 186:19; 87:3,
5, 15; 189:3, 8, 10,
15, 16, 19, 24; 190:5;
192:17
variations 63:10;
64:16; 84:5; 87:23
varies 228:23
varieties 172:6, 13
variety 171:16; 176:3
various 52:19; 53:6;
133:10; 182:17;
193:10
venture 211:15;
221:7
verbal 111:23
verbally 83:1, 3
verbatim 206:1
verify 174:24; 187:14
version 61:16;
68:16; 70:1, 2, 15;
80:15; 132:12;
137:18; 163:23;
164:10; 174:14
versus 193:8; 196:12
vicinity 16:21; 17:16
view 82:3, 12; 84:22;
95:8; 97:17; 121:22;
122:2, 22; 129:9, 20;
130:12, 17; 134:2,
14, 21; 136:15;
139:19, 21; 142:11;
166:8; 170:14; 174:1;
182:12; 193:9; 197:4,
24; 200:7
viewpoint 48:8, 12
views 89:18; 95:18;
104:1; 122:5, 13, 17;
123:4, 5; 131:20;
133:13; 138:21;
214:15
violation 9:15
Virginia 8:20; 15:15;
223:2, 5, 16, 23;
227:15
virtue 97:8
visits 222:19
voice 209:6, 12
volcanoes 64:17
Volume 203:6
voluntarily 199:10
voracity 154:7

W

Waggoner 167:9
wait 101:20
waived 5:7
walked 147:9
Wallace 167:9
Walter 118:4; 167:9
warm 22:15, 18, 24
warmer 55:9; 125:9;
128:20; 129:8, 24;
131:10, 12; 132:10,
17; 136:13; 140:14;
141:21; 219:12
warmest 55:2, 6
warming 25:5; 26:2;
31:12; 32:7; 33:13,
13, 14; 34:8, 10; 36:5;
39:11; 43:11; 45:7,
13; 48:8, 12, 13, 19;
49:2, 10, 13; 51:6;
54:24; 55:23; 57:22;
58:18; 59:22; 63:3;
89:14; 100:15; 101:2;
102:3; 110:23; 111:9;
112:5; 113:1; 129:12,
21; 130:12, 14;
131:9; 133:7; 135:12;
136:16; 138:13;
139:23, 24; 40:4, 11;
142:12, 15; 146:5;
148:6; 149:20;
150:13, 14, 14, 16,
18; 151:3, 6, 7, 14;
158:2, 5; 163:7;
164:14, 19, 21;
165:12; 166:9, 20;
170:18; 175:2, 7;
177:20; 183:1, 8, 23;
184:5, 11; 186:15,
17, 22; 188:19;
190:16, 18, 22, 24;
191:5, 8, 11, 18;
192:21; 193:15;
194:14; 195:4;
196:11, 12, 23;
203:3, 17; 04:24;
205:8; 208:13;
215:10; 218:3; 219:9;
224:4
warning 172:21
Washington 69:2;
133:19; 224:24
waste 145:21
water 20:19, 21;
21:1, 8, 19; 182:21
way 6:20; 33:23;
38:22; 45:20; 55:10;
59:14; 62:6; 66:19;
68:1; 72:18; 74:3;
82:2; 87:23; 91:4;
95:10, 11, 11;
101:21; 102:14;
131:16; 145:10;
146:23, 23; 151:16;
155:21; 163:17;
169:9; 176:22;

179:18; 183:4;
190:13; 191:10;
192:18; 200:3, 4;
205:15; 214:5, 10
ways 36:21; 44:11
weather 56:10
week 144:7, 11;
217:14
weeks 149:8; 155:1,
2
weight 180:2
Weinberg 15:12, 24;
18:6, 19, 20
welcomed 218:7
welfare 196:23
weren't 91:20;
145:18; 215:24
Western 6:14;
219:20; 220:15, 20,
24; 221:3, 7, 18, 21,
24; 222:3, 11, 16, 21,
24; 223:5, 9, 15, 23;
226:1
What's 18:20; 24:4;
36:3; 41:16; 70:23;
84:1; 88:24; 154:7;
203:1, 16; 226:13
whatsoever 179:22
whenever 7:19;
18:9; 175:13
whereas 158:7
whichever 157:3
White 204:5, 16
who's 82:17
whole 89:5; 100:19,
21; 101:1; 159:12;
168:9; 181:19
wholly 24:21
Whose 68:21; 69:1;
120:19; 167:4
wide 74:6; 196:4, 4;
203:22; 204:9
widely 173:15
width 74:7
wife 8:21, 23
Wigley 54:1, 4;
73:22; 74:20; 80:16
William 15:11; 127:2
willing 75:22;
158:16; 164:9;
192:16; 216:4
winter 26:20; 63:1;
129:15; 149:22;
150:8; 152:21; 175:4
wise 169:24
wish 46:4; 89:9
withdraw 12:2; 13:2;
14:1; 24:2; 48:14;
154:9; 168:21; 169:5;
182:22; 189:6; 192:1;
211:23; 231:9
Withdrawn 154:10
within 7:15; 208:17
without 6:9, 10;
27:17; 45:10; 61:17;

66:4; 75:12; 77:7;
146:24; 199:12
witness 8:11; 71:17;
81:2; 101:6, 14, 14;
110:13; 115:3;
129:17; 137:8;
147:23; 150:4; 163:1;
169:19; 170:12;
173:12
Woods 65:22
word 64:10, 11, 23;
67:7; 68:19; 83:20,
23; 96:6; 97:4;
100:14; 111:7;
113:12; 119:9;
142:10, 10; 159:11;
162:19; 163:21, 24;
164:9; 169:4, 5;
179:5, 8; 184:19;
200:7, 17, 23; 201:3
wording 95:5; 110:7;
113:9; 114:22;
132:13; 158:4; 165:6
words 37:9; 45:23;
54:19; 57:6; 63:21;
72:11; 76:23; 78:15;
81:5; 82:16; 85:17;
86:1; 93:19; 95:15,
17; 96:21; 97:6; 98:8;
99:5, 15, 15; 102:6;
103:23; 104:8; 111:8,
11, 15; 112:14, 20,
22; 113:3, 18; 114:1,
7, 14, 18; 115:12;
116:23; 118:9;
121:22; 127:15;
139:10; 142:23;
150:11; 152:20, 21;
163:13; 64:6, 15;
179:17; 180:4, 24;
183:7; 200:10; 212:8
work 5:19; 18:9;
19:3, 8, 23; 20:5;
37:7; 38:14, 14, 16;
53:4; 65:8; 66:21;
168:1, 10, 20, 24;
169:11; 172:4; 188:9;
198:9, 21; 199:14;
201:16; 212:7;
215:13; 218:22;
219:2; 223:17; 224:3;
226:15, 16; 228:22,
24; 229:22; 230:4,
16; 232:3
worked 5:18; 17:15;
29:6; 30:2; 177:10
working 17:11; 70:5;
126:20; 215:11
works 157:3; 214:5;
226:11
world 100:19, 21;
101:1
world's 128:19;
129:7; 141:20
worse 27:11; 167:3
worthwhile 173:5
write 35:1, 8; 46:9;
49:11, 11; 57:2;

69:23; 70:1; 82:20;
97:5; 99:21; 103:16;
134:1; 139:2, 5;
141:15; 215:9; 216:3;
229:10
writes 198:13; 214:3
writing 7:9; 10:5;
38:13; 47:6, 10, 12,
13; 67:3; 68:12;
91:10; 97:23; 100:9;
120:3; 139:9; 155:20;
166:24; 168:18;
169:3; 201:14, 15;
209:16; 226:20, 24
written 5:15; 10:11,
15; 11:24; 12:14;
30:21; 31:1; 37:6;
64:19; 92:2; 97:3;
103:1; 112:7, 14, 20;
114:2, 5, 7, 14;
120:12; 127:8, 20;
128:3, 6; 137:17;
149:8; 156:9, 21;
159:3, 14; 160:5, 17,
20; 162:20; 163:13;
165:13; 179:12;
193:22; 198:9;
211:13; 212:24;
214:16; 225:21; 229:7
wrong 209:15
wrote 57:5, 12; 58:2;
61:6, 14, 17; 66:11;
67:6; 68:5; 91:17, 20;
92:15; 93:5; 95:17;
97:19; 99:24, 24;
111:10; 118:19;
125:14; 138:6, 17,
19; 139:1, 9; 141:2,
15; 152:5; 160:13,
14; 169:23; 180:22;
197:15

X

Xeroxed 136:7

Y

Yale 127:2
Yeah 65:2; 72:8;
73:4; 77:6; 79:14;
106:2; 116:3; 119:14;
165:23; 188:7;
203:15; 212:20
year 9:10; 19:21;
55:2, 6, 9, 9, 11;
57:10; 59:19; 60:18;
63:2, 6; 76:21; 78:10,
11; 86:21; 87:1, 3, 9;
142:20, 24; 230:10
year-to-year 60:15;
61:11, 24; 63:10;
64:13, 16; 65:16;
66:3; 68:7; 71:20, 21;
82:12, 14, 21, 23;
83:6, 12, 20; 84:5, 16,
20; 85:4, 8, 18; 87:12,
23, 24; 88:11, 14;

90:4, 9, 10; 91:21;
129:14, 23; 130:14,
18; 142:16; 158:3, 7,
8, 11, 17; 163:15;
164:15, 20, 24;
165:20; 166:5;
170:16; 175:3;
177:24; 186:19; 87:2,
5, 15; 189:2, 8, 10,
15, 15, 19, 23; 190:4;
191:18; 192:17
yearly 228:10
years 17:14; 19:8, 8;
27:11; 28:6, 19;
36:17; 52:18; 54:11;
55:12; 57:10; 78:9;
82:15; 86:23; 87:8;
110:22; 132:23;
133:10; 136:10;
171:10, 12; 187:23;
204:14; 226:22; 227:1
yellow 96:3
Yep 59:3
yours 7:13; 159:16

Z

zero 130:24
Zodiacal 29:16