

DR. MILES: GOOD AFTERNOON. I AM VERY  
0477

1 DELIGHTED TO BE HERE. I HAVE BEEN READING YOUR  
2 PAPERS FOR THE LAST 17 YEARS OR SO, AND I KNOW ONLY  
3 THE MARINE SCIENTISTS IN THE ROOM, OR MAINLY THE  
4 MARINE SCIENTISTS. I ALSO KNOW A FEW OF THE TERRESTRIAL  
5 FOLKS.  
6 I HAD HOPED TO CONVINCED THE ORGANIZERS TO  
7 ALLOW ME TO CONDUCT A  
8 REAL-TIME EXPERIMENT AND I DID RECEIVE THEIR APPROVAL. THIS EXPERIMENT WAS  
9 STIMULATED FOR ME BY TWO THINGS: 1. AS YOU KNOW FROM  
10 WHAT I SAID YESTERDAY, WE HAVE A SEVERE DISCONNECT  
11 BETWEEN THE RATE AT WHICH NATURE IS CHANGING, HAVING  
12 BEEN PERTURBED BY US, AND THE RESPONSE RATE OF THE  
13 POLICY SYSTEMS AT GLOBAL AND NATIONAL LEVELS, AND THIS  
14 DISCONNECT IS QUITE SERIOUS. AND IF YOU WERE TO PUSH  
15 ME TO THE WALL, I WOULD SAY THE PROBABILITIES OF THE  
16 POLITICAL SYSTEMS MAKING THE DECISIONS THAT ARE  
17 REQUIRED TO KEEP THIS THING FROM BECOMING A RUNAWAY  
18 PROBLEM ARE NOT HIGH.

19 2. THE OTHER POINT I'M CONCERNED ABOUT WAS HIGHLIGHTED BY RALPH  
CICERONE WHEN HE  
21 SAID, SCIENCE IS A NECESSARY BUT NOT A SUFFICIENT  
22 CONDITION FOR THE DECISIONS THAT WE MAKE; AND THAT A  
23 MAJOR PROBLEM IS COMMUNICATION. THIS THEME OF POOR COMMUNICATION WAS  
24 ALSO TAKEN UP BY RICHARD SOMERVILLE IN THE PANEL ON  
25 WHICH HE APPEARED YESTERDAY.

2 SO THIS IS AN EXPERIMENT IN AN ATTEMPT TO BUILD A BRIDGE FOR  
3 COMMUNICATION BETWEEN THE TWO COMMUNITIES: THE CARBON CYCLE SCIENCE  
COMMUNITY AND THE PUBLIC

4 I HAVE JUST THREE SLIDES HERE.  
5 OKAY.

6 I CHOSE YOU BECAUSE I THINK YOU ARE A CRUCIAL LINK IN  
8 THIS CHAIN, AND WE COULDN'T DO THE JOB THAT NEEDS TO  
9 BE DONE WITHOUT YOU SPEAKING DIRECTLY TO THE LARGER NATIONAL  
10 CONSTITUENCY. WE OUGHT TO TAKE THE OPPORTUNITY  
11 THAT NOW EXISTS TO RESPOND TO INCREASING PUBLIC  
12 CONCERN ABOUT WHERE WE ARE HEADED, SO I WANT TO TRY  
13 TO COMPOSE, IF ONLY IN OUTLINE FORM, SOMETHING  
14 EQUIVALENT TO A SUMMARY FOR POLICY MAKERS IN THE IPCC  
15 STYLE, BASED UPON THE WORK REPORTED IN THE TWO PANELS  
16 THIS MORNING, BY THE TERRESTRIAL GROUP AND BY THE  
17 OCEAN GROUP. THIS EFFORT SHOULD PROVIDE A BASIS  
18 FOR STORIES TO BE USED INSIDE AND OUTSIDE THE  
19 SCIENTIFIC COMMUNITY. A RECORD IS BEING KEPT. WHAT  
20 WOULD PLEASE ME IMMENSELY IS FOR US TO PUT TOGETHER  
21 AN INITIAL STATEMENT THAT COULD APPEAR IN, FOR  
22 INSTANCE, "SCIENCE" MAGAZINE AS ONE OF THE POLICY

23 FORUM PIECES THAT DON KENNEDY OCCASIONALLY RUNS. AND  
24 IN ORDER TO DO THAT, I'M GOING TO ASK THE PANEL TO  
25 FOCUS ON FOUR QUESTIONS:

0479

1 THE FIRST ONE HAS TO DO WITH THE MOST  
2 RECENT RESULTS THAT WE HAVE BEEN DISCUSSING, THE  
3 IMPLICATIONS FOR SETTING EMISSIONS TARGETS AND  
4 CONCENTRATION PATHWAYS OF THE GREATER-THAN-PREDICTED  
5 GROWTH IN EMISSIONS SINCE 2000, COMBINED WITH WHAT  
6 APPEARS TO BE THE SLOWING DOWN OF THE UPTAKE OF CO2 IN  
7 BOTH THE TERRESTRIAL AND THE OCEAN SINKS.  
8 THE SECOND QUESTION IS, GIVEN THE  
9 GLOBAL WARMING COMMITMENT AND ACIDIFICATION EFFECTS STEMMING FROM THESE  
LAEGER CONCENTRAQTION LEVELS,  
10 HOW DO WE MANAGE ADAPTATION FOR BOTH TERRESTRIAL AND  
11 OCEANIC ECOSYSTEMS AND HUMAN SOCIAL SYSTEMS, WHICH  
12 ARE INTERLINKED, TO REVERSE OR HALT MOVEMENT TOWARDS  
13 THRESHOLDS OF CHANGE.

14 THE THIRD QUESTION IS: HOW MUCH TIME DO WE  
15 HAVE TO ACT AND WHAT IS TO BE DONE, WHEN?  
16 AND THE FOURTH QUESTION IS: WHAT ADDITIONAL AND/OR  
17 REVISED APPROACHES TO CARBON CYCLE MEASUREMENT ARE  
18 IMPLIED IN THE QUESTIONS POSED ABOVE?

19 WE HAVE ALTOGETHER 75 MINUTES FOR THIS  
20 PANEL. I WOULD LIKE TO CONCLUDE THE DISCUSSION WITH  
21 THE PANELISTS IN 50 TO 55 MINUTES; AND GIVE YOU, THE  
22 AUDIENCE, SUFFICIENT TIME TO HAVE AT LEAST A USEFUL  
23 DISCUSSION.

24 SO I WANT TO ASK THE PANELISTS TO CONFINE  
25 THEIR RESPONSES TO VERY TERSE, BULLET-TYPE POINTS FOR

0480

1 EACH QUESTION; AND THEN WE CAN ELABORATE IN WHATEVER  
2 TIME WE HAVE LEFT IN THE CONVERSATION WITH YOU. 3 I WILL CALL IT WHEN WE  
MOVE FROM QUESTION TO  
4 QUESTION.

5 SO WE WILL BEGIN WITH THE FIRST QUESTION,  
6 ASKING THE PANELISTS: WHAT ARE THE IMPLICATIONS FOR  
7 SETTING EMISSIONS TARGETS AND CONCENTRATION PATHWAYS  
8 GIVEN THE GREATER-THAN-PREDICTED GROWTH IN EMISSIONS  
9 SINCE 2000 AND THE SLOWING DOWN OF THE UPTAKE OF CO2  
10 IN BOTH THE TERRESTRIAL AND OCEAN SINKS.

11 DICK, YOU'RE RIGHT NEXT TO ME, SO WHY  
12 DON'T YOU BEGIN.

13 DR. FEELY: WHAT COMES TO MIND RIGHT AWAY  
14 IS THE NEW EVIDENCE THAT WE HAVE LEARNED OVER THE  
15 PAST COUPLE OF YEARS THAT THE EFFICIENCY OF THE OCEAN  
16 CARBON SINK IS CHANGING; AND CHANGING IN WAYS WE  
17 CAN ONLY MODEL RIGHT NOW; WE HAVEN'T THE  
18 OBSERVATIONAL WHEREWITHAL AT THIS POINT IN TIME TO  
19 OBSERVE THESE CHANGES. SO IT IS VERY, VERY  
20 DIFFICULT TO KNOW IF THE MODELS  
21 ARE INDEED CORRECT OR NOT.

22 THAT PRESENTS TWO PROBLEMS FOR US: ONE IS  
23 HOW DO WE ATTRIBUTE THAT TO, PERHAPS, DECADAL CHANGES

24 AND NATURAL CLIMATE VARIABILITY VERSUS HOW MUCH OF  
25 THIS IS DUE TO CHANGES AS A RESULT OF GLOBAL CHANGE, WHICH  
0481

1 WOULD REPRESENT MORE PERMANENT CHANGES.

2 SO FROM A PERSPECTIVE OF THE OCEANOGRAPHY,  
3 IT SEEMS VERY IMPORTANT TO GET A BETTER HANDLE  
4 ON THE OBSERVATIONS AND GET A BETTER HANDLE ON  
5 WHETHER OR NOT THE MODELS ARE, INDEED, SHOWING US  
6 THAT THESE CHANGES ARE REAL; AND IF IN FACT WE ARE  
7 HEADING DOWN THE ROAD WHERE THE EFFICIENCY OF THE  
8 OCEANS IS DECREASING OVER TIME, THEN THE  
9 IMPACT FOR THE OCEAN ECOSYSTEMS WILL OCCUR SOONER  
10 RATHER THAN LATER. THAT MEANS THEN THAT OUR  
11 APPROACHES FOR MITIGATION HAVE TO BE ACCELERATED.

12 DR. MILES: SCOTT.

13 DR. DONEY: THANKS, ED; BY THE WAY, THIS  
14 IS A WONDERFUL SURPRISE.

15 (LAUGHTER)

16 THE TWO THINGS THAT COME TO MIND, ED, ARE  
17 FIRST THAT THE TIME SCALE FOR RESPONSE IS PROBABLY  
18 MUCH SHORTER THAN IS BEING PORTRAYED IN A LOT OF THE  
19 PUBLIC POLICY DISCUSSIONS. THIS PROBABLY ISN'T A  
20 2030 DISCUSSION OR A 2050 DISCUSSION. THIS IS A 2010  
21 OR 2015 DISCUSSION GIVEN THE LEAD TIME FOR THE  
22 RESEARCH AND THE INFRASTRUCTURE THAT WOULD NEED TO BE  
23 PUT IN PLACE.

24 I THINK THE OTHER THING IS THIS IS STARTING  
25 TO LOOK MORE LIKE A RISK MANAGEMENT PROBLEM. THERE

0482  
1 IS NOT A SINGLE OBJECTIVE HERE; WE'RE NOT AIMING FOR A PATHWAY.  
2 WE HAVE TO SORT OF BALANCE THE POSSIBILITY OF HIGHER  
3 RESPONSES IN A LARGER WARMING, HIGHER CO2WORLD EVEN IF  
4 THOSE ARE 10 OR 20 PERCENT PROBABILITIES. WE NEED TO  
5 START THINKING OF THAT ALMOST LIKE AN INSURANCE PROBLEM, YOU  
6 KNOW, HOW MUCH RISK ARE WE WILLING TO TAKE FOR LARGE  
7 IMPACTS EVEN IF THEY'RE ONLY A 20-PERCENT OUTCOME. I  
8 THINK THAT IS MORE THE WAY WE WOULD WANT TO FORMULATE  
9 THIS.

10 DR. MILES: VICKI.

11 DR. FABRY: I AGREE WITH BOTH OF MY  
12 ESTEEMED COLLEAGUES ON MY LEFT. BUT I THINK, ALSO,  
13 BECAUSE OF THE TIME LAG AND THE NECESSITY OF GETTING  
14 STARTED NOW, AND WE HEARD YESTERDAY WHAT IT WOULD  
15 TAKE TO ACTUALLY SUBSTANTIALLY REDUCE CO2 EMISSIONS, THIS MEANS  
16 THAT WHAT WE WOULD BE ASKING OF THE PUBLIC IS QUITE A  
17 LOT. AND I WORRY IF WE HAVE THE CERTAINTY TO  
18 CONVINCED THEM. POLLS SHOW THAT PEOPLE ARE, IN FACT,  
19 QUITE IN FAVOR OF DOING SOMETHING, WHATEVER IT IS,  
20 ABOUT GLOBAL WARMING; BUT WHEN THEY GET DOWN TO BRASS  
21 TACKS OF WHAT'S GOING TO BE ASKED OF THEM, I WONDER  
22 IF THE SUPPORT WILL STILL BE THERE. I THINK AS  
23 SCIENTISTS WE WILL HAVE TO BE PREPARED TO COMMUNICATE  
24 THE POSSIBLE OUTCOMES TO THEM.

25 DR. MILES: THANK YOU.

0483

1 DAVID.  
2 DR. LOBELL: I GUESS I'M GLAD I SAT IN THE  
3 MIDDLE FOR THIS. I ASSUME YOU'RE NOT GOING TO START  
4 IN THE MIDDLE.  
5 I GUESS MY REACTION TO THIS QUESTION IS  
6 THAT THERE'S A CROSS SECTION OF PEOPLE IN SOCIETY.  
7 SOME OF US THINK WE SHOULD BE DOING  
8 EVERYTHING AS FAST AS WE CAN RIGHT NOW,  
9 GIVEN WHAT WE THOUGHT EMISSIONS WERE BEFORE. FINDING  
10 OUT THAT THE GLOBAL EFFECT IS COMING FASTER, IT HAS  
11 NO IMPLICATION FOR THAT SEGMENT OF THE POPULATION.  
12 ON THE OTHER HAND, THERE IS A SEGMENT OF THE POPULATION FOR WHOM  
13 IT WOULD HAVE TO BE TWICE AS FAST FOR THEM TO  
14 EVEN THINK THAT WE SHOULD DO ANYTHING.  
15 SO THIS IS ALONG THE LINES OF WHAT SCOTT  
16 WAS SAYING, THAT IT'S REALLY A QUESTION OF WHERE  
17 YOU ACCEPT RISK AND WHERE YOU DON'T. AND I THINK,  
18 ONE OF THE THINGS THAT WAS SAID YESTERDAY  
19 THAT I AGREED WITH STRONGLY WAS THAT WHEN THE LADY  
20 FROM EXELON WAS SAYING WE'RE AN ATYPICAL AUDIENCE,  
21 AND I THINK MOST OF US WOULD SAY THAT WE SHOULD BE  
22 MOVING QUITE FAST ON THIS ISSUE; BUT I THINK FOR THAT  
23 MIDDLE SEGMENT OF THE POPULATION, WHO ARE MAYBE A  
24 LITTLE BIT UNRESPONSIVE, THIS FASTER EMISSION RATE  
25 WOULD PUSH THEM OVER THE EDGE.

0484

1 DR. MILES: THANK YOU.  
2 CHRIS.  
3 DR. FIELD: WELL, YOU KNOW, I THINK IT'S  
4 REALLY CLEAR THAT THERE'S GOT TO BE A PRICE SIGNAL IN  
5 THIS; AND THAT IF WE SAY HOW FAST PEOPLE ARE GOING TO  
6 GO WITH VOLUNTARY STANDARDS, HOW FAST ARE THEY GOING  
7 TO GO IF TECHNOLOGY DEVELOPMENT PROCEEDS WITH A  
8 NONDRIVEN COMPONENT, THAT IT'S NOT GOING TO GO AS  
9 FAST AS WE NEED.  
10 I'M REALLY FRUSTRATED THAT THERE'S A BIG  
11 COMPONENT OF THE TIME DIMENSION, THIS IS A PROBLEM WE  
12 HAVEN'T TALKED ABOUT, AND THAT'S THE COMPONENT OF THE  
13 TECHNOLOGY DIFFUSION. WE HEARD YESTERDAY THAT  
14 THERE'S A POSSIBILITY OF A CAPTURE-AND-STORAGE  
15 FULL-SCALE POWER PLANT IN 2020. THAT'S THE FIRST  
16 PLANT. AND WHEN YOU LOOK AT THE RATE AT WHICH THE  
17 DIFFUSION OF LARGE-SCALE COAL-FIRED POWER OR  
18 GAS-FIRED POWER, NUCLEAR, ANYTHING HAS SPREAD ACROSS  
19 THE WORLD, WE'RE REALLY TALKING ABOUT MULTIPLE  
20 DECADES.  
21 AND I THINK THAT THERE IS GENERAL AGREEMENT  
22 NOT ONLY THE CARBON CYCLE COMMUNITY THAT WE  
23 HAVE HERE, BUT IN THE GENERAL COMMUNITY, AS WELL,  
24 THAT THERE OUGHT TO BE REAL SOLUTIONS IN PLACE TOWARD  
25 THE MIDDLE OF THE CENTURY. IT REALLY CONCERNS ME

0485

1 THAT WE'RE LOOKING AT TECHNOLOGIES THAT ARE SO

2 IMMATURE THAT THERE IS RELATIVELY LITTLE PROSPECT FOR  
3 GETTING THEM IN PLACE BY THE MIDDLE OF THE CENTURY.  
4 SO I THINK THE ONLY WAY THAT THE NECESSARY MOMENTUM IS GOING TO HAPPEN IS  
5 WITH A SIGNIFICANT PRICE SIGNAL SOON THAT RESULTS IN  
6 LARGE-SCALE CONSTRUCTION, LARGE-SCALE COST-REDUCTION  
7 ACTIVITIES FOR THE KEY TECHNOLOGIES THAT ARE GOING TO  
8 LEAD TO SIGNIFICANT MITIGATIONS.

9 DR. MILES: THANK YOU.

10 DR. KIRSHEN: IT'S A DIFFICULT SET OF  
11 QUESTIONS. MY ANSWERS ARE SOMEWHAT RELATED TO  
12 CHRIS'.

13 YOU KNOW, INFRASTRUCTURE LASTS ANYWHERE  
14 FROM 20 TO 100 YEARS, AND IT IS SURELY DIFFICULT TO  
15 ADJUST, EXTREMELY EXPENSIVE TO ADJUST. SO IT SEEMS  
16 TO ME THAT WE CAN'T ADJUST OUR INFRASTRUCTURE, LIKE  
17 OUR ROADS AND HIGHWAYS AND COASTAL DEFENSES, AS WE GO  
18 ALONG AND SEE WHAT HAPPENS TO CLIMATE. RIGHT NOW WE  
19 NEED TO START TAKING NEEDED ACTION FOR ALL  
20 INFRASTRUCTURE, AND I THINK ONE WAY TO FORCE THAT  
21 ACTION BEING TAKEN, BESIDES SETTING PRICES, IS ALSO  
22 BY REVISING BUILDING CODES AND STANDARDS. FOR  
23 EXAMPLE, RIGHT NOW -- CHRIS MENTIONED THIS ALSO --  
24 RIGHT NOW MANY BUILDING CODES ARE BASED UPON THE  
25 CLIMATE OF THE PRESENT OR THE CLIMATE OF THE PAST.

0486

1 WE NEED TO START THINKING ABOUT HOW WE INCORPORATE THIS  
2 NEW CLIMATE INFORMATION TO BUILDING CODES, SO  
3 INFRASTRUCTURE WILL BE DESIGNED FOR THE FUTURE, NOT  
4 FOR THE PAST.

5 DR. MILES: TED.

6 DR. SCHUUR: I'M AT THE END OF THE LINE  
7 HERE, SO LET ME SEE IF I CAN ADD ANYTHING.

8 IN TERMS OF WHAT WE SAW TODAY, TWO THINGS  
9 ARE GOING ON IN THE NEW DATA SINCE 2000, AS YOU  
10 LISTED IN THE QUESTION, BOTH THE INCREASED EMISSIONS  
11 AND THEN DECREASING UPTAKE BY BOTH TERRESTRIAL AND  
12 OCEAN SYSTEMS. AND I THINK, AS SCIENTISTS, ONE THING  
13 WE CAN DO IS KIND OF LOOK INTO THE FUTURE AND SAY,  
14 WELL, THIS UPTAKE THAT WE'VE BEEN RELYING UPON BOTH  
15 FOR THE LAND AND THE OCEAN, HOW LIKELY IS THAT TO  
16 CONTINUE IN THE FUTURE. IS IT LIKELY TO KEEP GOING  
17 IN DIRECTION OF SLOWING DOWN?

18 WHILE I THINK MOST OF THE INCREASE IS STILL  
19 DUE TO THE GREATER-THAN-EXPECTED EMISSIONS, I THINK  
20 WE CAN PROVIDE A LOT IN TERMS OF PROJECTING OUT WHERE  
21 THE TERRESTRIAL AND OCEAN SINKS ARE GOING TO BE GOING  
22 IN THE FUTURE.

23 DR. MILES: OKAY. WHY DON'T WE BEGIN WITH  
24 YOU AND WORK BACK --

25 (LAUGHTER)

0487

1 -- THE OTHER WAY ON THE SECOND QUESTION?  
2 WHATEVER HAPPENS, ADAPTATION IS GOING TO BE AS  
3 IMPORTANT AS MITIGATION. AND THE BIOSPHERE IS A

4 FOCUS WHICH WE NEED TO PAY A LOT OF ATTENTION TO BUT  
5 NOT IN A SEPARATED FASHION. HUMANS AND THE BIOSPHERE  
6 ARE LINKED. HUMANS ARE PART OF THE BIOSPHERE. AND  
7 WHAT THEN DO YOU THINK, FROM YOUR PERSPECTIVE AND THE  
8 WORK THAT YOU DO, WOULD BE THE MOST SENSIBLE WAY TO  
9 APPROACH THE ADAPTATION QUESTION FOR THE TERRESTRIAL  
10 SYSTEMS YOU WORK ON, TO REVERSE OR HALT MOVEMENT  
11 TOWARD THRESHOLDS OF CHANGE?

12 DR. SCHUUR: WELL, I'M NOT SURE IF I'M  
13 GOING TO ANSWER YOUR QUESTION, BUT I WILL TAKE A STAB  
14 HERE, WHICH IS I DO GET ASKED HOW CAN WE, YOU KNOW,  
15 MITIGATE THESE CHANGES AT HIGH LATITUDES. AND IT'S  
16 INTERESTING THERE BECAUSE A LOT OF WHAT'S GOING ON IS  
17 IN PLACES WHERE PEOPLE ARE AT VERY LOW DENSITIES.

18 WE'VE HEARD ABOUT SEVERAL KIND OF GEOENGINEERING  
19 PROPOSALS, PEOPLE TALKED MORE ABOUT THE OCEAN TODAY,  
20 BUT THERE ARE ALSO CONVERSATIONS OR DISCUSSIONS ABOUT  
21 ALBEDO CHANGES AND IF THE LAND SURFACE CAN BE CHANGED  
22 TO MITIGATE SOME OF THESE CHANGES.  
23 THINKING ABOUT THAT KIND OF GEOENGINEERING  
24 VERSUS DEALING WITH EMISSIONS, YOU'RE TALKING ABOUT  
25 CHANGING VERY LARGE AREAS OF, SAY, THE HIGH LATITUDES

0488

1 IF YOU WANT TO CONVERT, YOU KNOW, DARK EVERGREEN  
2 FORESTS INTO LIGHT DECIDUOUS FORESTS THAT MIGHT  
3 REFLECT MORE ENERGY. SO IN TERMS OF  
4 THINKING ABOUT MITIGATION, IT SEEMS LIKE VERY MUCH,  
5 A GLOBAL PROBLEM RATHER THAN LOCAL TO WHERE  
6 I WORK AT HIGH LATITUDES.

7 IN TERMS OF ADAPTATION, I THINK IT IS GOING  
8 TO BE KEY, ESPECIALLY IN THESE REGIONS-- IF YOU THINK ABOUT  
9 HIGH NORTHERN LATITUDES, ALTHOUGH THE POPULATION  
10 DENSITIES ARE LOW, THERE WERE THE THRESHOLDS THAT I  
11 TALKED ABOUT, AND THE THRESHOLDS AFFECT CARBON  
12 BALANCE, BUT THEY ALSO AFFECT THE INFRASTRUCTURE OF  
13 THE NORTH. SO THERE'S GOING TO BE A LOT OF CHANGES  
14 THAT ARE GOING TO BE NONLINEAR, BUT WE HAVE GOOD  
15 PREDICTABILITY IN THAT THE FREEZING POINT, ZERO  
16 DEGREE, IS A VERY KEY PLACE WHERE WE KNOW THAT THE  
17 TRANSITIONS TAKE PLACE. EVEN THOUGH WE MAY HAVE A  
18 HARD TIME MODELING THESE NONLINEAR THRESHOLDS, WE AT  
19 LEAST HAVE A BENCHMARK FOR WHERE OUR INFRASTRUCTURE  
20 AND WHEN OUR INFRASTRUCTURE WON'T BE EFFECTIVE.

21 DR. KIRSHEN: I SOMEWHAT ANSWERED THIS  
22 QUESTION IN MY FIRST ANSWER BECAUSE I MISUNDERSTOOD  
23 THE FIRST QUESTION.

24 BUT IN TERMS OF INFRASTRUCTURE, AS I SAID  
25 EARLIER, INFRASTRUCTURE LASTS A LONG TIME. THE TIME

0489

1 TO CONSIDER ADAPTING IT IS RIGHT NOW. BUT I DO WANT  
2 TO SAY THAT, , AT LEAST IN THE ENVIRONMENTAL  
3 COMMUNITY, "ADAPTATION" WAS A REAL DIRTY WORD FOR A  
4 LONG TIME. AND WHEN I STARTED TALKING ABOUT  
5 ADAPTATION, 5 OR 6 YEARS AGO, ALL

6 IN THE ENVIRONMENTAL COMMUNITY SAID: NO, NO, NO, YOU  
7 CAN'T GIVE UP, YOU CAN'T GIVE UP MITIGATION. I  
8 THINK THE FIRST THING WE HAVE TO DO IS ACCEPT  
9 ADAPTATION IS GOING TO BE NECESSARY. OBVIOUSLY, THAT  
10 GOES HAND IN HAND WITH MITIGATION. THESE IMPACTS ARE  
11 GOING TO GO WELL BEYOND THE NEXT CENTURY. I THINK  
12 THE FIRST STEP IS ADMITTING ADAPTATION IS GOING TO BE  
13 NECESSARY.

14 THE OTHER THING IS, ONCE WE ADMIT  
15 ADAPTATION IS GOING TO BE NECESSARY, I THINK WE'RE  
16 GOING TO FIND THAT A LOT OF ADAPTATION ACTIONS ARE  
17 GOING TO HAVE A LOT OF CO-BENEFITS RIGHT NOW IN TERMS OF DEALING  
18 WITH A LOT OF OUR PRESENT ENVIRONMENTAL PROBLEMS, AND  
19 THIS HAS BEEN ACTUALLY FAIRLY WELL DOCUMENTED. SO I  
20 THINK WE NEED TO ACTUALLY START THINKING ABOUT  
21 ADAPTATION IN A CONSTRUCTIVE WAY, JUST SO THE  
22 ECONOMICS AND BENEFITS WILL MAKE IT ATTRACTIVE TO  
23 PEOPLE TO START TAKING ACTION.

24 DR. MILES: CHRIS.

25 DR. FIELD: I THINK IT IS REALLY IMPORTANT

0490

1 TO DISTINGUISH BETWEEN WHAT OUR OPTIONS ARE FOR  
2 ADAPTING THESE UNMANAGED PARTS OF THE WORLD SYSTEM  
3 AND THE OCEANS AND THE ECOSYSTEMS AND THE HUMAN  
4 COMPONENTS WITH THE MANAGED PART. YOU KNOW,  
5 REALISTICALLY WE'RE JUST GOING TO HAVE TO PRIORITIZE  
6 AND PRIORITIZE. THERE ARE GOING TO BE A FEW THINGS  
7 WE CAN SAY, AND IT'S GOING TO BE, YOU KNOW, GENE POOL  
8 REPOSITORIES, IT'S GOING TO BE ZOOS, IT'S GOING TO BE  
9 PRESERVES, BUT THAT WE'RE NOT JUST GOING TO ADAPT THE  
10 WHOLE WORLD.

11 WITH HUMANS I THINK THAT THERE ARE REALLY  
12 TWO ISSUES: THAT PROBABLY THE MOST IMPORTANT ONE IS  
13 THAT THERE'S THIS INCREDIBLY NONUNIFORM DISTRIBUTION  
14 OF ADAPTIVE CAPACITY; AND I DON'T THINK AS A GLOBAL  
15 COMMUNITY WE HAVE THOUGHT VERY HARD AT ALL ABOUT HOW  
16 WE'RE GOING TO PROVIDE A DISTRIBUTION OF ADAPTIVE  
17 CAPACITY THAT IS MORE CONSISTENT WITH THE  
18 DISTRIBUTION OF EXPOSURE. I WISH I HAD A PROPOSAL  
19 ABOUT HOW TO DO THAT, BUT I THINK THAT'S THE PROBLEM  
20 THAT WE REALLY NEED TO FIND A WAY TO GRAPPLE WITH.

21 DR. MILES: DAVID.

22 DR. LOBELL: IN THE CONTEXT OF AGRICULTURE,  
23 I THINK IN TERMS OF BULLET ANSWERS, I WOULD SAY THREE  
24 THINGS ARE REALLY NEEDED:

25 ONE IS JUST MORE CONVERSATION BETWEEN THE

0491

1 COMMUNITIES THAT ARE REALLY GOING TO BE DIRECTLY  
2 INVOLVED WITH THE ADAPTATION WORK AND THE CLIMATE  
3 COMMUNITY. I HAVE HAD A FEW OPPORTUNITIES THIS LAST  
4 YEAR TO TALK TO SOME OF THESE GROUPS, AND I'M ALWAYS  
5 SURPRISED AT HOW SURPRISED THEY ARE ABOUT THE STATE  
6 OF CLIMATE SCIENCE AND WHAT WE KNOW ABOUT HOW  
7 TEMPERATURE'S CHANGING. JUST THE MAGNITUDE OF CHANGE

8 OVER THE NEXT 50, 100 YEARS REALLY BLOWS THEM AWAY  
9 EVEN NOW. THEY JUST DON'T SPEND THAT MUCH TIME  
10 THINKING ABOUT IT. AND THE RAINFALL PROJECTIONS,  
11 TOO, IN A LOT OF CASES; THEY'RE BLOWN AWAY BY THAT.  
12 AND THESE ARE, YOU KNOW, PEOPLE IN HIGH LEVELS THAT  
13 REALLY NEED TO BE THINKING ABOUT THIS STUFF, AND WE  
14 NEED TO BE INTERACTING WITH THEM MORE.

15 SO THE SECOND THING I WOULD SAY IS THAT THE  
16 SCALE OF INVESTMENT NEEDS TO JUST BE SO MUCH GREATER.  
17 AND I TALKED A LITTLE ABOUT THAT IN MY PRESENTATION. NOT  
18 ONLY THE MAGNITUDE, BUT ALSO SUSTAINED INVESTMENT.  
19 THAT GOES ALONG WITH WHAT RALPH KEELING WAS TALKING  
20 ABOUT YESTERDAY, IS THAT, AS IN MONITORING,  
21 ATMOSPHERIC MEASUREMENTS, DEVELOPING AGRICULTURAL  
22 TECHNOLOGIES REALLY REQUIRES SUSTAINED MEASUREMENT  
23 AND MONITORING AND EXPERIMENTATION AND THINGS LIKE  
24 THAT.

25 FINALLY, THE THIRD THING THAT I THINK WE

0492

1 REALLY NEED TO THINK HARD ON IS PRIORITIZING BECAUSE  
2 WE'RE NOT REALLY GOING TO BE ABLE TO ADAPT EVERYTHING EVERYWHERE..  
4 AND SO THE QUESTION REALLY COMES DOWN TO ,,  
5, WHERE ARE OUR PRIORITIES, WHERE DO WE  
6 REALLY FEEL LIKE WE CAN HAVE THE BEST BANG FOR THE  
7 BUCK, AND THINK HARD ACROSS DIFFERENT DISCIPLINES  
8 ABOUT WHERE WE SHOULD BE ADAPTING.

9 DR. MILES: VICKI.

10 DR. FABRY: WITH REGARD TO THE OCEANS, I  
11 THINK WE COULD CONTROL WHAT WE CAN. FOR INSTANCE, WE  
12 SHOULD TRY TO RELIEVE FISHING PRESSURE, DECREASE  
13 DEGRADATION OF THE MARINE ENVIRONMENT WHEREVER WE  
14 CAN, RELIEVE SOME OF THE OTHER ENVIRONMENTAL  
15 STRESSORS THAT ARE ON ORGANISMS SO THAT THEY MIGHT  
16 HAVE A BETTER CHANCE OF ADAPTING THEMSELVES AND  
17 SURVIVING CLIMATE CHANGE AND OCEAN ACIDIFICATION.  
18 MAYBE SETTING UP INCREASED AREAS FOR MARINE PROTECTED  
19 AREAS AND HAVING MANAGERS WATCH OVER CERTAIN AREAS.  
20 BUT THAT'S GOING TO BE FAIRLY LOCAL.

21 I THINK THAT IF WE ACCEPT THAT THIS IS A  
22 CRISIS, THEN WE HAVE TO, INDEED, PUT ALL MITIGATION  
23 STRATEGIES ON THE TABLE, NO MATTER HOW UNPLEASANT  
24 THEY MIGHT AT FIRST SOUND. AND IT MAY BE TIME TO DO  
25 THAT. MAYBE IT'S PAST TIME. WE SHOULD HAVE ALREADY

0493

1 BEEN DOING THAT. AND HAVE A MULTIDISCIPLINARY  
2 DISCUSSION OF THE PROS AND CONS, THE BENEFITS, THE  
3 DISADVANTAGES OF EACH METHOD AND SEE WHAT WE CAN DO.

4 BUT I AGREE WITH DAVID THAT I THINK IT WILL  
5 COME DOWN TO PRIORITIZING. WE'RE GOING TO HAVE TO  
6 MAKE A LOT OF DIFFICULT DECISIONS, AND THERE WILL BE  
7 WINNERS AND LOSERS.

8 DR. MILES: SCOTT.

9 DR. DONEY: A COUPLE OF DIVERSE THOUGHTS.  
10 THE FIRST, AND DAVID KEITH WILL PROBABLY



11 TALK ABOUT THIS A LITTLE TOMORROW, IS THE CHALLENGE  
12 OF ACIDIFICATION IS VERY DIFFICULT TO MITIGATE  
13 DIRECTLY OTHER THAN BY REDUCING EMISSIONS. THERE  
14 AREN'T OBVIOUS GEOTECHNICAL SOLUTIONS THAT AREN'T  
15 VAST IN SCALE IN TERMS OF MAINTAINING OCEAN  
16 ALKALINITY.

17 I'LL FOCUS A FAIR BIT ON ECOSYSTEM SERVICES  
18 AND THE ADAPTATIONS THAT HUMANS ARE GOING TO HAVE TO  
19 MAKE ON FISHING AND FISHERIES. I SEE TWO SIDES TO  
20 THAT. THERE'S THE BASICALLY FOLDING CLIMATE  
21 INFORMATION MORE READILY INTO FISHING PLANTS AND  
22 ACIDIFICATION INFORMATION INTO FISHING PLANTS, AS IS  
23 STARTING TO BE DONE BY SOME OF THE U.S. FISHERY  
24 COUNCILS, BUT NOT ALL OF THEM. I THINK RIGHT NOW  
25 THAT WITHOUT FOLDING THAT INFORMATION IN, THEY'RE

0494

1 GAMBLING THAT THE PAST WILL LOOK LIKE THE FUTURE, AND  
2 IT WON'T. AND SO THAT THERE'S AN INCREASE IN THE  
3 LIKELIHOOD THAT THEY WILL RESULT IN THE COLLAPSE OF  
4 FISHERIES, EVEN WITH THE BEST INTENTIONS OF THE  
5 MANAGEMENT CUSTODIAN, BECAUSE THEY'RE JUST LOOKING AT  
6 DIFFERENT CONDITIONS.

7 AND I THINK THE OTHER THING IS THE SOCIAL  
8 AND ECONOMIC FORCES THAT KEEP US MAINTAINING  
9 FISHERIES THAT AREN'T SUSTAINABLE. WE NEED TO  
10 DEVELOP MODELS TO ALLOW COMMUNITIES TO ADAPT BEFORE  
11 THE FISHERY ACTUALLY COLLAPSES AND BE MUCH MORE  
12 PROACTIVE ON THAT SIDE OF PROVIDING THE RESOURCES,  
13 RETRAINING, CAPITAL TO TAKE FISHERIES THAT ARE LOOKED  
14 TO BE ON THE EDGE, ON THE EDGE OF A BIOGEOGRAPHIC  
15 REGIME. WE KNOW THAT SOME OF THESE ECOSYSTEMS ARE  
16 GOING TO SHIFT POLEWARD. AND YOU REALLY WANT TO LOOK  
17 AT THE EDGES OF THE FISHERY BOUNDARIES, BECAUSE  
18 THAT'S WHERE THE HIGHEST IMPACT FROM CLIMATE IS  
19 PROBABLY GOING TO BE, AND GET THOSE FOLKS OUT INTO  
20 ANOTHER PRODUCTIVE ACTIVITY, EITHER ANOTHER FISHERY OR ANOTHER  
21 ECONOMIC RESOURCE BEFORE YOU DESTROY WHAT'S LEFT OF  
22 THE FISHERY.

23 DR. MILES: DICK.

24 DR. FEELY: TO GIVE A LITTLE DIFFERENT  
25 PERSPECTIVE, I THINK IT'S NECESSARY FOR US TO LOOK AT

0495

1 SOME NEW TECHNOLOGIES AND NEW APPROACHES TO REDUCE  
2 THE RISK OF THE CARBON FOOTPRINT, AT THE SAME TIME  
3 PROVIDING AN ECONOMIC INCENTIVE FOR DEVELOPING THESE  
4 NEW TECHNOLOGIES THAT WILL HELP REDUCE THE ECOSYSTEM  
5 RISKS, AS WELL.

6 ONE SUCH TECHNOLOGY THAT I THINK IS FAIRLY  
7 INTRIGUING IS ELECTROLYSIS OF SEAWATER. THIS  
8 APPROACH HAS BEEN APPLIED TO SEAWATER WITH POSITIVE  
9 IMPACTS AND INCREASE IN THE ALKALINITY SURROUNDING  
10 CORAL REEF SYSTEMS. IT ALSO HAS THE IMPACT OF  
11 HELPING CORAL REEF SYSTEMS GETTING THROUGH THE  
12 WARMING EVENTS OF EL NINOS AND OTHER IMPACTS, AS

13 WELL; AND IT HAS THE POTENTIAL, ALSO, OF PROVIDING  
14 NEW ENERGY SOURCES IN THE FORM OF HYDROGEN, AND THAT  
15 MAY PROVIDE US WITH AN ECONOMIC APPROACH TO ATTRACT  
16 COMPANIES TO BUILD SUCH SYSTEMS.

17 ONE OF THE DOWNFALLS OF THE ELECTROLYSIS OF  
18 SEAWATER, IS THAT IT IS HIGHLY ENERGY INTENSIVE, AND THERE'S  
19 A LOT OF CONCERNS ABOUT THAT; BUT PERHAPS IF WE CAN  
20 COMBINE THIS WITH, FOR EXAMPLE, WIND POWER OR SOLAR  
21 POWER, WE CAN STILL REDUCE OUR CARBON IMPRINT AND  
22 MAKE THIS A VERY ATTRACTIVE AND ECONOMICALLY FEASIBLE  
23 WAY TO HELP OUR ECOSYSTEMS.

24 SOME PEOPLE HAVE SUGGEST(ED) THAT IT WOULD TAKE IN  
25 THE NEIGHBORHOOD OF ABOUT 700 PLANTS GLOBALLY TO

0496

1 PURSUE SUCH AN OPTION, AND THIS WOULD PROVIDE ONE WEDGE. SO I THINK A  
2 NUMBER OF TECHNOLOGY APPROACHES LIKE THIS ONE MAY  
3 PROVIDE US WITH SOME SOLUTIONS THAT WE CAN REALLY  
4 WORK WITH.

5 DR. MILES: THE NEXT QUESTION IS REALLY  
6 DIFFICULT, AND ACTUALLY IT'S ANOTHER QUESTION THAT  
7 RALPH RAISED AT THE BEGINNING WHEN HE TALKED ABOUT  
8 WHAT IS DANGEROUS CHANGE. THE QUESTION IS: HOW  
9 MUCH TIME DO WE HAVE TO ACT? AND THAT RELATES TO  
10 THRESHOLDS. WE SEE THINGS COMING MUCH MORE QUICKLY  
11 THAN WE HAD ANTICIPATED. IT WAS ASSUMED WHEN THE  
12 FRAMEWORK CONVENTION WAS NEGOTIATED THAT DOUBLING THE  
13 PRE-INDUSTRIAL CONCENTRATION WAS A REASONABLE WAY OF  
14 DEFINING WHAT DANGEROUS WAS. THAT IS A VERY  
15 QUESTIONABLE ASSUMPTION. SO GIVEN WHAT WE KNOW NOW  
16 ABOUT THRESHOLDS ON A NUMBER OF DIMENSIONS, WHICH  
17 HAVE BEEN DISCUSSED, FLOODING, FIRES, DROUGHTS, A  
18 NUMBER OF EXTREME EVENTS, HOW MUCH TIME DO WE HAVE TO  
19 MAKE THESE DECISIONS? AND WHAT IS TO BE DONE, WHEN?

20 YOU'RE FIRST, SCOTT.

21 DR. DONEY: I THINK DAVID SHOULD GO FIRST.

22 DR. LOBELL: I WOULD BE HAPPY TO.

23 DR. FEELY: THIS IS ONE OF THE MORE  
24 DIFFICULT QUESTIONS. I THINK WITHIN THE OCEAN  
25 ENVIRONMENT. I THINK THE COMMENTS THAT SCOTT MADE

0497

1 EARLIER TODAY ADD UP TO A NEED TO HAVE SOME CLEAR  
2 UNDERSTANDING OF THE PROCESSES TO GET A GOOD  
3 PERSPECTIVE ON WHAT THE OVERALL THRESHOLDS ARE. FOR  
4 OCEAN PH, FOR EXAMPLE, THERE HAVE() BEEN SOME  
5 SUGGESTIONS THAT A THRESHOLD OF .2 PHFROM THE  
6 PRE-INDUSTRIAL ERA, WHICH REPRESENTS AN ATMOSPHERIC CO2  
7 LEVEL OF ABOUT 500 PARTS PER MILLION, IS ONE  
8 THRESHOLD. THAT MEANS THAT WE HAVE TO BEGIN TO WORK  
9 VERY SOON, WITHIN THE NEXT 10 YEARS, TO MAKE SURE  
10 THAT WE CAN STABILIZE CO2, TO NOT GO BEYOND SUCH A  
11 THRESHOLD. I'M NOT AT ALL CONVINCED THAT WE KNOW  
12 EXACTLY WHAT THOSE THRESHOLDS ARE YET, BUT IT'S  
13 FAIRLY CLEAR THAT IF WE GO MUCH BEYOND THAT  
14 PARTICULAR THRESHOLD, THAT WE WILL HAVE SOME SERIOUS

15 PROBLEMS WITH OUR OCEAN ECOSYSTEMS. SO THAT AT LEAST  
16 GIVES US A STARTING POINT FOR DISCUSSIONS AND A  
17 STARTING POINT TO WORK ON THIS PROBLEM. SO I WOULD  
18 SAY THAT WITHIN THE NEXT 10 YEARS OR SO IS A VERY  
19 CLEAR REQUIREMENT.

20 DR. MILES: THANK YOU.  
21 SCOTT.

22 DR. DONEY: WELL, I GUESS I WILL SORT OF  
23 TURN IT AROUND A LITTLE BIT. YOU KNOW, ONE OF THE  
24 THINGS IS THAT WE KNOW WE'RE ALREADY COMMITTED, EVEN  
25 IF WE WERE TO SHUT OFF EMISSIONS TODAY, WE'RE ALREADY

0498  
1 COMMITTED TO FURTHER WARMING, FURTHER OCEAN  
2 ACIDIFICATION, AND FURTHER SEA LEVEL RISE. AND WHEN  
3 YOU COMBINE THAT WITH THE TIME LAGS IN THE  
4 INFRASTRUCTURE, ECHOING SOME OF THE COMMENTS OF PAUL  
5 AND CHRIS, THAT I GET WORRIED WHEN YOU SAY, WELL, WE  
6 NEED TO MAKE A DECISION IN 10 YEARS BECAUSE THE TIME  
7 LAGS FOR IMPLEMENTING THESE TECHNOLOGIES AND THE COST  
8 OF NOT MOVING FORWARD, WHERE YOU'RE BUILDING  
9 INFRASTRUCTURE NOW THAT'S NOT THE RIGHT  
10 INFRASTRUCTURE, BUT THAT INFRASTRUCTURE IS GOING TO  
11 STICK AROUND FOR 50 YEARS. I THINK RATHER THAN SORT  
12 OF POSING IT AS, YOU KNOW, WHEN DO WE NEED TO MAKE  
13 THE DECISION, I THINK YOU START MAKING DECISIONS NOW  
14 ABOUT WHAT'S THE LOW-HANGING FRUIT, WHAT ARE THE  
15 TECHNOLOGIES YOU COULD IMPLEMENT NOW, WHAT ARE THE  
16 TECHNOLOGIES YOU WANT TO START TO INVEST IN NOW. AND  
17 SO I THINK THE ANSWER IS WE PROBABLY WANTED TO BE  
18 MAKING THESE DECISIONS 5 YEARS AGO. SO I'LL SAY  
19 MINUS 5.

20 DR. MILES: VICKI.

21 DR. FABRY: I'LL ADDRESS THE THRESHOLDS,  
22 THE QUESTION OF THRESHOLDS. AND TODAY I TALKED ABOUT  
23 CALCIFICATION, OCEAN ACIDIFICATION. I THINK THERE IS  
24 A DEFINITE LINK THERE WITH THE EXCEPTION OF SOME  
25 COCCOLITHOPHORE SPECIES, ALL CALCIFIERS THAT HAVE

0499  
1 BEEN INVESTIGATED TO DATE SHOW A DECREASED RATE OF  
2 CALCIFICATION AT ELEVATED P2. THAT IS A NICE  
3 NONLINEAR SYSTEM. YOU HAVE CALCIFICATION, AND THEN  
4 YOU HAVE DISSOLUTION AND CLEAR THRESHOLD. AND WE SEE  
5 THAT WITH THE CORALS WHICH HAPPENS TO BE AROUND  
6 THAT DELTA OF 0.2 PH UNITS, AS DICK WAS MENTIONING. BUT  
7 I THINK IN A WAY THAT GIVES US KIND OF A FALSE  
8 SECURITY BECAUSE THAT SHOULD BE THE HIGH END. THERE  
9 COULD BE OTHER IMPACTS THAT WE'RE NOT SEEING THAT  
10 COULD BE HAPPENING ALREADY THAT HAVE TO DO WITH  
11 CHRONIC EXPOSURE TO ELEVATED CO2 AND WE JUST AREN'T  
12 ABLE TO MEASURE IT. SO PROBABLY THAT IS TOO HIGH,  
13 AND WE WOULD NEED TO BE BELOW 500.

14 SO, IN THAT SENSE, I AGREE WITH SCOTT; WE  
15 NEED TO -- SHOULD HAVE STARTED SOME TIME AGO, BUT  
16 WE'RE GOING TO HAVE TO STABILIZE AND THEN REDUCE

17 EMISSIONS -- I MEAN REDUCE THE CO2 CONCENTRATION IN  
18 THE ATMOSPHERE.

19 DR. MILES: DAVID.

20 DR. LOBELL: SO I GUESS I'M JUST GOING TO  
21 TACKLE THE ADAPTATION QUESTION BECAUSE I THINK FROM  
22 AN AGRICULTURE STANDPOINT, LIKE SCOTT SAID, THE NEXT  
23 50 YEARS WE'RE PRETTY MUCH COMMITTED TO MORE OR LESS  
24 WHAT THE CLIMATE IS GOING TO BE DOING, AND THOSE ARE  
25 REALLY THE TIME SCALES OF AGRICULTURAL DECISIONS.

0500  
1 SO I THINK, ALSO, TO POINT OUT -- I MEAN,  
2 THIS HAS BEEN SAID MANY TIMES -- BUT THIS IS NOT JUST  
3 A QUESTION FOR SCIENCE, OBVIOUSLY. AND I'M ALWAYS  
4 CAREFUL NOT TO IMPOSE MY VALUES ON THESE KINDS OF  
5 QUESTIONS. SO, FOR EXAMPLE, IN THE STUFF I SHOWED  
6 TODAY, ONE QUESTION WOULD BE:

HOW MUCH DO  
7 WE CARE ABOUT A PLACE LIKE SOUTH AFRICA? IF THE  
8 ANSWER IS VERY MUCH, THEN I THINK IT'S VERY CLEAR  
9 THAT WE HAVE TO BE DOING SOMETHING RIGHT NOW BECAUSE  
10 THE LAGS IN THE SYSTEM THAT ARE REQUIRED TO ADAPT TO  
11 THE MAGNITUDES OF CHANGES THAT WE'RE SEEING IS GOING  
12 TO BE SUCH THAT IT'S GOING TO BE REALLY STRUGGLING TO  
13 KEEP UP WITH THE PACE OF CLIMATE CHANGE. THERE ARE  
14 OTHER AREAS WHERE IT'S NOT QUITE AS EXTREME, BUT  
15 THERE ARE CERTAINLY A PRETTY SUBSTANTIAL LIST OF  
16 PLACES WHERE, I THINK, ADAPTATION NEEDS TO BE  
17 HAPPENING FIVE YEARS AGO, ALSO.

18 DR. FIELD: LET ME CHANGE THE FRAMEWORK  
19 JUST A LITTLE BIT.

20 I'M CONCERNED THAT THE IDEA THAT WE CAN  
21 IDENTIFY A RIGHT LINE BETWEEN WHAT'S DANGEROUS AND  
22 WHAT'S NOT IS EVENTUALLY GOING TO WORK TO OUR  
23 DISADVANTAGE. I THINK THERE IS SIGNIFICANT RISK THAT  
24 AS PUBLIC APPRECIATION THAT WE'RE NOT GOING TO BE  
25 ABLE TO STAY BELOW SOME TARGET EMERGES, THAT WE MIGHT

0501  
1 BE BESET WITH A SENSE OF DESPAIR AND SORT OF GIVE UP  
2 ON THE WHOLE PROBLEM.

3 I VIEW THE "DANGEROUS ANTHROPOGENIC  
4 INTERFERENCE" LANGUAGE IN THE FRAMEWORK CONVENTION AS  
5 BOTH A BLESSING, IT'S HELPED FOCUS ATTENTION, BUT  
6 IT'S INCREASINGLY, I THINK, EMERGING AS A HOBBLE.  
7 AND FROM MY PERSPECTIVE, WHAT WE NEED TO RECOGNIZE IS  
8 THAT STABILIZING CO2 AT 500 IS BETTER THAN STABILIZING  
9 AT 550; STABILIZING AT 550 IS BETTER THAN STABILIZING  
10 AT 600; STABILIZINGS AT 750 IS BETTER THAN  
11 STABILIZING AT 800. WE NEED TO BE WORKING AS  
12 HARD AS WE CAN TO FIND A WAY TO MOVE TOWARDS  
13 STABILIZATION, DOING IT IN A  
14 FRAMEWORK WHERE THE FAILURE TO MEET THE MOST  
15 AGGRESSIVE TARGET DOESN'T MEAN WE GIVE UP THE  
16 STRUGGLE. IT MEANS THAT WE WORK HARDER NOT TO PASS  
17 THE NEXT TARGET.

18 DR. KIRSHEN: THIS IS A QUESTION I HAVEN'T  
19 EVEN THOUGHT TOO MUCH ABOUT, BUT I CERTAINLY AGREE  
20 WITH WHAT MY COLLEAGUES ARE SAYING.

21 I THINK ALL I CAN SAY, THOUGH, THE ONE  
22 THING I'M VERY SURE ON, IS TO START MOBILIZING PUBLIC  
23 OPINION RIGHT NOW AND GET THEM ALL INVOLVED IN THIS  
24 DISCUSSION, BECAUSE WE'RE REALLY NOT GOING TO HAVE  
25 ANY ACTION UNTIL MORE OF THE PUBLIC IS INVOLVED AND

0502

1 BEHIND THIS ISSUE. I ALSO WANT TO SAY THAT  
2 I DO SEE SIGNS OF ENCOURAGEMENT. I JUST GOT A PHONE  
3 CALL FROM SOMEONE IN MINNESOTA THIS MORNING. THEY  
4 WANT TO HAVE A BIG CONFERENCE ON CLIMATE CHANGE IN  
5 MINNESOTA ABOUT ADAPTATION AND MITIGATION AND WHAT WE  
6 SHOULD BE DOING. SO I THINK THE PUBLIC IS READY TO  
7 BE CAPTURED, AND WE NEED TO PROVIDE LEADERSHIP ON  
8 THIS ISSUE.

9 DR. MILES: I DON'T THINK IT WOULD BE WISE  
10 TO TALK PUBLICLY ABOUT CAPTURING THE PUBLIC; WE WANT TO  
11 INFORM THE PUBLIC.

12 DR. KIRSHEN: STRIKE THAT FROM THE RECORD,  
13 PLEASE.

14 DR. SCHUUR: I GUESS AT THE END OF THE LINE  
15 HERE, I JUST WOULD ECHO CHRIS' WORDS A MINUTE  
16 AGO THAT ALTHOUGH THERE ARE THRESHOLDS IN THE EARTH  
17 SYSTEM, THIS IS KIND OF A CONTINUOUS PROCESS, WHERE  
18 THERE'S NOT ONE LINE THAT'S SAFE AND  
19 ANOTHER THAT IS DANGEROUS.

20 I GUESS ONE THING I THINK ABOUT IS THAT  
21 PEOPLE DO RESPOND TO ECONOMICS, AND MAYBE  
22 THE HIGHER WE GO, THE MORE IT MAY COST US AS WE HAVE  
23 TO MOVE OUR INFRASTRUCTURE. SO WE MAY BE ABLE TO  
24 ASSOCIATE NOT A SINGLE TARGET, BUT A TARGET THAT  
25 IF WE PREDICT OUT SEA LEVEL RISE, WE'RE GOING

0503

1 TO INCUR THIS MUCH COST IF WE GET TO THIS LEVEL; IF  
2 WE KEEP GOING TO THE NEXT LEVEL, WE CAN DO THAT, BUT  
3 IT IS GOING TO INCUR MORE COSTS. NOT EVERY PART OF  
4 THE SYSTEM CAN BE PUT INTO DOLLARS AND CENTS, BUT  
5 THAT MIGHT BE A USEFUL WAY TO CONNECT "DANGEROUS" AND  
6 "SAFE" TO WHAT IS GOING TO BE MORE EXPENSIVE FOR OUR  
7 ECONOMY OR LESS EXPENSIVE. THAT MIGHT BE A CONCEPT  
8 TO MOVE TOWARDS OR TIE INTO THIS DISCUSSION.

9 DR. MILES: I'VE COME TO THE LAST QUESTION.  
10 WE HAVE A SITUATION IN WHICH THERE'S SERIOUS CAUSE  
11 FOR CONCERN, AND IPCC WORKING GROUP I DID A VERY  
12 BEAUTIFUL JOB IN LAYING THIS OUT CLEARLY. WE HAVE A  
13 DIFFICULT QUESTION IN OUR DISCUSSION WITH THE POLITICAL  
14 SYSTEM AND THE PUBLIC OVER THE UNCERTAINTY IN  
15 RELATION TO THE LEVEL OF RISK THAT ONE MIGHT BE  
16 WILLING TO ACCEPT. ONE OF THE INTERESTING  
17 THINGS TO NOTE, AS THE PENDULUM HAS SWUNG, IS THE RECENT  
18 INTEREST OF THE INSURANCE COMPANIES AND THE  
19 REINSURANCE COMPANIES IN THAT VERY QUESTION. DURING THE FIRST NATIONAL

20 ASSESSMENT IN THE PACIFIC NORTHWEST. ONE LARGE  
21 COMPANY ALMOST RAN ME OUT THE DOOR AND TOLD ME, GO  
22 TALK TO FEMA, WE DON'T HOLD THE PAPER ON THIS. AND  
23 THEN THE LAST THING THAT WAS SAID WAS THAT HE WOULD  
24 BE GODDAMNED IF HE WOULD DO ANYTHING TO HELP  
25 AL GORE BE ELECTED PRESIDENT. THAT'S AN ODD WAY OF  
0504

1 DEALING WITH RISK IN AN INSURANCE COMPANY, I THOUGHT.  
2 BUT NOW THEY'RE COMING TO US WITH A FLOOD  
3 OF QUESTIONS. IN A WAY THAT IS GRATIFYING BECAUSE IT SHOWS  
4 THEY GET IT, BUT WE HAVE TO DO BETTER ON DEALING WITH  
5 UNCERTAINTY. SO I TURN TO THE LAST QUESTION:  
6 GIVEN THE WORK YOU'VE BEEN DOING AND THE PROBLEMS  
7 YOU'VE SEEN, WHAT ADDITIONAL AND/OR REVISED  
8 APPROACHES TO CARBON CYCLE MEASUREMENT DO WE NEED TO  
9 GET ON WITH?

10 DR. FEELY: WITHIN THE OCEAN ENVIRONMENT  
11 IN WHICH OCEAN ACIDIFICATION IS ONE OF THE  
12 MAJOR THEMES, WE SEEM TO HAVE FOCUSED PRIMARILY ON  
13 THE MEASUREMENT OF PCO2 EXCLUSIVELY IN THE SURFACE  
14 OCEANS; AND IN DOING SO, WE'VE MISSED THE OTHER  
15 COMPONENTS OF THE CARBON SYSTEM ALTOGETHER. IT'S  
16 CLEAR NOW THAT IN ORDER TO UNDERSTAND THE OCEAN  
17 ACIDIFICATION PROCESSES, WE NEED TO MAKE AT LEAST TWO  
18 MEASUREMENTS OF THE CARBON SYSTEM; THAT IS, PCO2 AND  
19 ALKALINITY BECAUSE THESE ARE AT LEAST TWO COMPONENTS THAT ALLOW US  
20 TO MEASURE AND QUANTIFY HOW THE CARBON SYSTEM IS  
21 CHANGING OVER TIME.

22 SO ONE OF THE RECOMMENDATIONS I WOULD HAVE  
23 IS THAT OUR MONITORING EFFORTS FOR THE CARBON SYSTEM  
24 OF THE OCEANS SHOULD INCLUDE AT LEAST TWO COMPONENTS  
25 OF THE CARBON SYSTEM.

0505

1 DR. DONEY: I WILL PUT ON MY NUMERICAL  
2 MODELING HAT AND USE YOUR WORD "MEASUREMENT" IN A  
3 VERY BROAD SENSE.

4 I GUESS ALMOST FROM THE PERSPECTIVE OF SOCIAL SCIENCE, THAT IS  
SCIENCE  
5 AS A SOCIAL ENTERPRISE, I THINK WE NEED TO STOP  
6 TREATING APPLIED SCIENCE AS A DIRTY WORD, AND WE NEED  
7 TO GET OUR BRIGHTEST YOUNG FACULTY MEMBERS WORKING ON  
8 MUCH MORE APPLIED PROBLEMS AND NOT DISCOURAGE THEM FROM DOING SO.  
9 I SEE THAT AS A REALLY SERIOUS PROBLEM  
10 HINDERING OUR ABILITY TO GET FUNDS TO DO WORK THAT IS MORE RELEVANT TO  
11 DECISION MAKERS.

12 THE SECOND THING IS ON THE SORT OF MODELING  
13 SIDE. YOU KNOW, WE'RE VERY GOOD AT MAKING  
14 LARGE-SCALE BASIC MAPS OF WHAT'S GOING TO HAPPEN. I  
15 THINK WE NEED TO START MAKING FORECASTS AT THE SCALE  
16 RELEVANT FOR DECISION MAKERS, THAT IS SMALLER SCALES  
17 FOR DECENTRALIZED DECISIONS AT THE STATE LEVEL, THE  
18 LOCAL LEVEL, THE CORPORATE LEVEL. WE ALSO NEED TO  
19 PROVIDE THE NEW INFORMATION IN A WAY THAT IS MORE  
20 USEFUL FOR THEM. I THINK IT'S NOT JUST HOW YOU

21 PACKAGE THE SCIENCE; IT'S A DIFFERENT WAY OF THINKING  
22 ABOUT HOW YOU LOOK AT THE OBSERVATIONS, LOOKING AT  
23 THE MODEL SIMULATIONS.

24 DR. MILES: THANK YOU.

25 DR. FABRY: REGARDING THE OCEAN AND THE

0506

1 MEASUREMENTS WE MAKE IN THE OCEAN, IF WE WANT TO  
2 TRACK CLIMATE CHANGE AND OCEAN ACIDIFICATION, IT  
3 REALLY NEEDS TO BE AN INTERNATIONAL PROGRAM. WE NEED  
4 TO CREATE A GLOBAL NETWORK OF OBSERVATIONS; AND KEY  
5 TO THAT WOULD BE STANDARDIZED PROTOCOLS, PARTICULARLY  
6 FOR BIOLOGICAL MEASUREMENTS. WE HAVE THIS FOR THE CO2  
7 SYSTEM IN SEAWATER. AND DICK, SCOTT, OTHERS HAVE  
8 DONE A WONDERFUL JOB OF MEASURING CO2 IN THE WORLD  
9 OCEANS. THAT COLLABORATION HAS WORKED WELL  
10 MAINLY BECAUSE THEY HAVE DONE THE INTERCOMPARISON  
11 STUDIES, SO THEY HAVE GOOD ACCURACY, GOOD PRECISION.  
12 WE DON'T HAVE THAT IN BIOLOGICAL MEASUREMENTS. SO,  
13 IF, FOR EXAMPLE, I MAKE A CALCIFICATION RATE  
14 MEASUREMENT AND MY COLLEAGUE DOES SOMETHING  
15 DIFFERENT, WE DON'T KNOW IF IT'S A TRUE DIFFERENCE OR  
16 JUST A METHODOLOGICAL DIFFERENCE. SO WE NEED TO  
17 STANDARDIZE PROTOCOLS FOR THESE BIOLOGICAL RATE  
18 MEASUREMENTS SO WE CAN COMPARE THEM IN SPACE AND  
19 TIME.

20 ALSO, WE DO NEED TO INVEST IN LONG-TERM  
21 MONITORING; AND RALPH REALLY MADE THAT TOPIC POINT VERY  
22 ELOQUENTLY YESTERDAY, I THINK. "MONITORING" HAS TO  
23 STOP BEING A DIRTY WORD FOR OUR FUNDING AGENCIES.

24 I THINK WE HAVE TO INVEST IN NEW  
25 TECHNOLOGIES, AS WELL. IF WE COULD LOOK AT GENE

0507

1 EXPRESSION FOR A VARIETY OF ORGANISMS IN THE FIELD,  
2 THEN WE WOULD NOT HAVE TO HAVE THESE SMALL LAB  
3 EXPERIMENTS, FOR EXAMPLE, AND THAT WOULD BE MORE  
4 IDEAL.

5 I THINK, TO FOLLOW UP ON WHAT SCOTT  
6 SAID, IT IS IMPORTANT TO BRING IN THE BUSINESS  
7 COMMUNITY, AND IT SEEMS TO ME THAT THE FOURTH  
8 ASSESSMENT HAS BEEN MUCH MORE SPECIFIC THAN THE  
9 PREVIOUS ONES. IT'S THAT SPECIFICITY, I THINK,  
10 THAT ENABLES THE BUSINESS COMMUNITY TO PLAN AHEAD.

11 WE'RE GOING TO NEED THAT. IN SOME WAYS  
12 SOMETIMES I THINK WE HAVE BEEN LOOKING FOR  
13 GOVERNMENTS TO SOLVE OUR PROBLEMS WITH GLOBAL  
14 WARMING; AND IT MAY, IN FACT, COME FROM THE PRIVATE  
15 SECTOR.

16 DR. LOBELL: I THINK I'LL BROADEN THE  
17 QUESTION A LITTLE BIT BECAUSE OTHERWISE I DON'T THINK  
18 I HAVE AN INTELLIGENT ANSWER. FOR TERRESTRIAL CARBON  
19 CYCLE MEASUREMENTS, THERE'S PLENTY OF PEOPLE THAT ARE  
20 BETTER SUITED TO ANSWER THAT.

21 I THINK, AGAIN, FROM AN AGRICULTURAL  
22 PERSPECTIVE, SOME OF THE KEY THINGS THAT I THINK

23 WE'RE MISSING FROM THE MEASUREMENT/EXPERIMENTAL SIDE  
24 ARE MULTIFACTOR EXPERIMENTS WHERE WE'RE LOOKING AT  
25 CO<sub>2</sub>, TEMPERATURE, OTHER FACTORS. AND I THINK CHRIS

0508

1 HAS PIONEERED THIS IN NATURAL ECOSYSTEMS; BUT IN  
2 MANAGED ECOSYSTEMS, WE DON'T NECESSARILY HAVE  
3 LONG-TERM EXPERIMENTS TO REALLY UNDERSTAND THE  
4 RESPONSES, THE INTERACTIVE RESPONSES TO THESE  
5 FACTORS.

6 ALONG THOSE LINES, WE REALLY ARE LIMITED  
7 RIGHT NOW, SURPRISINGLY, IN OUR ABILITY TO MONITOR  
8 AGRICULTURAL SYSTEMS FROM SPACE WITH HIGHER  
9 RESOLUTION SATELLITE DATA. IN MY OWN WORK THAT HAS  
10 BEEN A MAIN CONSTRAINT. SO I'LL THROW THAT OUT  
11 THERE.

12 THE OTHER BIG THING TO THINK MORE BROADLY  
13 ABOUT IS HOW DO WE PRIORITIZE BOTH MITIGATION AND  
14 ADAPTATION. IT IS VERY HARD RIGHT NOW TO SAY HOW  
15 MUCH ADAPTATION IS ACTUALLY GOING ON AND MEASURING  
16 THAT. THINKING OF WAYS TO MEASURE THAT IS IMPORTANT,  
17 AND I DON'T KNOW IF I HAVE ANY GREAT IDEAS, BUT I  
18 HAVE SOME IDEAS. I THINK WE NEED TO START  
19 THINKING MORE ABOUT HOW TO DO THAT.

20 DR. FIELD: IF WE FOCUS ON CARBON CYCLE  
21 MEASUREMENTS, I THINK THE CRITICAL QUESTION THAT WE  
22 NEED TO RESOLVE WITH RESEARCH IS, IN 2060, IS THE  
23 AIRBORNE FRACTION GOING TO BE .4? IS IT GOING TO BE  
24 .8? IS IT GOING TO BE 1.2? IS IT GOING TO BE .2?  
25 AND AT THIS POINT WE GENUINELY DON'T HAVE A

0509

1 SUFFICIENT FOUNDATION IN EITHER THE OCEANS OR THE  
2 LAND IN ORDER TO CONSTRAIN IT WITHIN THAT RANGE.

3 IF WE LOOK AT THE LAND, THE FROZEN SOILS  
4 TOPIC THAT TED ALREADY TALKED ABOUT IS SUBJECT TO  
5 VAST UNCERTAINTY. TROPICAL RAINFORESTS, WE REALLY  
6 DON'T KNOW WHETHER OR NOT THEY'RE CLOSE TO A  
7 THRESHOLD WHERE ECOSYSTEMS THAT HAVE NEVER SUPPORTED  
8 WILDFIRE ALL OF A SUDDEN SUPPORT WILDFIRE. ACROSS  
9 THE VAST STRETCHES OF THE BOREAL FOREST, WHERE  
10 THERE'S SOME OF THE HIGHEST SOIL CARBON, WE DON'T  
11 REALLY KNOW WHETHER WE'RE GOING TO SEE CHANGES IN THE  
12 ABUNDANCE OF INSECT OUTBREAKS OR WILDFIRE THAT CAN  
13 RESULT IN CONVERSION OF THOSE TO HIGH-LATITUDE STEPPES.

14 WE REALLY ARE AT A STAGE IN OUR  
15 UNDERSTANDING OF THE RELEASE OF MAJOR RISKS FROM  
16 TERRESTRIAL POOLS OR, ALTERNATIVELY, THE POSSIBILITY  
17 OF MAJOR UPTAKE IN TERRESTRIAL POOLS, THAT IS FAR  
18 FROM SATISFACTORY FOR ADDRESSING AN ISSUE AS  
19 SERIOUS AS THIS. I THINK THAT THERE IS AN  
20 OVERWHELMING NEED FOR A CONCENTRATED RESEARCH EFFORT  
21 ON THE FUTURE TRAJECTORIES OF BOTH OCEAN AND LAND  
22 CARBON STOCKS; AND I THINK THAT FROM THE PERSPECTIVE  
23 OF THE CARBON CYCLE ISSUES THAT WE'RE ADDRESSING,  
24 THERE IS NOTHING THAT WILL CONTRIBUTE MORE TO



25 INFORMED DISCUSSIONS ABOUT WHAT THE HUMAN ACTION  
0510 SHOULD BE.

1 DR. KIRSHEN: FIRST OF ALL, I WANT TO  
2 SUPPORT SCOTT'S COMMENT ABOUT THE NEED FOR MORE  
3 FUNDING FOR APPLIED RESEARCH. IT'S VERY DIFFICULT TO  
4 FIND FUNDS TO ACTUALLY DOON-THE-GROUND  
5 ADAPTATION STUDIES BOTH HERE, AS WELL AS IN THE  
6 DEVELOPING WORLD.

7 I'M GOING TO ANSWER THIS QUESTION ABOUT  
8 MEASUREMENT WITH A LITTLE STORY, I GUESS. I WAS IN A  
9 MEETING LAST WEEK WITH SOME OFFICIALS, AND WE WERE  
10 TALKING ABOUT CLIMATE CHANGE. THESE ARE GOVERNMENT  
11 OFFICIALS, CITY OFFICIALS, AND THEY WERE SAYING,  
12 WELL, WHEN SHOULD WE TAKE ACTION ABOUT CLIMATE  
13 CHANGE? WHEN SHOULD WE WORRY ABOUT TRYING  
14 TO PROTECT OUR COAST? SOMEONE IN THE ROOM SAID,  
15 WELL, JUST SORT OF MONITOR THE CHANGES, AND  
16 THEN WHEN YOU FEEL THE TIME IS RIGHT, GO  
17 AHEAD AND TAKE SOME ACTION. SO HE WAS TALKING ABOUT,  
18 KEEPING TRACK OF SEA LEVELS AND THINGS LIKE  
19 THAT. I GUESS I FELT THAT'S NOT  
20 REALLY THE RIGHT APPROACH, BECAUSE IF WE SORT OF WAIT  
22 FOR IT TO HAPPEN, IT'S GOING TO HAPPEN, AND IT'S  
23 GOING TO BE TOO LATE. I KEEP THINKING ABOUT KATRINA.  
24 WE ALL KNEW IT WAS GOING TO HAPPEN. IT WAS A VERY

0511 VULNERABLE COMMUNITY. AND IF WE SORT OF KEEP WAITING  
1 AND WAITING, THAT'S WHAT HAPPENS, IT'S REALLY TOO  
2 LATE. SO I THINK THIS ISN'T THE URGENCY OF KATRINA,  
3 BECAUSE WE'RE NOT QUITE BELOW SEA LEVEL YET, BUT I  
4 THINK WE CAN'T JUST WAIT AND WAIT AND WAIT AND WAIT  
5 FOR THESE CHANGES TO BECOME APPARENT. WE HAVE TO  
6 REALIZE THAT THERE IS A LOT OF RISK AND UNCERTAINTY;  
7 AND CERTAINLY TAKE THE MEASUREMENTS BECAUSE THEY  
8 REINFORCE WHAT'S GOING ON, BUT WE CAN'T WAIT FOR THE  
9 MEASUREMENTS TO ACT.

10 DR. SCHUUR: WELL, I GUESS JUST TO  
11 REITERATE PAST SPEAKERS, I THINK WE ARE MOVING ON TO  
12 ADAPTATION AND MITIGATION, AND IT SEEMS TO BE THE  
13 MESSAGE THAT WE PROMOTED, AND LET'S JUST BRING ALONG  
14 RESEARCH AND MONITORING ALONG WITH THAT, AS WE ALL  
15 KNOW THERE IS MUCH MORE OF THAT TO BE DONE.

16 DR. MILES: THANK YOU VERY MUCH.

17 WE NOW HAVE 20 MINUTES FOR YOU THE AUDIENCE  
18 TO PARTICIPATE IN THIS DISCUSSION. DON'T FEEL CALLED  
19 UPON TO COMMENT ON ALL FOUR QUESTIONS, BUT LET'S TRY  
20 TO GET AS MANY AS PEOPLE AS POSSIBLE.

21 DR. WILLIAMS: PETER WILLIAMS. I WORK FOR  
22 IBM.

23 THINKING ABOUT THE HUMAN SOCIAL SYSTEM, IT  
24 SEEMS TO ME THAT THE PROBLEM IS NOT NECESSARILY THE

0512 PHYSICAL SIDE PROBLEM; IT'S ACTUALLY A HUMAN  
1

2 BEHAVIORAL PROBLEM AT EVER SO MANY LEVELS.  
3 HOW DO YOU STOP ME, AS A CONSUMER, I LIVE  
4 IN CALIFORNIA, I GO AND BUY MY ORGANIC LUBBERS AND I  
5 FEEL I BOUGHT ORGANIC ^ LUBBERS. I THEN OPEN THE  
6 PACKET AND THINGS HAVE BEEN AIR-FREIGHTED FROM CHILE.  
7 HOW DO YOU STOP ME FROM BUYING A SPORTS CAR THAT ONLY  
8 GETS 20 MILES TO THE GALLON WHEN I SHOULD WE BUYING A  
9 CAR THAT GETS 30 MILES TO THE GALLON. OR AS A  
10 PROFESSIONAL, WORKING IN THE SUPPLY CHAIN, HOW DO YOU  
11 MAKE ME OPTIMIZE MY SUPPLY CHAIN FOR CARBON  
12 EMISSIONS? OR HOW DO YOU MAKE ME CHOOSE AN AIRLINE  
13 FOR MY BUSINESS TRAVEL THAT IS MORE MILEAGE EFFICIENT  
14 THAN THE AIRLINE THAT I NORMALLY USE ON A DAY-TO-DAY  
15 BASIS?

16 IT SEEMS TO ME THAT ONE OF THE THINGS  
17 THAT YOU NEED TO DO IF YOU'RE GOING TO HAVE AN  
18 EFFECTIVE RESPONSE TO THIS IS TO STOP THINKING ABOUT  
19 THIS AS JUST PHYSICAL SCIENCE. AT THE NEXT  
20 CONFERENCE LIKE THIS THAT YOU HAVE, YOU WANT  
21 BEHAVIORAL ECONOMICS REPRESENTED, YOU WANT PSYCHOLOGY  
22 REPRESENTED, YOU WANT SOCIAL SCIENCE REPRESENTED.  
23 THAT WAY WE'LL GET AN EFFECTIVE DIALOGUE ABOUT HOW TO  
24 CHANGE PEOPLE'S BEHAVIOR, WHICH IS THE ROOT CAUSE OF  
25 ALL THIS STUFF THAT WE'RE TALKING ABOUT.

0513

1 THANK YOU.  
2 DR. SOCOLOW: ROB SOCOLOW, FROM PRINCETON.  
3 I MAY BE STRETCHING THE QUESTION, BUT I  
4 HOPE NOT MUCH, TO SAY THAT I'M STILL NOT HEARING  
5 PEOPLE ON THE PANEL POSITIONING, WORKING IN A FRAME  
6 OF REFERENCE WHERE THE WORLD IS ATTACKING THE CARBON  
7 PROBLEM AND, THEREFORE, IS RAISING QUESTIONS ABOUT  
8 WHETHER VARIOUS THINGS WORK.

9 IT'S GOING TO BE LIKE A MAGIC RIPPLE  
10 EFFECT. WE DON'T HAVE THE ACTIONS UNDERWAY IN SOME  
11 INSTANCES THAT WE WOULD LIKE TO BE DOING OR BE ASKING  
12 WHETHER WE SHOULD BE. BUT WE WILL NEED THIS  
13 COMMUNITY WITH MEASUREMENT PROGRAMS ANTICIPATING WHAT  
14 KIND OF QUESTIONS PEOPLE ARE GOING TO ASK THAT RELATE  
15 TO THE PHYSICAL AND BIOLOGICAL SYSTEM. IF WE HAVE  
16 MAJOR AFFORESTATION, WHAT DOES THAT DO THAT WOULD  
17 CHANGE -- HOW WOULD YOU DECIDE HOW WELL IT'S WORKING?  
18 IF WE HAVE A MAJOR WIND DEPLOYMENT, HOW WOULD YOU  
19 DECIDE HOW WELL THAT IS WORKING? PROJECTION OF CO2  
20 BELOW GROUND, WOULD YOU BE ABLE TO SEE LEAKS?

21 THERE IS A VERY LARGE AGENDA THAT IS GOING  
22 TO BE GENERATED BY DEALING WITH THE PROBLEM. AND  
23 YOU'RE STILL STANDING IN THE POSITION OF SAYING  
24 PROBABLY NOTHING IS GOING TO HAPPEN. WE'RE GOING TO  
25 DOCUMENT HOW WE'RE GOING DOWN.

0514

1 (LAUGHTER)  
2 AND IT REALLY IS A MIND-SET THAT'S VERY  
3 HARD TO GET PAST BECAUSE IT DIDN'T LOOK LIKE WE'RE

4 DOING ANYTHING BUT GO DOWN UNTIL VERY RECENTLY.

5 DR. TANS: I'M PIETER TANS FROM EARTH  
6 SYSTEM RESEARCH LAB.

7 ACTUALLY, WE DO HAVE A PLAN FOR  
8 MEASUREMENTS TO HELP MITIGATION EFFORTS. WE'RE  
9 TRYING TO DEVELOP OUR CARBON TRACKING SYSTEM SO THAT  
10 IT IS SUITABLE FOR MEASURING EMISSIONS, QUANTIFYING  
11 EMISSIONS IN AN OBJECTIVE WAY, WHICH IS SOMETHING WE  
12 WILL NEED ONCE THE WORLD SERIOUSLY STARTS TO TACKLE  
13 THE PROBLEM OF EMISSIONS. WE NEED TO HAVE SOME  
14 OBJECTIVE MEASURE TO SEE TO WHAT EXTENT ARE THESE  
15 POLICIES EFFECTIVE, WHAT IS WORKING, WHAT IS NOT.

16 NOW, ANOTHER THING, I ACTUALLY DISAGREE  
17 WITH THAT FIRST QUESTION. IT TALKS ABOUT, I WILL  
18 READ THE LAST PART OF IT: "COMBINED WITH THE SLOWING  
19 DOWN OF THE UPTAKE OF CO2 IN BOTH THE TERRESTRIAL AND  
20 OCEAN SINKS."

21 WHERE IS THE EVIDENCE FOR THIS? I DON'T  
22 BUY IT. SURE, THE RATE OF INCREASE IN CO2 IN THE LAST  
23 6 OR 7 YEARS HAS ACCELERATED SOMEWHAT, BUT LESS THAN  
24 THE ACCELERATION OF THE EMISSIONS. IN OTHER WORDS,  
25 THAT BALANCE WOULD SEEM TO IMPLY THAT TOTAL SINKS

0515

1 HAVE ACTUALLY INCREASED IN THE LAST, SAY, 6 OR 7  
2 YEARS. NOW, IF THE OCEANOGRAPHERS ARE SAYING THAT  
3 THE OCEANS ARE BECOMING LESS EFFECTIVE IN TAKING UP  
4 CO2, THEY ARE IMPLYING THAT THE UPTAKE BY THE  
5 TERRESTRIAL ECOSYSTEM HAS GREATLY ACCELERATED IN THE  
6 LAST 6 OR 7 YEARS. I SEE NO EVIDENCE OF THAT. SO I  
7 THINK, ACTUALLY, THAT IS A WRONG PREMISE. AND I  
8 DON'T KNOW WHY EVERYBODY SEEMS TO BE BELIEVING THAT.  
9 I THINK WE SHOULD LEAVE IT OFF THE QUESTION.

10 DR. FIELD: CAN I SPEAK ON THIS?

11 IT DOESN'T SAY THAT LAND SINKS ARE  
12 DECREASING; IT SAYS THAT THERE IS NO TREND IN LAND  
13 SINKS. AND OF COURSE, THE DEFINITION OF A DECREASING  
14 EFFICIENCY OF THE OCEAN SINK IS THAT THE OCEAN SINK  
15 IS, AS A FRACTION OF TOTAL EMISSIONS, GOING DOWN.  
16 OCEAN SINKS ACTUALLY CONTINUE TO INCREASE THROUGH  
17 TIME AND ARE CONTINUING TO DO THAT, AS FAR AS WE CAN  
18 TELL. SO, CERTAINLY, THOSE STATEMENTS ARE NOT  
19 SUPPORTED BY THE RECENT ANALYSIS.

20 DR. TANS: SO ARE YOU SAYING THE OCEAN  
21 SINKS ARE INCREASING BUT NOT IN PROPORTION TO WHAT WE  
22 HAD EXPECTED THAT THEY WOULD INCREASE? ARE YOU  
23 SAYING THAT?

24 DR. FIELD: ALL THAT PAPER SAYS IS THAT, AS  
25 A FRACTION OF TOTAL EMISSIONS, OCEAN SINKS ARE GOING

0516

1 DOWN.

2 DR. TANS: YEAH. WELL, THAT'S MISLEADING.  
3 I MEAN, HERE IT IS FORMULATED AS TOTAL SINKS ARE  
4 BASICALLY DIMINISHING. IT'S NOT THE CASE, PEOPLE.  
5 SINKS HAVE BEEN INCREASING IN RECENT YEARS. I THINK

6 WE SEE THAT FROM SIMPLE MASS BALANCE, AND WE SHOULD  
7 NOT FORMULATE IT THIS WAY. THIS IS MISLEADING. BUT  
8 AS FRACTIONS, MAYBE THEY HAVE DECREASED SOMEWHAT  
9 BECAUSE EMISSIONS ARE REALLY GOING THROUGH THE ROOF  
10 AT THE MOMENT. THAT COULD BE TRUE, AS A FRACTION OF  
11 EMISSIONS, THE SINKS HAVE DECREASED A LITTLE BIT  
12 WHILE STILL GOING UP IN THE ACTUAL SENSE, THAT'S  
13 POSSIBLE.

14 UNIDENTIFIED SPEAKER: BUT NOT THAT THE  
15 CONCENTRATIONS ARE GOING UP MORE SLOWLY THAN THE  
16 EMISSIONS.

17 DR. TANS: I THINK, PERSONALLY, THE  
18 FRACTIONS HAVE PROBABLY STAYED THE SAME. THAT'S WHAT  
19 I THINK, ACTUALLY.

20 DR. FIELD: WELL, ALL THE ANALYSIS IS THAT  
21 THE FRACTION TAKEN UP BY THE OCEAN IS DECREASING, AND  
22 THE FRACTION STAYING IN THE ATMOSPHERE IS INCREASING.

23 MR. MENDONCA: BERNARD MENDONCA, ESRL,  
24 NOAA, BOULDER.

25 I'D LIKE TO GO BACK -- WELL, I WOULD LIKE

0517

1 TO START BY STATING THAT I HAVE BEEN OUT OF THE  
2 SCIENCE FOR AWHILE, AND I'M HERE, AND I'M REALLY  
3 ENJOYING THIS CONFERENCE. I'M OLD SCHOOL, I GUESS.

4 BUT WHAT I WOULD LIKE TO COMMENT ON TODAY  
5 IS THAT EVERY WEEK I HEAR A DISCUSSION GROUP OF  
6 RETIRED PEOPLE IN BOULDER, COLORADO IN THE LIBRARY;  
7 AND THESE ARE -- I CALL THEM HAS-BEENS-WHO-NEVER-  
8 -WERE --

9 (LAUGHTER)

10 -- THEY'RE TEACHERS, RETIRED COLLEGE  
11 PROFESSORS, ENGINEERS, AIRPLANE PILOTS, BUSINESSMEN,  
12 LAWYERS. THERE'S ABOUT 35 OF US, MEN AND WOMEN WHO  
13 MEET EVERY YEAR. AND I'M THE CLIMATE GUY, AS YOU CAN  
14 IMAGINE. AND I'VE BEEN TRYING TO GET THIS ACROSS TO  
15 THEM FOR TWO YEARS NOW. THEY DON'T BELIEVE IT. AND  
16 THESE ARE EDUCATED PEOPLE. AND IT'S A TOUGH, TOUGH  
17 NUT.

18 SO WHAT I'D LIKE TO COMMENT ON TODAY TO YOU  
19 PEOPLE NOW, WHO ARE CARRYING THE CAUSE, IS: IS IT  
20 REASONABLE TO ASK OR TO MAKE THE PUBLIC REALIZE THAT  
21 THE SCIENCE AND THE SCIENTISTS CAN BASICALLY DEFINE  
22 THE PROBLEM BUT THEY CANNOT RESOLVE IT?

23 BECAUSE EVERY TIME I START TALKING ABOUT  
24 THE CLIMATE, THE REACTION I GET IS: THOSE  
25 SCIENTISTS, THEY TALK IN THESE MYSTERIOUS TERMS,

0518

1 THEY'RE WAY OUT THERE, AND THEY REALLY CAN'T BE  
2 TRUSTED. THIS IS THE FEEDBACK THAT'S JUST COMMON ALL  
3 THE TIME.

4 AND I'VE THOUGHT ABOUT THIS A LOT. AND I'M  
5 ASKING: IS THIS COMING ABOUT BECAUSE THE SCIENTIFIC  
6 COMMUNITY IS NOT DISCIPLINED ENOUGH TO BE ABSOLUTELY  
7 SURE AND ROCK HARD WHAT THEY TELL THE PUBLIC IS TRUE

8 AND UNCONTESTED? THESE PEOPLE DON'T LIKE CONJECTURE;  
9 AND IF YOU HAVE THIS ON ONE HAND AND YOU HAVE THIS ON  
10 THE OTHER, THAT TELLS THEM YOU GUYS CAN'T BE TRUSTED.  
11 IT REALLY DOES.

12 AND THEN THE OTHER QUESTION I HAVE, THE  
13 ONLY THING I SEE THAT'S REALLY CAUGHT ON IS THE AL  
14 GORE APPROACH; AND WHAT HE'S DONE IS HE'S MADE IT  
15 VERY PERSONALLY RELEVANT. IT'S WHAT IS IT GOING TO  
16 DO TO ME PERSONALLY? HIGH GASOLINE PRICES, MY BEACH  
17 HOME IS IN DANGER, THINGS LIKE THAT.

18 AND I'LL STOP HERE. BUT I'M INTERESTED TO  
19 HEAR THE RESPONSE BECAUSE I'M GOING BACK NOW. I'M  
20 ARMED AGAIN, AND I'M GOING TO TRY ONE MORE TIME TO  
21 CONVINCING THESE GUYS. HELP ME OUT.

22 THANK YOU.

23 DR. FIELD: ONE BRIEF COMMENT: I WANT TO  
24 REPEAT SOMETHING ALMOST VERBATIM THAT RICHARD  
25 SOMERVILLE SAID YESTERDAY. YOU KNOW, IPCC IS A

0519  
1 WONDERFUL PROCESS, AND I THINK THE REASON IT DESERVES  
2 A NOBEL PRIZE IS LARGELY BASED ON THE PROCESS. AND  
3 ONE OF THE THINGS I THINK PEOPLE GENERALLY DON'T  
4 UNDERSTAND IS THAT THAT SUMMARY FOR POLICY MAKERS FOR  
5 EACH OF THE WORKING GROUPS IS APPROVED WORD-BY-WORD  
6 BY REPRESENTATIVES OF EVERY COUNTRY IN THE WORLD,  
7 INCLUDING THOSE THAT ARE THE MOST SKEPTICAL ABOUT  
8 CLIMATE SCIENCE. THERE IS ABSOLUTELY NOT A SINGLE  
9 STATEMENT IN AN IPCC SUMMARY FOR POLICY MAKERS THAT  
10 ISN'T ACCEPTED WORD-BY-WORD BY THE MOST SKEPTICAL  
11 COUNTRIES. I DON'T SEE HOW YOU CAN HAVE A STRONGER  
12 STATEMENT THAN THAT. I THINK THAT SOMEHOW THAT  
13 MESSAGE HASN'T COME OUT NEARLY AS STRONGLY AS IT  
14 NEEDS TO.

15 UNIDENTIFIED SPEAKER: IT HASN'T. IT  
16 REALLY HASN'T.

17 DR. FIELD: THAT'S TRUE. YOU KNOW, SUSAN  
18 HAS SAT THROUGH COUNTLESS SESSIONS WITH PEOPLE  
19 ARGUING OVER INDIVIDUAL WORDS.

20 DR. GAMMON: RICHARD GAMMON, UNIVERSITY OF  
21 WASHINGTON.

22 I THINK THAT THAT IS EXACTLY RIGHT. PEOPLE  
23 DON'T UNDERSTAND THE IPCC PROCESS OR WHAT THE SUMMARY  
24 FOR THE POLICY MAKERS REALLY REPRESENTS.

25 THEY'LL SAY, WELL, THAT'S ON THE ONE HAND,

0520  
1 AND I READ AN EDITORIAL IN "THE WALL STREET JOURNAL"  
2 THAT SAID THIS. AND THERE YOU GO.

3 I JUST WANT TO MAKE A FEW POINTS FOLLOWING  
4 ON WHAT BERNARD SAID.

5 I THINK THAT AS SCIENTISTS WE'RE MOVED BY  
6 GRAPHS, WE'RE MOVED BY DATA. BUT THE PUBLIC IS MOVED  
7 BY STORIES. YOU HAVE TO TELL A STORY. YOU HAVE TO  
8 TELL A STORY THAT PEOPLE CAN RELATE TO. AND SO THE  
9 STORY CAN BE SCARY IF IT MOVES PEOPLE. AND I THINK I

10 WANT TO SORT OF SAY THAT I'M ALL WITH JIM HANSEN ON  
11 THE RECENT ARTICLE HE WROTE CALLED "THE RETICENCE OF  
12 SCIENTISTS." WE HAVE TO BE WILLING TO BE ADVOCATES.  
13 YOU DON'T HAVE TO BE AN ADVOCATE FOR THE REPUBLICANS  
14 OR THE DEMOCRATS, BUT YOU HAVE TO BE AN ADVOCATE FOR  
15 THE PLANET. WE HAVE TO REALLY TALK HONESTLY IN A  
16 LANGUAGE THEY UNDERSTAND ABOUT THE NATURE OF THE  
17 PROBLEM. AND SO MAYBE YOUR ANALOGY IS YOU'RE DRIVING  
18 ALONG A LONELY ROAD, IT IS GETTING DARK, AND THE  
19 "CHECK ENGINE" LIGHT JUST CAME ON. SO SOMETHING  
20 PEOPLE CAN RELATE TO ABOUT THE NATURE OF THE CRISIS  
21 WE FACE. AS BILL MCKIBBON SAID, WE'RE NOW IN THE  
22 "OH, SHIT" PHASE OF CLIMATE CHANGE.

23 (LAUGHTER)

24 DR. COHEN: I'M ANNA UNRUH COHEN, AND I'M  
25 WITH THE HOUSE SELECT COMMITTEE ON ENERGY AND GLOBAL

0521

1 WARMING, AND I'M THE CLIMATE SCIENTIST ON STAFF. SO  
2 I SPEND A LOT OF MY DAYS TRYING TO BE THE BRIDGE  
3 BETWEEN THE SCIENTIFIC COMMUNITY AND THE POLICY  
4 MAKERS, AND IT REALLY IS TOUGH, EVEN WORKING FOR  
5 MEMBERS WHO ARE CONCERNED ABOUT THE PROBLEM AND WANT  
6 TO MAKE A DIFFERENCE. THEY DON'T UNDERSTAND SCIENCE  
7 AS WELL AS MAYBE WE'D LIKE.

8 BUT ONE OF MY QUESTIONS HERE IS WE'VE  
9 TALKED A LOT ABOUT MITIGATION ISSUES OVER THE YEARS,  
10 AND SO THERE IS RELATIVELY GOOD UNDERSTANDING ON  
11 CAPITOL HILL ON MITIGATION EFFORTS. WE HAVE THE  
12 SOCOLOW MITIGATION WEDGES SO THEY CAN THINK IN THEIR  
13 MIND, OKAY, WHAT DO I DO TO BUILD MORE WIND FARMS?  
14 WHAT DO I DO TO INCREASE FUEL ECONOMY? BUT WE DON'T  
15 HAVE THE SAME TYPE OF INFORMATION FOR THEM ON THE  
16 ADAPTATION SIDE.

17 AND SO I JUST WONDERED IF YOU, AS A PANEL  
18 FOR THE GREATER COMMUNITY, HAS STARTED TO THINK ABOUT  
19 HOW WE CAN PUT TOGETHER IN A WAY THAT POLICY MAKERS  
20 CAN UNDERSTAND SOME OF THOSE ADAPTATION NEEDS AND HOW  
21 THAT CAN INFORM POLICY MAKING, BECAUSE IT IS BEHIND  
22 OUR THINKING ON MITIGATION, AND IT NEEDS TO CATCH UP  
23 QUICKLY BECAUSE CONGRESS IS GOING TO START WORKING ON  
24 A CLIMATE BILL. TO MAKE IT AS COMPREHENSIVE AS  
25 POSSIBLE, WE NEED THOSE TYPE OF THINGS TO INFORM

0522

1 THAT PROCESS.

2 I GUESS JUST A SECOND PART OF THE  
3 QUESTION WOULD BE: WHAT DO YOU SEE THE ROLE OF  
4 SCIENCE PLAYING WITH POLICY MAKERS IN DEALING WITH  
5 THE ADAPTATION ISSUES AS WE GO FORWARD CRAFTING A  
6 LEGISLATIVE POLICY TO DEAL WITH THIS CLIMATE CHANGE  
7 ISSUE COMPREHENSIVELY?

8 DR. MILES: THANK YOU.

9 ANY TAKERS?

10 DR. LOBELL: I THINK THAT'S AN EXCELLENT  
11 QUESTION, AND I AGREE TOTALLY THAT ADAPTATION HASN'T

12 BEEN THOUGHT ABOUT HARD ENOUGH OR AS HARD, CERTAINLY,  
13 AS THE MITIGATION ISSUES.

14 I MEAN, I WOULD SAY THE MITIGATION WEDGES  
15 HAVE REALLY GOTTEN TRACTION ON CAPITOL HILL. WE  
16 MIGHT AS WELL TRY THE ADAPTATION WEDGES TO GO ALONG  
17 WITH THAT. AND IT WOULD BE INTERESTING TO THINK  
18 ABOUT TRYING TO FIGURE OUT WHAT THAT MEANS IN TERMS  
19 OF DIFFERENT OPTIONS FOR ADAPTATION.

20 DR. MILES: A COUPLE OF POINTS: I REALLY  
21 THINK THAT THE ADAPTATION ISSUE YOU RAISE IS AN  
22 EXTREMELY IMPORTANT ONE, AND THE ADAPTATION TO BOTH  
23 CLIMATE VARIABILITY AND CLIMATE CHANGE IN A WIDE  
24 VARIETY OF SECTORS IS PART OF THE BREAD-AND-BUTTER OF  
25 A PROGRAM WITHIN NOAA, THE RISA PROGRAM, REGIONAL

0523

1 INTEGRATED SCIENCES ASSESSMENT, OF WHICH MY TEAM IS  
2 ONE; AND WE WORK VERY CLOSELY WITH A WIDE VARIETY OF  
3 STAKEHOLDERS IN OUR REGION, THE PACIFIC NORTHWEST.  
4 BUT THERE ARE NOW 9 TEAMS IN THE NOAA  
5 PROGRAM, AND EVERYBODY WORKS VERY CLOSELY WITH THEIR  
6 OWN STAKEHOLDERS.

7 CALIFORNIA, OF COURSE, LED THE WAY IN DOING  
8 A COMPREHENSIVE CLIMATE CHANGE ASSESSMENT FOR THE  
9 STATE, AND THIS IS ONLY THE FIRST IN AN AUTHORITATIVE  
10 SERIES, AND WE USED THAT AS LEVERAGE FOR CONVINCING  
11 THE STATE OF WASHINGTON TO DO THE SAME. NOW WE  
12 ARE IN AN EXTENDED CONVERSATION WITH THE STATE, VERY  
13 CLOSELY, I MIGHT SAY, WORKING WITH POLICY MAKERS AND OPERATIONAL MANAGERS.-  
14 THE POLICY WE

15 HAVE ADOPTED INTERNALLY IS THAT WE WILL DO THE WHOLE  
16 CHAIN OF ANALYSIS UP TO THE POINT OF IDENTIFYING AND  
17 EVALUATING OPTIONS. BEYOND THAT, WE WILL NOT GO.  
18 AND WE WILL WORK WITH THEM UNTIL THAT POINT. THEN WE  
19 WILL STEP BACK.

20 DR. KIRSHEN: COULD I MAKE A COMMENT?

21 DR. MILES: YES.

22 DR. KIRSHEN: I HAVEN'T THOUGHT THIS  
23 THROUGH TOTALLY, OKAY, YOU KNOW, BUT ADAPTATION TO  
24 INFRASTRUCTURE TENDS TO BE DONE LOCALLY, ALMOST  
25 PROJECT BY PROJECT. AND SO I WOULD LIKE TO SEE  
SOMETHING LIKE ADAPTATION ADDED INTO THE

0524

1 ENVIRONMENTAL IMPACT STATEMENT PROCESS. BECAUSE THAT  
2 WOULD REALLY FORCE PROJECT PROPONENTS TO THINK ABOUT  
3 HOW THIS IS GOING TO FUNCTION IN THE FUTURE. AND I  
4 HAVE ALREADY SEEN IT DONE. FOR EXAMPLE, I HAVE SEEN  
5 THE CORPS OF ENGINEERS EXAMINE FLOOD CONTROL  
6 PROJECTS, AND SAY SEA LEVEL WAS 2 FEET HIGHER, HOW  
7 WOULD THIS FUNCTION, AND FORCE THEM TO SORT OF START  
8 LOOKING AT THESE TRADEOFFS. OKAY, MAYBE THEY WON'T  
9 DESIGN TO 2 FEET NOW, BUT WILL CERTAINLY LEAVE THE  
10 OPTION THERE, SO WHEN THEY DO HAVE 2 FEET, I CAN  
11 QUICKLY ADJUST AND GO FORWARD.

12 AND I THINK, AGAIN, LIKE I SAID, JUST SORT

13 OF BUILDING MENTALITY, BUT I THINK THE WAY TO SORT OF  
14 FORCE ADAPTATION THINKING IS TO INSTITUTIONALIZE IT.  
15 THE EIS PROCESS IS A WAY IT CAN BE DONE. AND, ALSO,  
16 THE FEDERAL GUIDELINES FOR MANAGING WATER RESOURCES  
17 ARE CALLED THE PRINCIPLES AND GUIDELINES, AND THERE'S  
18 ACTUALLY RECENT LEGISLATION THAT WAS PASSED THAT THEY  
19 HAVE TO BE UPDATED. CLIMATE CHANGE, IT'S IN THE  
20 ORDER OF 2007, CLIMATE CHANGE SHOULD BE IN THAT.  
21 START INSTITUTIONALIZING THIS, AND THEN, I THINK,  
22 WE'LL START SEEING SOME ADAPTATION. ONCE YOU OPEN  
23 THE FLOOD GATES, MORE AND MORE WILL HAPPEN.  
24 DR. MILES: WE ARE JUST ABOUT AT THE END, I  
25 THINK.

0525

1